

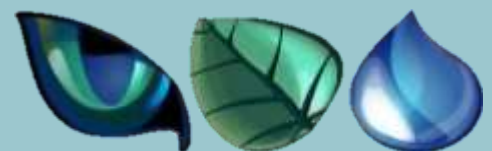


**Pilbara  
Minerals**

# **Pilgangoora Project Biological Survey**

**Pilbara, Western Australia**

Prepared for  
Pilbara Minerals Limited by  
Animal Plant Mineral Pty Ltd.



October 2023



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LIMITED

## EXECUTIVE SUMMARY

Animal Plant Mineral Pty Ltd (**APM**) was commissioned by Pilbara Minerals Limited to undertake a Detailed flora and vegetation and Targeted terrestrial vertebrate fauna survey for the Pilgangoora Lithium Project, located 84 kilometres (**km**) south-east of Port Hedland in the Pilbara region of Western Australia (**WA**). The area under investigation is referred to herein as the **Survey Area**. The Survey Area is 1162 hectares (**ha**).

The field survey was conducted between the 27<sup>th</sup> of June and the 3<sup>rd</sup> August 2023. Rainfall in the season preceding the survey was below average. The timing of the flora and vegetation survey was within the recommended Supplementary survey period for the region (EPA 2016). Fauna survey timing was within the range accepted for mammals (EPA 2020). The low rainfall preceding survey was a minor constraint to the completeness of the survey.

Seven vegetation types are described for the Survey Area. No vegetation of conservation significance was recorded, and current extent of regional vegetation units is close to pre-European extent. Vegetation is predominantly in Very Good condition with the main disturbances being low to moderate intensity cattle grazing, vegetation clearing for mining and pastoral activity and a small number of weeds. Completely Degraded areas comprise 34.1 ha or 2.9% of the Survey Area.

No Threatened flora are known to occur in the Survey Area or were recorded during the survey. One Priority (**P**) 3 flora species – *Triodia chichesterensis* was recorded. An additional three P3 species were determined likely to occur based upon the availability of suitable habitat and proximity of local records. One of these is a perennial shrub, identifiable from vegetative parts and would have been detectable at the time of survey. The remaining two are annual species, and seasonal conditions were unsuitable for the presence of these species to be detected.

No Declared weeds or Weeds of National Significance were recorded. Four weeds were recorded - *Cenchrus ciliaris*, *Cenchrus setiger*, *Tribulus terrestris* and *Aerva javanica* in small, isolated occurrences of low abundance.

Seven fauna habitats are described for the Survey Area. Stony Plains is the most common habitat present covering 765 ha (65%) of the Survey Area. Shallow Drainage Basins and Creeks followed by Low Hills are also common covering 167 ha (14%) and 145 ha (12%) of the Survey Area respectively. Platy Rock Outcrops, Major Drainage Line, Historic Mine Workings and Rocky Outcrops all contribute less than 4% each with the latter at just 0.06%.

Previous records of Threatened or Priority fauna species in the Survey Area is restricted to a Northern Quoll scat recorded in a Rocky Outcrop area in the south-eastern extent. An additional eight conservation significant fauna are likely to occur based upon local records and the availability of suitable habitat.

Targeted survey for conservation significant fauna identified:

- Denning, foraging and dispersal habitat suitable for the Northern quoll in the Rocky Outcrop areas. Northern quoll presence was confirmed in the north-eastern extent through camera captures, and in the southern extent, where previous evidence was found, in the form of scats. Local populations and habitat of Northern quoll are critical to the survival of the species as defined in CoA (2016) and require a 1 km buffer.
- Call sequences of the Pilbara leaf-nosed Bat. The Pilbara leaf-nosed Bat is known to occur in the local area and diurnal roosts occur within the range of the Survey Area. There are no roosts suitable for the Pilbara leaf-nosed Bat in the Survey Area. The conservation ranking of foraging habitat in the Survey Area is limited to small areas of Priority 2 (Historic Mine Workings) and 3 (Rocky Outcrop) in the north-eastern extent where recorded calls were concentrated, and the remainder being Priority 4 and 5.
- Some signs that cannot be excluded as originating from bilby, however the significance of the observed signs is Potential bilby activity - Presence not confirmed. Even if the signs were confirmed to belong to bilby, the occurrence would be transitory and indicates that limited forage was available, and therefore the Study Areas do not present important habitat for this species.
- Two active, four intermediate and two extinct Pebble-mound mouse mounds. The suitability of mound building habitat is confined by the availability of suitable size pebbles, which occur in subsections of the Stony Plains and Low Hills habitats.
- Wallaby scats expected to originate from Spectacled hare-wallaby. Suitable habitat is the Shallow Drainage Basins and Creeks.
- Habitats that would be subject to inundation in the Survey Area are limited to the claypans or gilgai within the Stony Plains habitat. Due to the high evaporation rate and low vegetation cover these are unlikely to retain water for more than a short period and are unlikely to sustain habitat suitable for migratory shorebirds. There are no nationally or internationally significant aggregations of migratory species known to occur within or near the Survey Area.
- Foraging habitat suitable for the Grey falcon and Ghost bat occurs and may be used by local populations, however no evidence of their presence was recorded.

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- Appendix B: PMST Search Results
- Appendix C: Detailed flora and vegetation survey sites
- Appendix D: Fauna Habitat Photos
- Appendix E: Specialised Zoological Technical Report
- Appendix F: Species by Site Matrix - Flora
- Appendix G: Fauna Likelihood of Occurrence Assessment - Fauna

## PROJECT TERMS

Abbreviation	Meaning
The Project	Pilgangoora Lithium Project
Survey Area	The 1162 ha area that is the subject of this survey

## UNITS OF MEASURE

Unit	Measure
%	Percentage
°C	Degrees Celsius
ha	Hectare
km	Kilometre
m	Metre
mm	Millimetre

## LIST OF ABBREVIATIONS

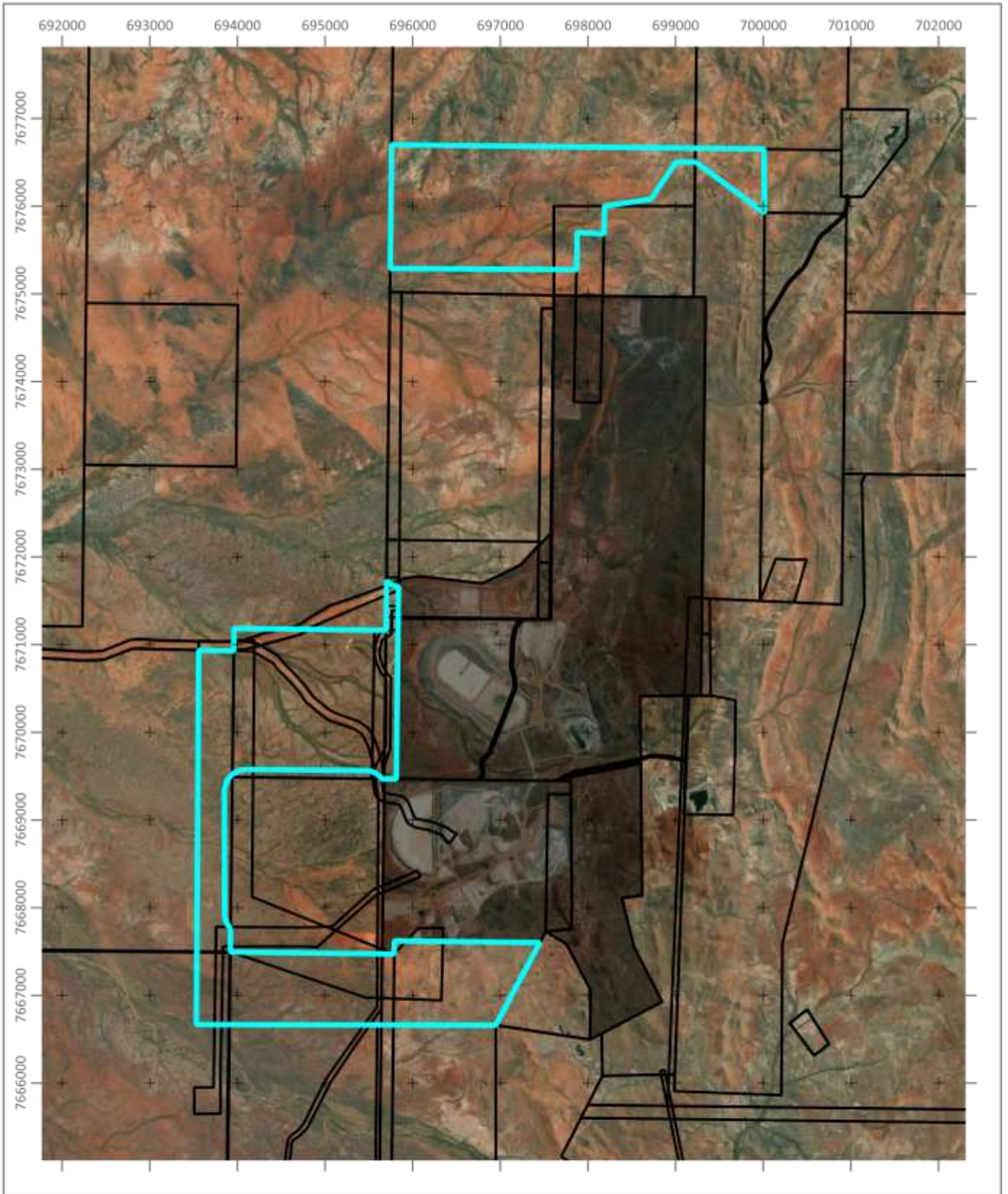
Abbreviation	Meaning
APM	Animal Plant Mineral Pty Ltd
BAM Act	Biosecurity and Agriculture Management Act 2007
BC Act	Biodiversity Conservation Act 2016
BoM	Bureau of Meteorology
DBCA	Department of Biological Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEE	Department of Energy and the Environment
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environment Regulation
DPIRD	Department of Primary Industries and Regional Development
EN	Endangered
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESA	Environmentally Sensitive Areas
IBRA	Interim Biogeographic Regionalisation for Australia
IBSA	Index of Biodiversity Surveys for Assessment

MI	Migratory
MNES	Matters of National Environmental Significance
OS	Other Specifically Protected
PEC	Priority Ecological Community
P	Priority
Abbreviation	Meaning
PMST	Protected Matters Search Tool
TEC	Threatened Ecological Community
T	Threatened
VU	Vulnerable
WA	Western Australia
WONS	Weeds of National Significance

## 1 INTRODUCTION

### 1.1 PROJECT AND LOCATION

Animal Plant Mineral Pty Ltd (**APM**) was commissioned by Pilbara Minerals Limited to undertake a Detailed flora and vegetation and Targeted terrestrial vertebrate fauna survey for the Pilgangoora Lithium Project, located 84 kilometres (**km**) south-east of Port Hedland in the Pilbara region of Western Australia (**WA**). The area under investigation is referred to herein as the Survey Area. The Survey Area is 1162 ha and the location is shown in Figure 1-1.



Author: TB    Approved: EH    Date: 25/07/2023

## Project Location

Prepared for:



Figure 1-1

Scale: @ A4  
1: 62,500



0    0.5    1 km

Coordinate System: GDA 2020 MGA Zone 50  
Projection: Transverse Mercator



## Legend

- Survey Areas
- Project Tenements
- Pilgangoora Operations



## 1.2 SCOPE OF WORK

The scope of work includes a Detailed flora and vegetation and Targeted terrestrial vertebrate fauna survey.

Survey data accompanies this report in a format suitable for submission to the Index of Biodiversity Surveys for Assessment (**IBSA**) online portal.

### 1.2.1 Flora and Vegetation

The flora and vegetation survey was conducted in accordance with the Environmental Protection Authority's (**EPA**) Technical Guidance - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (2016) at a Detailed level of assessment.

The aims of the desktop study were to:

- Establish vegetation associations previously determined for the site;
- Identify threatened (**T**) and priority (**P**) flora and threatened ecological communities (**TECs**) previously recorded on site;
- Identify weed species previously determined as present on site, in particular any Declared weeds; and
- Identify potentially suitable habitat for conservation significant flora known from the region.

The aims of the field survey were to:

- Describe and map the vegetation types present and provide comparisons to locally described types;
- Identify species present on site, including T and P Flora, and weed species in particular any Declared weeds; and
- Identify conservation significant features of the flora and vegetation.

### 1.2.2 Terrestrial Fauna

The scope of work was to conduct a basic and targeted terrestrial vertebrate survey in accordance with the EPA's fauna guidelines: Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (2020).

The aims of the desktop study were to:

- Identify T and P Fauna species previously determined as present on-site;
- Identify habitat types previously determined as present on-site regarded as suitable for T and P fauna; and
- Identify introduced species previously determined as present on-site.

The aims of the field survey were to conduct:

- Targeted quoll survey using unbaited camera traps;
- Bat survey using acoustic monitoring devices; and

- Traverses searching for signs of T and P fauna and record habitats suitable for T and P fauna.

## 2 BACKGROUND AND SUPPORTING INFORMATION

### 2.1 RELEVANT LEGISLATION AND GUIDANCE

#### 2.1.1 Commonwealth Government EPBC Act

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (**EPBC Act**) is administered by the Department of Climate Change, Energy, the Environment and Water (**DCCEEW**). It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as Matters of National Environmental Significance (**MNES**).

If a project has the potential to significantly impact on MNES it is to be referred to the DCCEEW for determination on whether the matter is a 'controlled action' and therefore requiring assessment.

The EPBC Act provides for the identification and listing of species under several categories listed in Appendix A. The EPBC Act also provides for the development of conservation advice and recovery plans, development of a register of critical habitat, recognition of key threatening processes and the development of threat abatement plans.

#### 2.1.2 Western Australia BC Act

The Biodiversity Conservation Act 2016 (**BC Act**) provides a statutory basis for the listing of T species, specially protected species, extinct species, TECs, collapsed ecological communities, critical habitat and key threatening processes in WA. The BC Act provides for the listing of T flora and fauna species and ecological communities under specified conservation categories listed in Appendix A. Species and communities listed under the BC Act are protected and require authorisation by the Minister to take or disturb.

Species may also 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 to science. Species of special conservation interest, migratory species and species subject to international agreements are known as Specially Protected Species in the BC Act.

#### 2.1.3 Western Australia Priority species and communities

Flora and fauna species and communities are listed by the Department of Biodiversity, Conservation and Attractions (**DBCA**) as P when they are considered to have a greater level of significance than other native species and communities. This generally occurs where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to T species and communities categories. Whilst P species and communities are not specifically listed in the BC Act, all flora and fauna are protected in WA following the provisions in Part 10 of the BC Act. This protection applies even when a species is not listed as T or specially protected. The categories covering P species and communities are listed in Appendix A.

#### 2.1.4 BAM Act

Plants may be 'Declared' by the Agriculture Protection Board under the Biosecurity and Agriculture Management Act 2007 (WA) (**BAM Act**). Declared Plants are gazetted under three categories (C1-C3) which define the action required. Details of the definitions of these categories are provided in Appendix A. A declaration may apply to the whole State, to districts, individual properties or even to single paddocks. If a plant is 'Declared', landholders are obliged to control that plant on their properties.

#### 2.1.5 Weeds of National Significance

The DCCEEW, along with the State and Territory governments, has endorsed 32 Weeds of National Significance (**WONS**). Four major criteria were used in determining WONS:

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

Each WONS has a national strategy and a national coordinator, responsible for implementing the strategy. WONS are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts (DAWE 2020).

#### 2.1.6 Guidelines

The terrestrial biological assessment was conducted in accordance with the above Commonwealth and State legislation, as well as EPA requirements for environmental surveys as outlined below:

- Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020); and
- Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

Relevant species-specific survey and assessment guidelines include:

- Survey Guidelines for Australia's T Bats (Department of the Environment Water Heritage and the Art (**DEWHA**) 2010).
- Survey Guidelines for Australia's T Mammals (Department of Sustainability Environment Water Population and Communities (**DSEWPAC**) 2011); and

Relevant guidance for the preparation of spatial datasets to accompany this report are:

- Guidelines for biological survey and mapped data (Department of the Environment and Energy (**DEE**) 2018); and
- Instructions for the preparation of data packages for IBSA (EPA 2021).

## 2.2 LAND USE

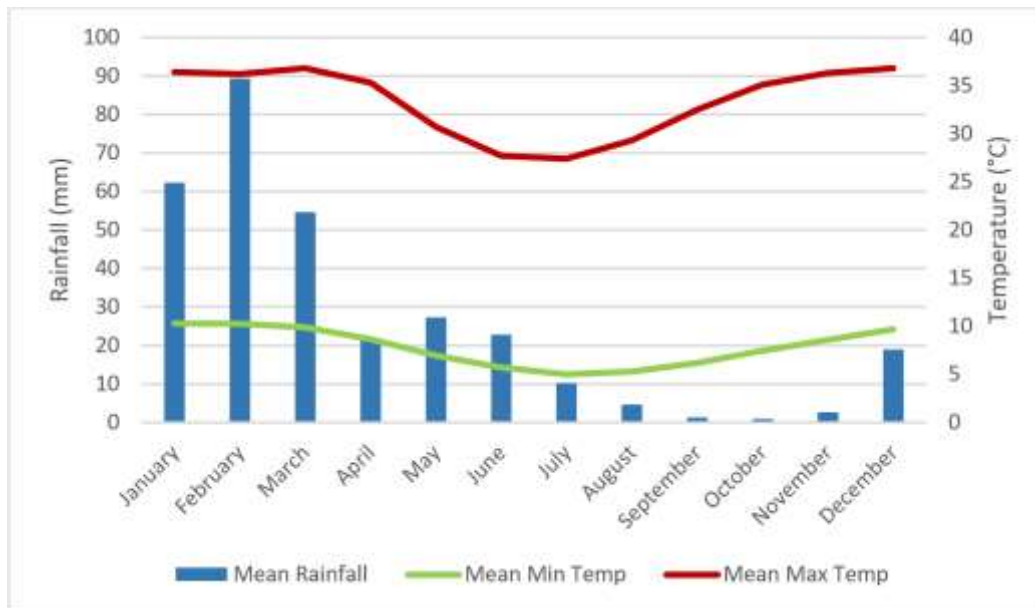
The Survey Area lies within the Wallareenya pastoral lease (N050365). The current land use is cattle grazing.

Active mining operations occur within the Pilgangoora Lithium Project, to the east and south of the Survey Area.

## 2.3 CLIMATE

The Pilbara has very hot summers, mild winters and low and variable rainfall. It is classified as hot desert in northern and inland areas and hot grasslands in the north-west. The climate of the Chichester subregion of the Pilbara is described as semi-desert-tropical, receiving 300 millimetres (mm) of rainfall annually (Kendrick and McKenzie, 2001).

The nearest Bureau of Meteorology (BoM) weather station with a long historical record is at Port Hedland Airport (BoM Site Number: 004032), approximately 75 km northeast of the Survey Area. Port Hedland Airport has recorded rainfall from 1942 (80 years), and temperature from 1948 (74 years). The average climate data recorded for the region over these periods is shown in Figure 2-1. Monthly mean maximum temperature ranges from 36.8°C in March and December to 27.4°C in July. Monthly mean rainfall ranges from 89.3 mm in February to 0.9 mm in October, with a mean annual rainfall of 318.5 mm (BoM 2023).



**Figure 2-1. Temperature and rainfall averages for Port Hedland Airport weather station (Station No. 004032) (BoM 2023)**

## 2.4 GEOLOGY

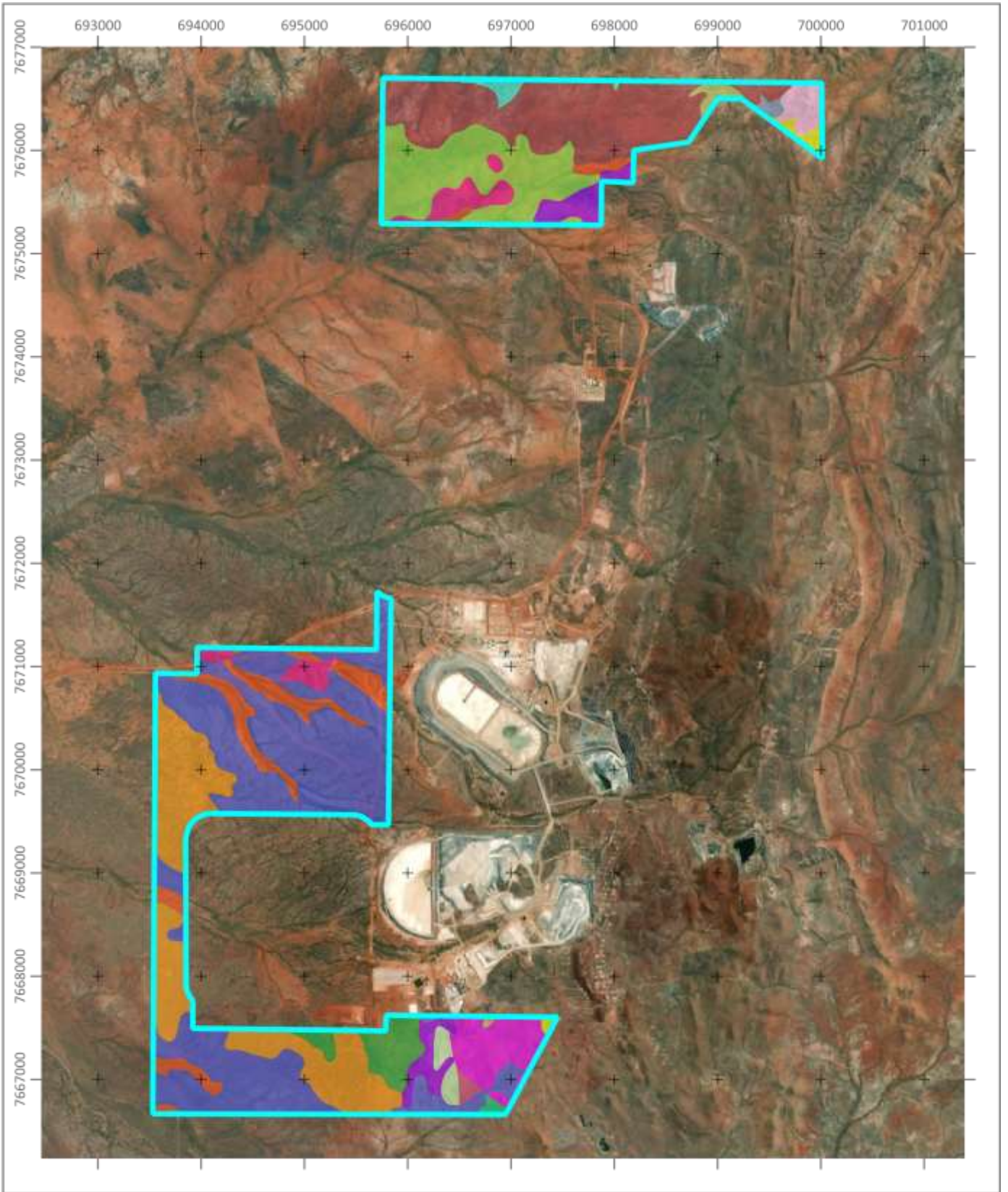
The Pilbara 2014 Geological Information Series dataset (Geological Survey of Western Australia 2014) features a 1:100 000 scale surface geology compilation. The digital layers are based on published maps from the 1994-2005 Pilbara Craton Mapping Project, carried out by the Geological Survey of Western

Australia and Geoscience Australia under the North Pilbara National Geoscience Mapping Accord. The Survey Area is within the Wodgina (2655) map area.

The Survey Area contains the following 17 geological formations:

- A-DA-mats; Dalton Suite; Serpentinite, schistose
- A-KEe-mbaq; Euro Basalt; Silicified amphibolite and metabasalt
- A-KEe-mu; Euro Basalt; Metamorphosed ultramafic rock;
- A-CLmo-xm gm-mgg; Motherin Monzogranite; Interleaved metamonzogranite, metagranodiorite, gneiss, and pegmatite; moderately to strongly foliated; intruded by abundant sheets of massive to weakly foliated muscovite-bearing metamonzogranite and pegmatite;
- A-CLmo-jm gm-mwa; Motherin Monzogranite; Interleaved seriate to porphyritic metamonzogranite, hornblende--biotite metagranodiorite, and pegmatite; strongly foliated and banded, locally gneissic; contains greenstone enclaves and pendants;
- A-mty-P; Pilbara Craton greenstones; Mylonitized metasandstone
- A-PI-musr; Pilbara Supergroup; Tremolite--chlorite--talc schist
- A-PI-mats; Pilbara Supergroup; Strongly sheared serpentine schist derived from intrusive ultramafic rocks
- A-Soc-mtqm; Corboy Formation; Muscovite-bearing quartzite; minor pelite
- A-SR-gp; Split Rock Supersuite; Pegmatite
- \_A1c; Alluvial unit; Sand, silt, and gravel in active drainage channels; includes clay, silt, and sand in poorly defined drainage courses on floodplains; unconsolidated.
- \_A1f-cb-vb; Alluvial unit; Clay, silt, sand, and basaltic or doleritic gravel on floodplains; gilgai surface in areas of expansive clay; derived from ferromagnesian parent rock; unconsolidated
- \_A1i; Alluvial unit; Mixed floodplain deposits; sand, silt, and clay adjacent to main drainage channels; numerous small claypans; unconsolidated
- \_A2-d-k; Alluvial unit; Partly consolidated alluvial gravel, sand, and silt; local carbonate cement; dissected by present-day drainage;
- \_C1; Colluvial unit; Colluvial sand, silt, and gravel in outwash fans; scree and talus; proximal mass-wasting deposits; unconsolidated;
- \_C2; Colluvial unit; Partly consolidated colluvial sand, silt, and gravel in proximal outwash fans; scree and talus; dissected by present-day drainage
- \_R1-g-pg; Residual or relict unit; Residual quartzofeldspathic sand, with quartz and rock fragments; overlying and derived from mass-wasting of granitic rocks; unconsolidated;

The geology of the Survey Area is shown in Figure 2-2.



Author: TB    Approved: EH    Date: 25/07/2023

Legend

# Surface Geology of the Survey Areas

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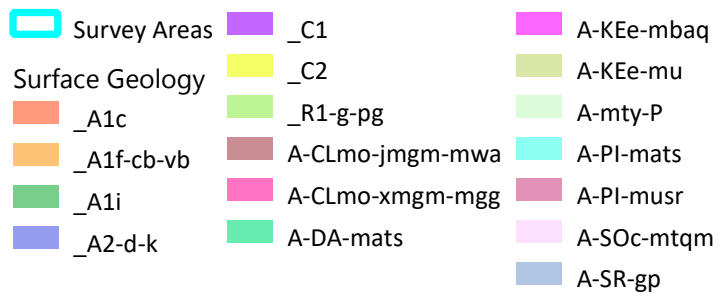
## Figure 2-2

Scale: @ A4  
1: 53,000



0 0.5 1 km

Coordinate System: GDA 2020 MGA Zone 50  
Projection: Transverse Mercator



The soils of the Survey Area were mapped by Tille (2006). The Survey Area is situated in the Fortescue Province, in the western edge of the Nullagine Hills Zone, with influences from the Abydos Plains and Hills Zone.

The Nullagine Hills Zone is characterised by:

“Hills and ranges (with some stony plains) on volcanic and sedimentary rocks of the Pilbara Craton (including the Hamersley Basin). Stony soils with red shallow loams and sands. Spinifex grasslands with kanji and snappy gum. Located in the north-eastern Pilbara around Marble Bar and Nullagine (Tille 2006).”

The Abydos Plains and Hills Zone is characterised by:

“Stony plains (with some hills) on granitic rocks of the Pilbara Craton (East Pilbara Terrane). Red deep sandy duplexes and red shallow loams with stony soils, red sandy earths and red loamy earths. Spinifex grasslands with kanji (and some tussock grasslands). Located in the northern Pilbara between Yandeyarra Community, Bamboo Springs Station, and Marble Bar (Tille 2006).”

## **2.5 BIOGEOGRAPHIC REGIONALISATION**

The Interim Biogeographic Regionalisation for Australia (**IBRA**, version 7) classifies the Australian continent into regions (bioregions) of similar geology, landform, vegetation, fauna, and climate characteristics (Thackway and Cresswell 1995). The mapping completed by Beard (1975) provides the basis for the IBRA bioregions. IBRA mapping (Version 7), places the Project within the Pilbara Bioregion.

The Pilbara Bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges. Vegetation is predominantly mulga low woodlands or snappy gum over bunch and hummock grasses.

The Pilbara Bioregion is further subdivided into the Chichester (PIL1), Fortescue (PIL2), Hamersley (PIL3) and Roebourne (PIL4) Sub-regions. The Project lies entirely within the Chichester Sub-region of the Pilbara Bioregion.

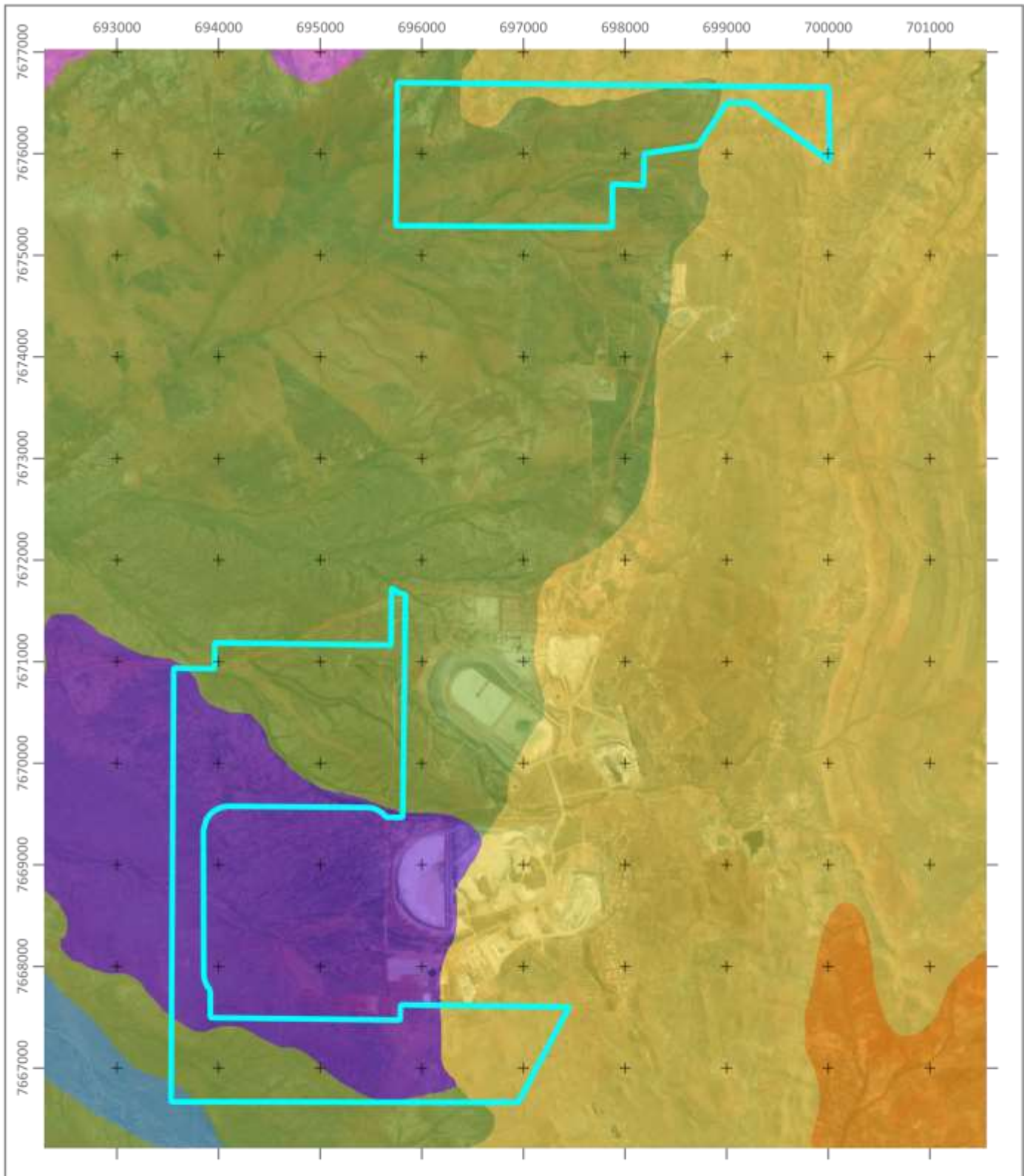
The Chichester Sub-region comprises the northern section of the Pilbara Craton and is comprised of undulating Archaean granite and basalt plains and includes significant areas of basaltic ranges. Plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on ranges (Kendrick and McKenzie, 2001).

## 2.6 LAND SYSTEMS

Land Systems of the Pilbara region are described by van Vreeswyk et al. (2004). Mapping of Land Systems is available from Department of Primary Industry and Regional Development (**DPIRD**, 2019a). The Survey Area falls within four soil landscape systems, Macroy, Satirist, River and Talga, as listed in Table 2-1 and illustrated in Figure 2-3.

**Table 2-1. Land Systems**

Land System	Geology	Description
Macroy	Level to gently undulating stony and gritty surfaced plains with occasional granite tor fields and domes and closely to moderately spaced dendritic tributary drainage floors, relief up to 25 metres ( <b>m</b> )	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands
Satirist	Quaternary alluvium and colluvium; clay, gravel and pebble deposits, minor Lower Proterozoic or Archaean chert, quartzite, shale and agglomerate	Stony plains and low rises supporting hard spinifex grasslands, and gilgai plains supporting tussock grasslands
River	Quaternary alluvium	Active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands
Talga	Hill and ridge tracts of mafic and ultramafic rocks (greenstones), other metamorphics and chert, relief up to 100 m	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands



Author: TB    Approved: EH    Date: 25/07/2023

## Land Systems

Prepared for:

 **Pilbara Minerals**    Figure 2-3

Scale: @ A4  
1: 55,000



0    0.5    1 km


Coordinate System: GDA 2020 MGA Zone 50  
Projection: Transverse Mercator



### Legend

 Survey Areas

#### Land Systems


 Macroy Land System

 River Land System

 Satirist Land System

 Talga Land System

 Boolaloo Land System

 Rocklea Land System



## 2.7 REGIONAL VEGETATION

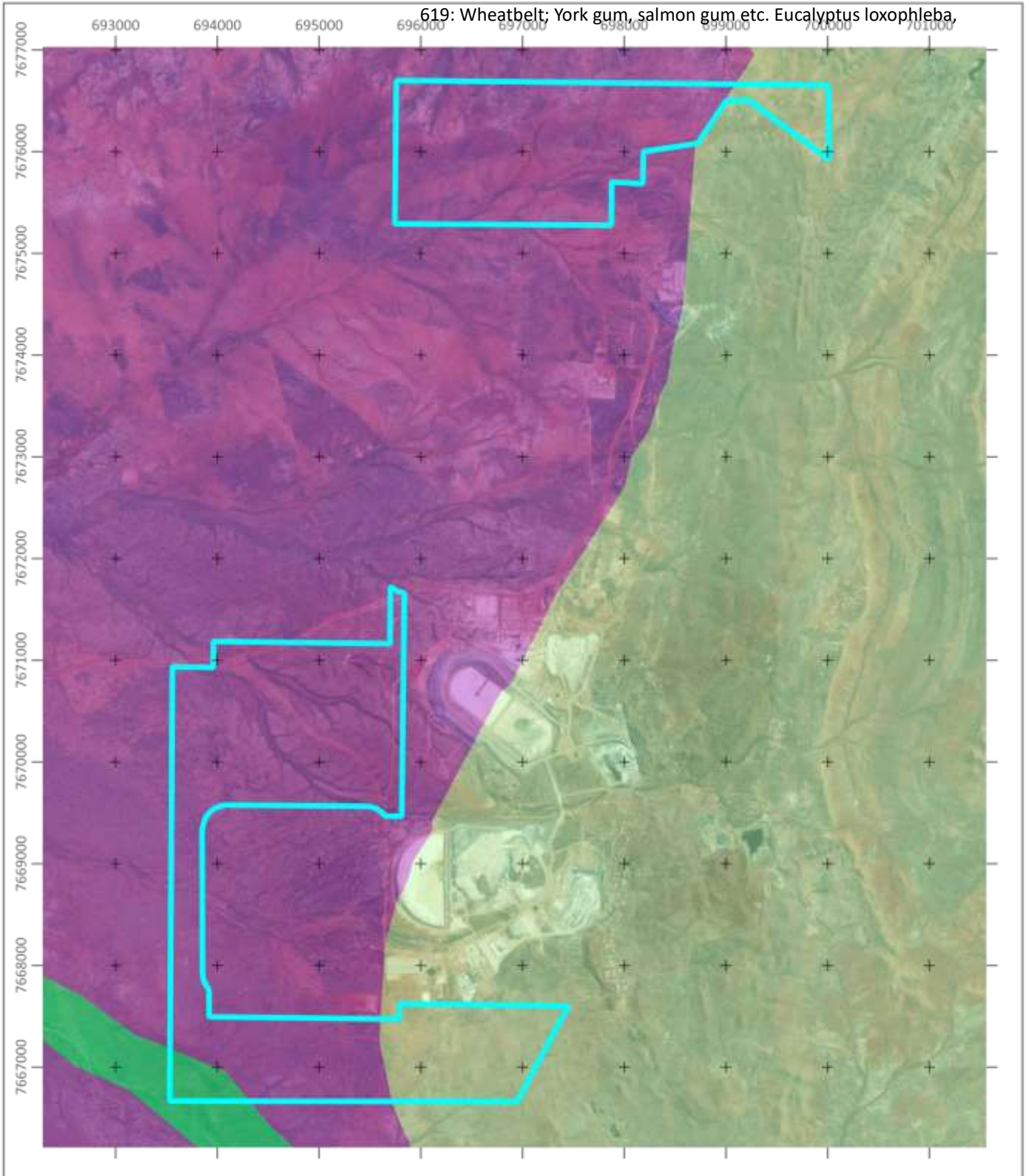
The Survey Area is located within the Eremaean Botanical Province and contains three pre-European Beard vegetation association of the Abydos Plain – Chichester System as shown in Figure 2-4 (DPIRD 2019b). The remaining extent of these vegetation associations is outlined in the most recent DBCA Statewide Vegetation Statistics table dated 2018 and summarised in Table 2-2 below.

Vegetation associations within and nearby the Survey Area have over 99% pre-European Vegetation extent remaining. Conservation significance ranking of vegetation associations occurring within and nearby the Survey Area are of 'Least Concern'.

**Table 2-2 Pre-European Beard Vegetation Associations**

Unit	Vegetation Description	PreEuropean Extent (ha)	Current Extent (ha)	PreEuropean Extent Remaining (%)	Current Extent within DBCA Managed Lands (%)
82	Hummock grassland with scattered bloodwoods and snappy gum <i>Triodia</i> spp., <i>Corymbia dichromophloia</i> , <i>Eucalyptus leucophloia</i>	2,565,901	2,553,206	99.51	11.57
93	Hummock grassland with scattered shrubs or mallee <i>Triodia</i> spp. <i>Acacia</i> spp., <i>Grevillea</i> spp. <i>Eucalyptus</i> spp.	3,044,310	3,040,641	99.88	1.96
619	Riverine; rivergum <i>E. camaldulensis</i>	119,374	118,205	99.02	0.2

619: Wheatbelt; York gum, salmon gum etc. *Eucalyptus loxophleba*,



Author: TB    Approved: EH    Date: 25/07/2023

## Pre-European Beard Vegetation Associations

Prepared for:



Figure 2-4

Scale: @ A4  
1: 55,000



0    0.5    1 km

Coordinate System: GDA 2020 MGA Zone 50  
Projection: Transverse Mercator



### Legend

Survey Areas

#### Vegetation Association

82: Hummock grassland with scattered bloodwoods & snappy gum *Triodia* spp., *Corymbia dichromophloia*, *Eucalyptus leucophloia*

93: Hummock grassland with scattered shrubs or mallee *Triodia* spp. *Acacia* spp., *Grevillea* spp. *Eucalyptus* spp



Riverine; rivergum *E. camaldulensis*. Tropical; messmate

*E. salmonophloia*. Goldfields; gimlet, redwood etc. *E. salubris*, *E. oleosa*.

## 2.8 ENVIRONMENTALLY SIGNIFICANT AREAS

### 2.8.1 Conservation Estate

The Western Australian Conservation Estate includes land and waters vested in the Conservation and Parks Commission under the Conservation and Land Management Act 1984. The Conservation Estate is managed by the Parks and Wildlife Service of DBCA to protect WA's biodiversity, and includes National Parks, Nature Reserves, Conservation Reserves, and other areas managed primarily for biodiversity conservation (DEE 2016).

A search of the Collaborative Australian Protected Area Database returned no conservation estates located within 50 km of the Survey Area. The nearest gazetted terrestrial conservation estate is Mungaroo Range, 80 km to the south-west of the Survey Area.

### 2.8.2 Environmentally Sensitive Areas

Environmentally Sensitive Areas (**ESA**) are areas that are defined by the Department of Water and Environment Regulation (**DWER**) (2019) as:

- A declared World Heritage property as defined in s.13 of the EPBC Act;
- An area that is included on the Register of the National Estate, because of its natural heritage value under the Australian Heritage Council Act 2003;
- A defined wetland and the area within 50 m of the wetland;
- The area covered by vegetation within 50 m of T flora, to the extent to which the vegetation is continuous with the vegetation in which the T flora is located;
- The area covered by a TEC;
- A Bush Forever site;
- Areas covered by the Gngangara Mound Crown Land Policy and Western Swamp Tortoise Policy;
- Areas covered by lakes, wetlands, and fringing vegetation of the Swan Coastal Plain Lakes Policy, including Southwest Agricultural Zone Wetlands Policy and Swan and Canning Rivers Policy; and
- Protected wetlands as defined in the Environmental Protection (Southwest Agricultural Zone Wetlands) Policy 1998.

Environmentally Sensitive Areas can be viewed on the DWER clearing permit system map viewer. There are no ESAs within the Survey Area.

The Australian Wetlands Database includes nationally significant wetlands (as listed in the directory of important wetlands), wetlands listed under the Ramsar convention, wetlands that are representative, rare or unique, or wetlands that are considered of international importance (DEE 2019). The nearest wetlands listed in the Directory of Important Wetlands within 150 km of the Survey Area are the Leslie (Port Hedland) Saltfields System, 80 km to the north, the De Grey River System, 85 km to the north-east, and the Fortescue Marshes, 130 km to the south-west.

## 3 METHODOLOGY

### 3.1 DESKTOP STUDY

The desktop study provides background information on the known attributes of flora, vegetation, and fauna of the Survey Area, and in the local surrounding area.

#### 3.1.1 Database Searches

A search for EPBC Act MNES was undertaken using the DCCEEW Protected Matters Search Tool (**PMST**). The PMST identifies EPBC listed flora and fauna species and communities based on predicted distributions of the species and/or their habitat, in conjunction with species records. The PMST may predict the occurrence of a species or community in an area where there are no documented records, or documented records are historic. For this search, the Survey Area was imported into the PMST viewer as the feature area and a buffer of 30 km applied. The conservation codes are described in Appendix A. The results of the PMST search are included in Appendix B.

The DBCA maintains databases for records of T and P species and communities. A request was made for a search of DBCA databases for T and P flora and fauna and the presence of TECs or Priority Ecological Communities (**PECs**). Results were obtained in August 2022. A 30 km buffer was applied to the search results from a central coordinate of 696681, 7674607 (GDA 2020, MGA Zone 50).

Flora and Fauna Inventory, including records for Introduced flora and fauna from within 30 km, were obtained from the Dandjoo Biodiversity Data Repository hosted by the DBCA Biodiversity Office (DBCA 2023).

Table 3-1 lists the database searches conducted for the desktop study.

**Table 3-1. Database Searches**

Attribute	Search Area	Database	Location
Threatened and Priority Ecological Communities	30 km radius	DBCA	Figure 4-2; Section 4.1.1
	30 km radius	PMST	Appendix B
Threatened Flora	30 km radius	DBCA	Figure 4-1; Section 4.1.1
	30 km radius	PMST	Appendix B
Introduced Flora	30 km radius	Dandjoo	Section 4.1.3
Threatened Fauna	30 km radius	DBCA	Figure 5-1; Section 5.1.1
	30 km radius	PMST	Appendix B
Introduced Fauna	30 km radius	Dandjoo	Section 5.1.2

The DBCA fire history database (DBCA 2022) was consulted to identify local fire history.

### 3.1.2 Literature Review

Flora, vegetation, and terrestrial vertebrate fauna surveys have been conducted in the local area for the Pilgangoora Project. The following local surveys were reviewed, and the results incorporated into the Desktop Study:

- Flora and Fauna Survey Report – Pilgangoora. Prepared on behalf of Altura Mining Limited by Natural Area Consulting, February 2014
- Flora, Vegetation and Fauna Survey Report – Pilgangoora Lithium Project. Prepared on behalf of Altura Mining Limited by Natural Area Consulting, June 2016
- Baseline Vertebrate Fauna Survey, Pilgangoora. Prepared on behalf of Pilbara Minerals Limited by 360 Environmental, May 2016.
- Pilgangoora Project Area – Flora, Vegetation and Fauna Assessment. Prepared on behalf of Pilbara Minerals Limited by MMWC Environmental Pty Ltd, July 2016
- Pilgangoora Access Road Borrow Pits - Flora and Vegetation Assessment. Prepared on behalf of Pilbara Minerals Limited by MMWC Environmental Pty Ltd, July 2016.
- Pityrodia sp. Marble Bar (G. Woodman and D. Coultas GWDC opp 4) Targeted Flora Survey (L45/430 and L45/413). Prepared on behalf of Pilbara Minerals Limited by Ecologia Environmental, 29 June 2017.
- Pilgangoora Lithium Project – M45/1260 Level 1 Fauna and Reconnaissance Flora and Vegetation Assessment. Prepared on behalf of Altura Mining Limited by Ecologia Environmental, 7 July 2018.
- Pilgangoora Project – Stage 2 Expansion Desktop Environmental Assessment. Prepared on behalf of Pilbara Minerals Limited by Ecologia Environmental, 26 October 2018.
- Pilbara Leaf-nosed Bat Survey, Pilgangoora Prepared for Pilbara Minerals Limited by 360 Environmental, November 2015
- Pilbara Leaf-nosed Bat Roost Survey, Pilgangoora Prepared for Pilbara Minerals Limited by 360 Environmental, February 2016
- Northern Quoll Survey on mining tenement M45/1266. Prepared for Pilbara Minerals Limited by Terrestrial Ecosystems, January 2020.
- Lynas Find Biological Survey - Prepared for Pilbara Minerals Limited by APM, October 2022.
- TSF Option 2 and Option 5 Biological Survey - Prepared for Pilbara Minerals Limited by APM, November 2022.
- Northern Quoll Targeted Survey - Prepared for Pilbara Minerals Limited by APM, March 2023.
- E45/2287 Infill Biological Survey - Prepared for Pilbara Minerals Limited by APM, May 2023.
- Targeted Searches for Conservation Significant Bat Roosts - Prepared for Pilbara Minerals Limited by APM, August 2023.

### 3.1.3 Likelihood of Occurrence

Threatened and Priority flora, fauna and communities returned from the database searches and literature review were assessed for their likelihood of occurrence within the Survey Area using the likelihood of occurrence criteria listed in Table 3-2.

**Table 3-2. Likelihood of occurrence criteria**

Likelihood of occurrence	Criteria
Recorded	Identified from database records or field survey as occurring within the Survey Area
Likely	Suitable habitat is present in the Survey Area and the species has previously been recorded within 15 km
Possible	Suitable habitat is present within the Survey Area and the species has previously been recorded between 15 – 30 km of the Survey Area
Unlikely	No suitable habitat is present in the Survey Area

## 3.2 FIELD SURVEY

### 3.2.1 Survey Personnel and Timing

The terrestrial vertebrate fauna survey was carried out by Dr Mitchell Ladyman. The flora and vegetation field survey was undertaken by Dr Neil Pettit, Dr Eleanor Hoy and Ms Tia Berard.

Acoustic analysis and bat call identification was conducted by Dr Kyle Armstrong and Yuki Konishi at Specialised Zoological, a scientific consultancy business that specialises in bats, bioacoustics, and genetic identification. Dr Armstrong has 20 years' experience in environmental consultancy specialising in bats.

Table 3-3 lists the personnel involved in the field survey.

**Table 3-3. Field Survey Personnel**

Survey Date	Personnel	Experience	Description
27 <sup>th</sup> – 30 <sup>th</sup> June 2023			
14 <sup>th</sup> – 17 <sup>th</sup> July 2023	Dr Mitchell Ladyman	20+ years	Terrestrial vertebrate fauna survey
4 <sup>th</sup> August 2023			
	Dr Neil Pettit	25+ years	Flora and vegetation survey
14 <sup>th</sup> – 18 <sup>th</sup> July 2023	Dr Eleanor Hoy	15+ years	
	Ms Tia Berard	2 years	

Autonomous recording devices were installed during the first fauna field survey period, were redeployed during the second survey period and collected in the third survey period.

### 3.2.2 Survey Conditions

The total summer rainfall prior to survey (1<sup>st</sup> December 2022 to 28<sup>th</sup> February 2023) was below average at 97.4 mm compared to 170.6 mm (BoM 2023). The sum of the total rainfall for the period January to July 2023 was 170 mm, which is 61% of the average for the same period (277.6 mm).

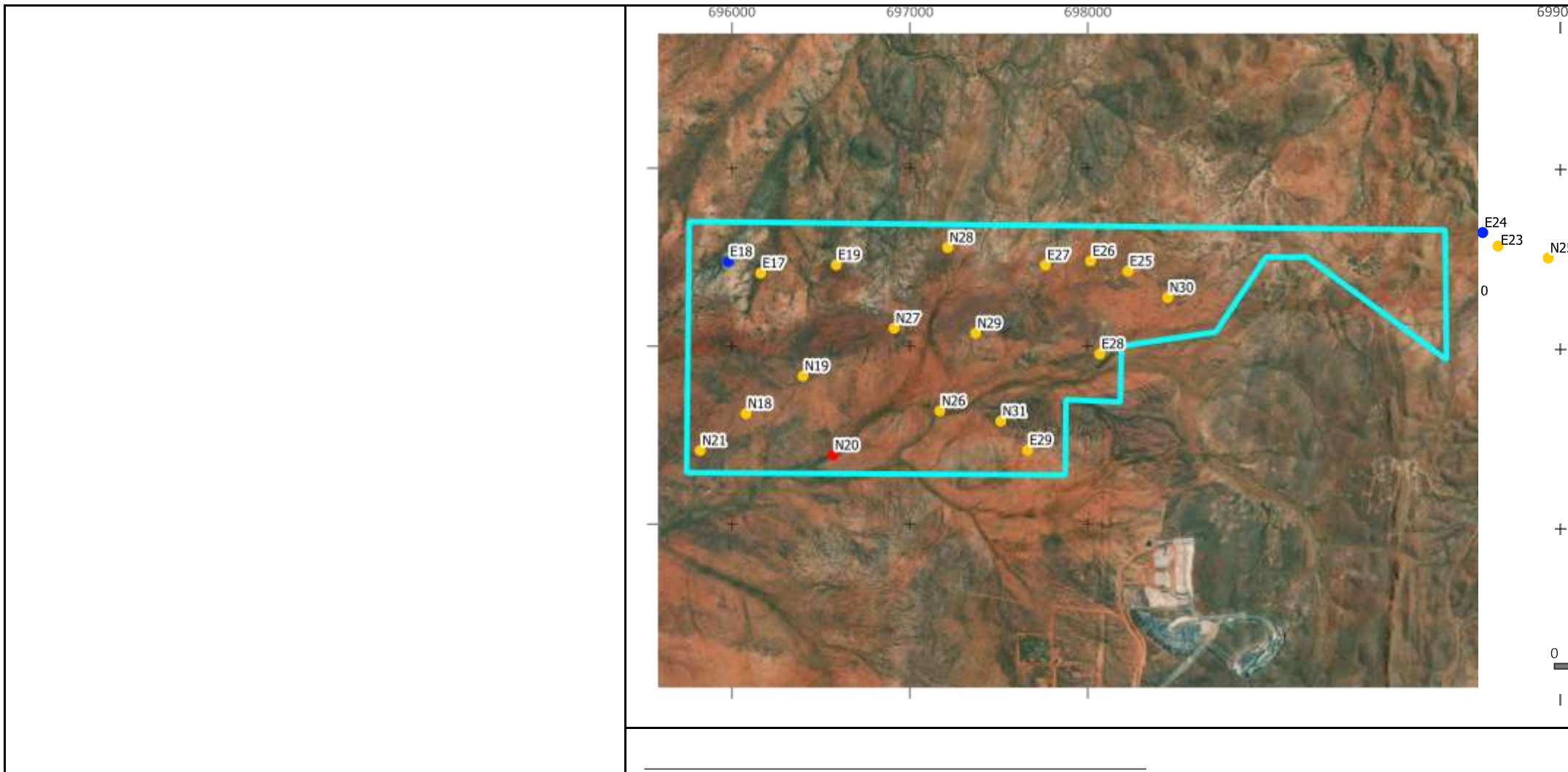
During the survey period, daytime temperatures reached a maximum of between 30.9 and 28.8 °C and a minimum of between 10.5 and 15.3°C overnight, which is typical of the time of year (BoM 2023). No adverse weather conditions occurred that would impact the results of the survey. No rainfall was recorded on the BoM weather station for July and for the duration of the survey.

The Survey Area is within the Eremaean botanical province. Recommended timing for flora and vegetation survey is 6-8 weeks post wet season (March – June) for Primary survey, and a Dry season survey (after winter rainfall if available) for Supplementary survey (EPA 2016). The timing of the field survey is within the Supplementary period for the region, being three weeks following a rainfall in midJune.

Fauna survey timing was within that recommended for mammals (EPA 2020).

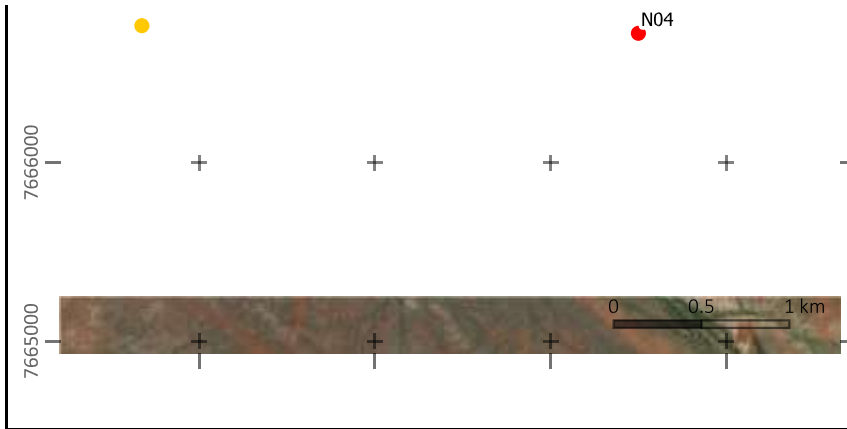
### **3.2.3 Flora and Vegetation**

A Detailed survey was conducted for flora and vegetation. Vegetation was sampled using 49 quadrats of 50 x 50 m, four quadrats of 25 x 100 m and six relevés of approximately 50 x 50 m (Figure 3-1). Quadrats are vegetation survey plots which are accurately measured out as 50 x 50 m (or an area equivalent to 2500 m<sup>2</sup>) and marked at the north-west corner using a handheld Global Positioning System (**GPS**) unit. Relevés were conducted where vegetation units were present in areas less than 2500 m<sup>2</sup> or in geometries that were not of a regular shape.

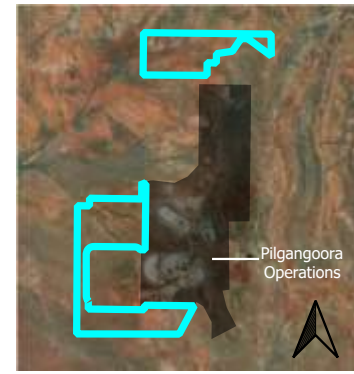




Coordinate System



- Legend**
- Survey Areas
- Flora Assessment Sites**
- 50 x 50 m Quadrat
  - 25 x 100 m Quadrat
  - Relevé



Field data at each survey site was recorded on a pro-forma data sheet and included the parameters listed in Table 3-4. The attributes of Detailed survey sites are provided in Appendix C.

**Table 3-4. Parameters recorded at each Detailed site**

Variable	Parameters
Collection attributes	Personnel/recorder; date, quadrat dimensions and marking method, site code and georeferenced photographs of the quadrat.
Physical features	Landform, slope, aspect, soil attributes, ground surface cover, litter, rock type and physical attributes.
Location	Coordinates recorded using a hand-held GPS (Garmin) to accuracy approximately $\pm 5$ m.
Vegetation	Dominant growth form, height, cover, and species for the three traditional strata (upper, mid and ground) compatible with NVIS Level V (ESCAVI 2003).
Vegetation condition	Vegetation condition was assessed using the condition rating scale devised by Trudgen (1988).
Disturbance	Level and nature of disturbances (e.g. weed presence, fire, and time since last fire, impacts from grazing, vegetation clearing, erosion).
Flora	List of all species within the quadrat including weeds and listing species average height and cover.

A flora inventory was compiled from taxa listed in Detailed survey sites and from opportunistic floristic collections throughout the Survey Area, with at least one collection made for every taxon encountered. Specimens were identified by an experienced botanical taxonomist in the Western Australia Herbarium (**WAH**) using published reference material. The nomenclature applied is consistent with Florabase (WAH 1998-).

The conservation status of all recorded flora was determined from the DBCA Wildlife Conservation Rare Flora Notice 2022, T and P Flora List 6 October 2022, and the EPBC Act List of T Flora (DCCEEW 2023). The Western Australian Organisms List database was consulted to determine if any are BAM Act Declared Plants (DPIRD 2023), and the Weeds of National Significance list to determine any WONS (DAWE 2020).

The vegetation types were described based on their structure and species composition, as defined by quadrat data, and field observations. Vegetation was mapped in the field using handheld GPS units and aerial photographs, then digitised using GIS software. Vegetation is described at the association level (ESCAVI 2003) and referred to as Vegetation Types (EPA 2016).

Vegetation Condition was assigned using the scale developed for the Eremaean and Northern Botanical Provinces adapted from Trudgen (1988) as recommended in EPA (2016). Table 3-5 lists the six potential categories.

**Table 3-5. Vegetation Condition Scale**

<b>Vegetation Condition</b>	<b>Ermaean and Northern Botanical Provinces adapted from Trudgen (1988)</b>
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs

Data analysis was applied using the method recommended by EPA (2016). A species by site matrix was prepared using the complete suite of species recorded. The Primer 7 (Clarke and Gorley, 2015), software was used to perform floristic composition vegetation classification. Data was transformed to presence/absence and a resemblance matrix was constructed using the Bray Curtis similarity measure. A cluster analysis was performed using group averages. The SIMPROF routine was used to test the hypothesis that the species and/or abundances are different at each group of sites using 999 permutations and a significance level of 5%.

The completeness of the survey was tested using a species accumulation curve and applying the Michaelis-Menton model to estimate the species richness of the Survey Area.

### 3.2.4 Fauna

Fauna habitat assessments were performed at 18 locations. Descriptive data was recorded including soil type, landform, presence of microhabitats, disturbances and images were recorded. Reference sites were also recorded as mapping notes and site photos, to record the extent/distribution and condition of habitat types. Fauna habitat assessment site photos and reference site photos are included in Appendix D.

Targeted search was conducted for direct observation and signs of conservation significant fauna using traverses on foot, with tracklogs recorded on a handheld GPS. Signs include scats, prints, slough skin, scratchings made during foraging and other diggings, burrows and mounds. Georeferenced photos of

signs were taken. Traverses were conducted during daylight hours. Traverses covered a linear distance of 79.4 km and are shown in Figure 3-2.

Motion-triggered and time lapse cameras were deployed throughout the Survey Area between the 27<sup>th</sup> and 29<sup>th</sup> of June 2023. These cameras were closed and re-deployed between the 14<sup>th</sup> and 15<sup>th</sup> of July 2023 at different locations and were closed on the 3<sup>rd</sup> of August 2023. Cameras were generally deployed in pairs with one camera set up as motion-triggered capture (3 photos per trigger with a 5-minute reset period) and one set up as a time lapse capture method (1 photo every 5 minutes). Table 3-6 lists the camera locations and confirmed operational days.

**Table 3-6. Motion-triggered and time lapse camera setup and duration**

Targeted Fauna Habitat	Location	Camera	Method	Trap nights
	(GDA 2020 MGA zone 50)			
Cameras deployed between the 27 <sup>th</sup> June and 15 <sup>th</sup> July 2023				
Shallow Drainage Depression and Creeks	697597, 7675800	C31(1)	Motion Sensor	5
		C21x(1)	Time Lapse	13
Historic Mine Workings	699467, 7676512	C32(1)	Motion Sensor	8
		C20(1)	Time Lapse	17
Shallow Drainage Depression and Creeks	698187, 7676017	C33(1)	Motion Sensor	7
		C9(1)	Time Lapse	16
Rocky Outcrop	699735, 7676675	C34(1)	Motion Sensor	7
		C21(1)	Time Lapse	17
Rocky Outcrop	699658, 7676683	C35(1)	Motion Sensor	6
		C13(1)	Time Lapse	17
Shallow Drainage Depression and Creeks	698401, 7676627	C36(1)	Motion Sensor	4
		C18(1)	Time Lapse	4
Rocky Outcrop	699580, 7676575	C37(1)	Motion Sensor	9
		C7(1)	Time Lapse	17
Major Drainage Line	694153, 7671149	C10(1)	Time Lapse	17
		C6(1)	Motion Sensor	15
Major Drainage Line	695836, 7670653	C16(1)	Motion Sensor	17
		C14(1)	Time Lapse	17
Shallow Drainage Depression and Creeks	698266, 7670653	C30(1)	Motion Sensor	8
		C11(1)	Time Lapse	17
Cameras deployed between the 15 <sup>th</sup> July and 4 <sup>th</sup> August 2023				
Rocky Outcrop	696438, 7666886	C21x(2)	Time Lapse	19
Platy Rock Outcrop	696287, 7667222	C32(2)	Motion Sensor	19
		C21(2)	Time Lapse	19
Stony Plains	694294, 7667312	C33(2)	Motion Sensor	18
Platy Rock Outcrop	696287, 7667222	C34(2)	Motion Sensor	19
		C20(2)	Time Lapse	19

Rocky Outcrop	696923, 7666789	C35(2)	Motion Sensor	20
		C13(2)	Time Lapse	20
Major Drainage Line	695723, 7670951	C36(2)	Time Lapse	17
		C11(2)	Motion Sensor	17
Rocky Outcrop	696904, 7666819	C37(2)	Motion Sensor	20
		C7(2)	Time Lapse	20
<b>Total</b>				<b>465</b>

Identifications from camera captures were made as far as necessary to rule out target species, however most fauna captures were determined to species level. Individual captures were counted where a time gap of at least an hour was recorded between captures of the same species unless demarcations were available to definitively identify individuals.

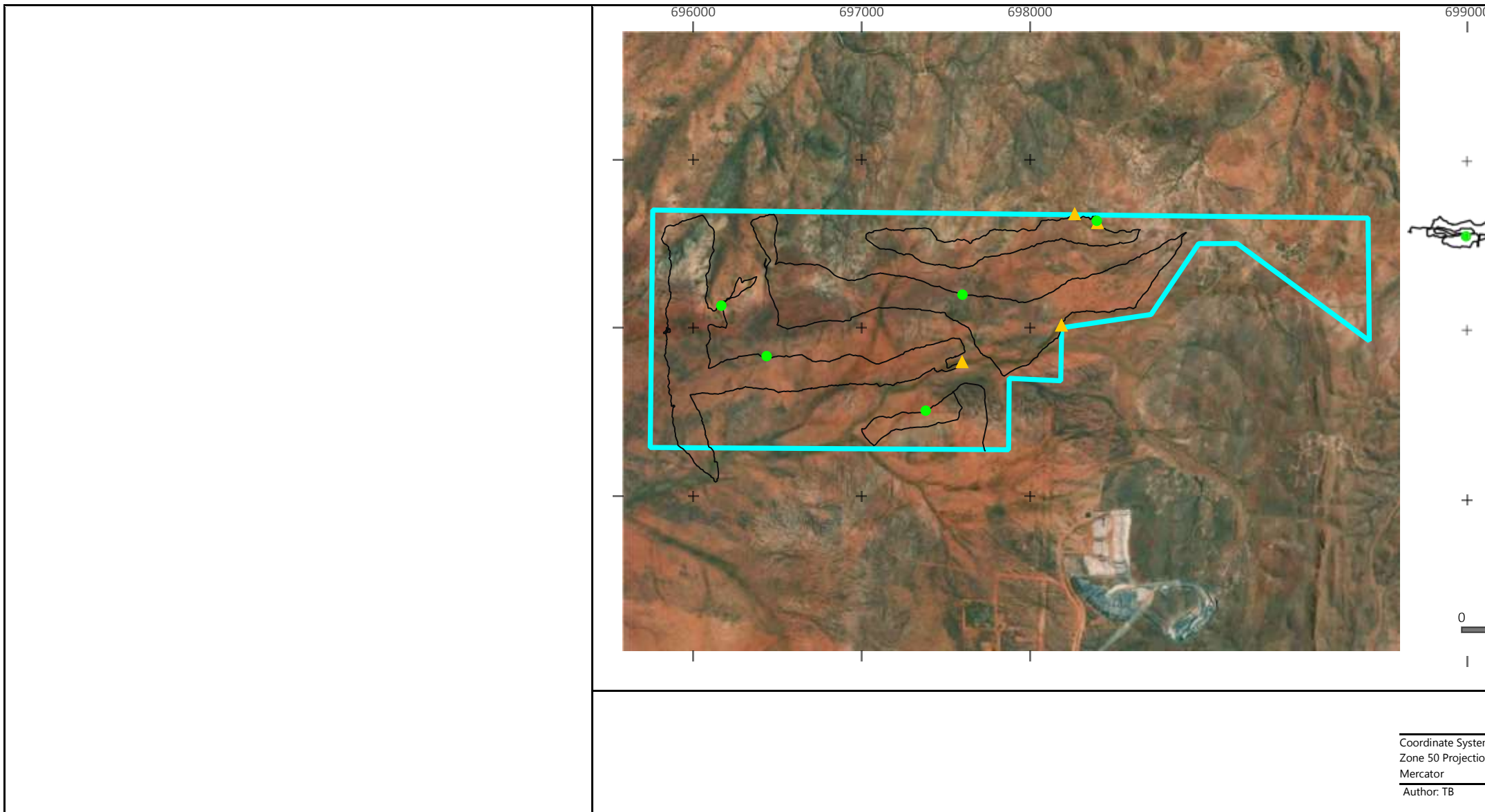
Five Anabat Swift acoustic bat recording devices were deployed between the 14<sup>th</sup> of July and 2<sup>nd</sup> of August 2023 for a total of 49 nights. Table 3-7 lists the acoustic bat recording devices deployed, the habitat type targeted, and the number of trap nights.

Bat call analysis was performed by Dr Kyle Armstrong of Specialised Zoological. A technical report with specifications on the analysis method is included as Appendix E. The scope of the analysis was limited to the detection of the conservation significant species Ghost bat *Macroderma gigas* and Pilbara leafnosed bat *Rhinonictis aurantia*.

**Table 3-7. Acoustic bat recording device location and duration**

Habitat	Location (GDA	Acoustic Bat Recorder	Trap nights
	2020 MGA zone 50)		
Rocky Outcrop	699665, 7676685	AS660654	17
Historic Mine Workings	699456, 7676503	AS60630	7
Major Drainage Line	694016, 7671058	AS45085	3
Major Drainage Line	695818, 7670642	AS642022	17
Shallow Drainage Depressions and Creeks	693801, 7666455	AS450007	5
<b>Total</b>			<b>49</b>

Nomenclature within this report is applied according to the WA Checklist of Terrestrial Vertebrates (Western Australian Museum 2023). Figure 3-2 shows the location of cameras, acoustic recording devices and targeted searches. Detailed fauna habitat assessments were made at the locations where cameras and acoustic recording devices were deployed, and during traverses.



Coordinate System  
Zone 50 Projection  
Mercator  
Author: TB

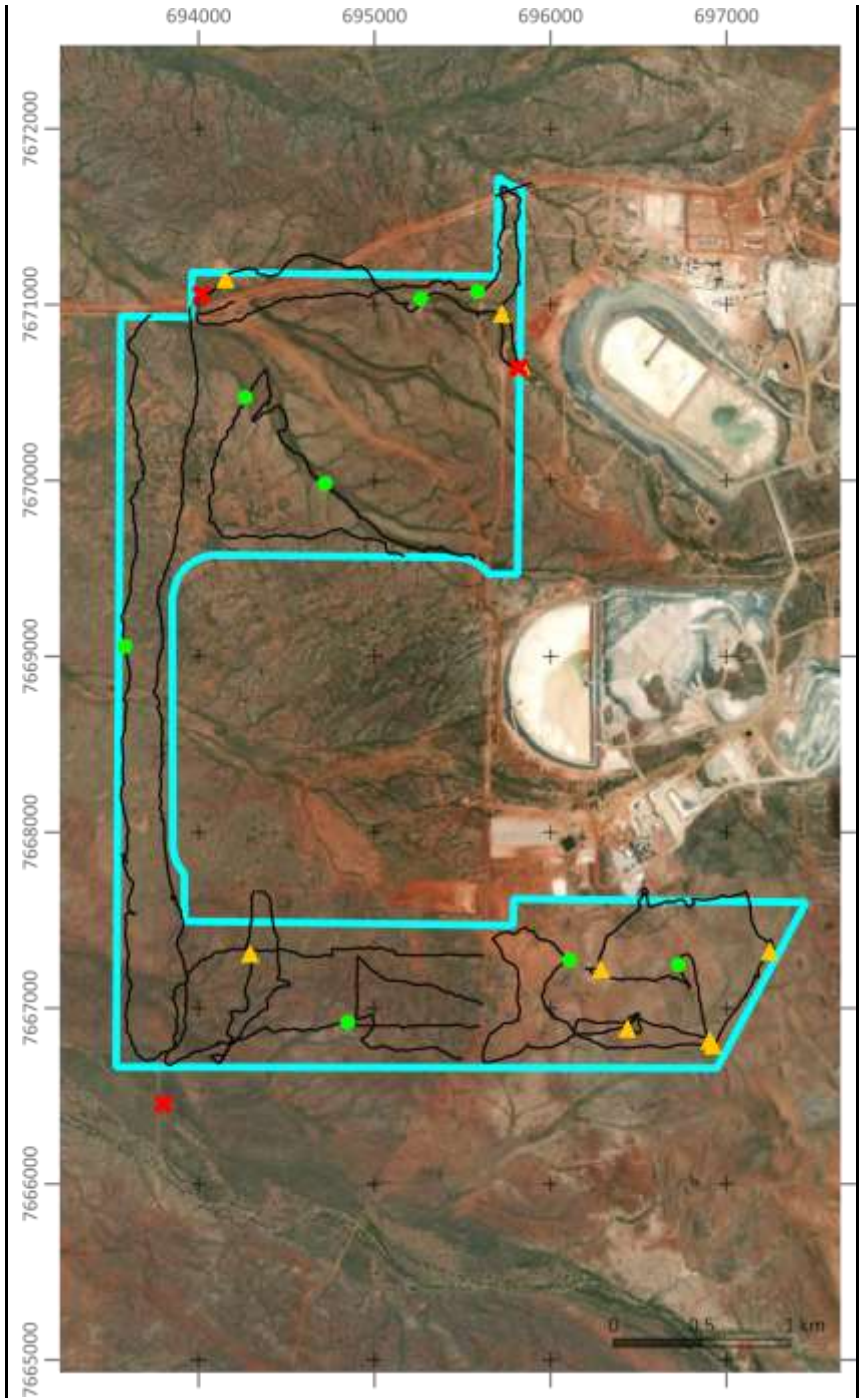
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### Legend

-  Survey Areas
-  Acoustic Bat Recorder
-  Motion Triggered Camera
-  Fauna Habitat Assessment
-  Targeted Search Traverses





### 3.3 CONSTRAINTS

Several limitations may arise during field survey EPA (2016 and 2020). These potential survey limitations are listed below in Table 3-8 with comments on the constraint to the outcomes of the survey.

**Table 3-8. Survey Constraints**

Factor	Impact of survey outcomes
Access problems	Not a constraint. All of the Survey Area was accessed.
Experience levels	Not a constraint. The personnel were suitably qualified
Scope: Flora and vegetation	Not a constraint. Survey was carried out at a level of Detailed assessment
Scope: Fauna	Not a constraint. The survey was carried out at a level of Targeted level of assessment, suitable for the size and intensity of the proposed Project and the availability of previous local survey.
Timing, weather, season, cycle	<p>Not a constraint. The Survey Area is within the Eremaean Botanical district. Rainfall in the season prior to survey was lower than average. The Flora and Vegetation survey was conducted in the Supplementary survey period (EPA 2016).</p> <p>No inclement weather occurred during the survey period that would impact the detection of target fauna.</p> <p>Survey timing was within that recommended for mammals. Conditions were unsuitable for reptiles, water birds and amphibians, however the assessment of habitat availability for these groups was possible and target species were predominantly mammals.</p>
Sources of information	Not a constraint. Previous biological reports and database records are available for the locality and region.
Completeness: Flora and vegetation	Minor constraint. Two plant specimens (1.4% of the collection) were not able to be determined to the species level due to lack of fertile material. Modelling indicates the survey captured 93% of the floristic richness present at the time of survey. Due to low rainfall preceding the survey, the presence of annual species was restricted to areas receiving runoff and/or with higher moisture retention.
Completeness: Fauna	<p>Not a constraint. The scope was completed. The survey resulted in no ambiguous identifications of bat calls. Some deployed bat detection devices failed to record correct date and location data and due to continuous recording battery longevity was reduced. The locations and date/time of deployment was recorded using GPS and therefore was known. The acoustic survey totaled 49 nights and confirmed the presence of the Pilbara leaf-nosed bat and therefore the technical issues were not a constraint.</p> <p>Seven photos were unable to be determined to species level but were able to be ruled out as being target species and therefore was not a constraint.</p>

## 4 FLORA AND VEGETATION RESULTS

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### 4.1 DESKTOP STUDY

#### 4.1.1 Significant Flora

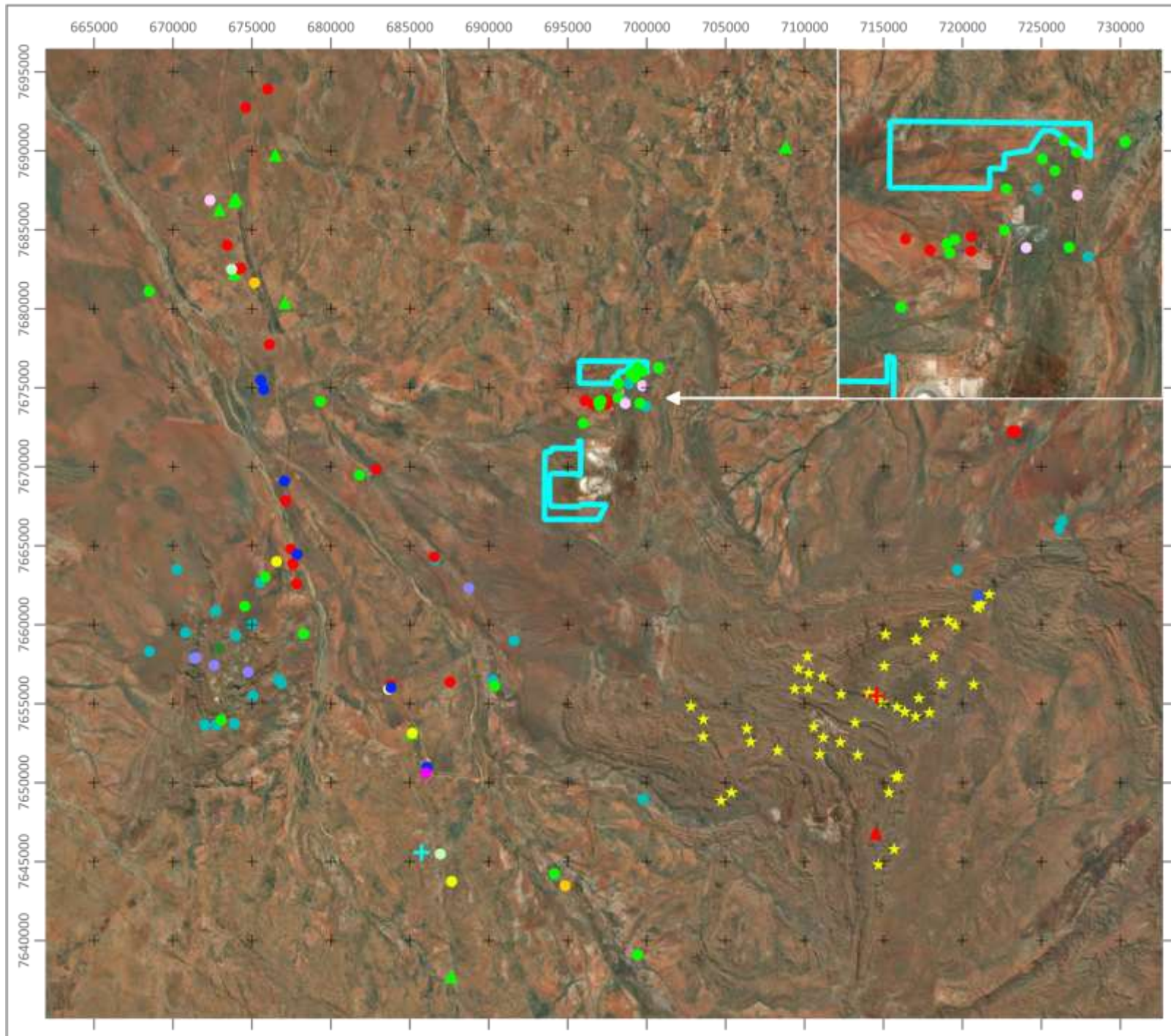
No T or P Flora listed under the BC Act and/or EPBC Act have been previously recorded within the Survey Area.

One T flora species has been recorded within 30 km, *Quoya zonalis* (formerly *Pityrodia* sp. Marble Bar, listed as Endangered under the EPBC Act and BC Act). Two P1, thirteen P3, and two P4 species have records within 30 km of the Survey Area.

No additional T or P species were returned from the PMST or literature review, however a local record of *Rothia indica* subsp. *australis* (APM 2022a) increased the likelihood of occurrence from Possible to Likely.

T and P flora returned from the DBCA database with records within 30 km of the Survey Area are shown in Figure 4-1. Records of P flora previously recorded within the Pilgangoora Project are also shown.





## Legend

Survey Areas

### Endangered

*Quoya zonalis*

### Priority 1

*Acacia leeuweniana*

*Themeda* sp. Panorama  
(J. Nelson et al. NS 102)

### Priority 3

*Eragrostis crateriformis*

*Euphorbia clementii*

*Euploca mutica*

*Gomphrena leptophylla*

*Gymnanthera cunninghamii*

*Nicotiana umbratica*

*Phyllanthus hebecarpus*

*Rothia indica* subsp. *australis*

*Stylidium weeliwolli*

*Terminalia supranitifolia*

*Triodia basitricha*

*Triodia chichesterensis*

*Vigna triodiophila*

### Priority 4

*Bulbostylis burbidgeae*

*Ptilotus mollis*

Scale: @ A4  
1: 350,000



0 5 10 km

Coordinate System: GDA 2020 MGA Zone 50  
Projection: Transverse Mercator



Author: TB Approved: EH Date: 26/07/2023

## Threatened and Priority Flora Records

Prepared for:



Figure: 4-1

An assessment of the likelihood of occurrence of these 18 species within the Survey Area was performed using the criteria listed in Table 3-2. The results of the assessment are listed in Table 4-1.

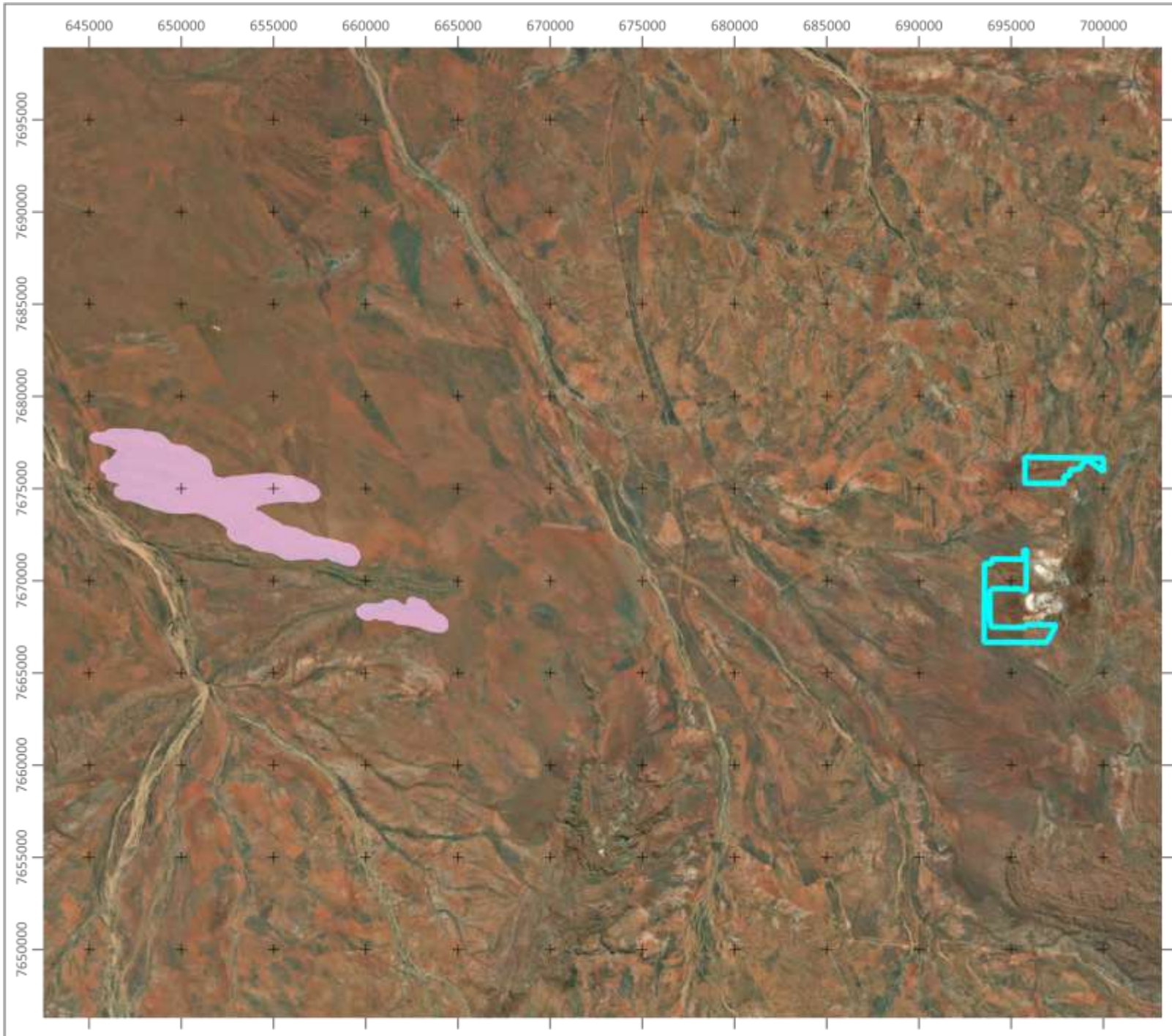
**Table 4-1. Threatened and Priority Flora Likelihood of Occurrence**

Species	Cons. Code		Preferred Habitat	Likelihood of Occurrence
	BC Act	EPBC Act		
<i>Acacia leeuweniana</i>	P1	-	Gritty, skeletal red-grey sandy loam, light orange-brown gravelly sand, granite. In rock fissures in outcrops, among boulders.	Possible. Suitable habitat in granite outcrop areas.
<i>Bulbostylis burbidgeae</i>	P4	-	Granitic soils. Granite outcrops and cliff bases.	Possible. Suitable habitat in granite outcrop areas.
<i>Eragrostis crateriformis</i>	P3	-	Clayey loam or clay. Creek banks, depressions.	Possible. Suitable habitat in the claypans.
<i>Euphorbia clementii</i>	P3	-	Gravelly hillsides, stony grounds.	Likely. Suitable habitat on the stony plains and rises.
<i>Euploca mutica</i>	P3	-	Hummock grassland and sandplains.	Likely. Suitable habitat in sandplains.
<i>Gomphrena leptophylla</i>	P3	-	Open flats, sandy creek beds, edges salt pans and marshes, stony hillsides.	Possible. Suitable habitat in the plains and sandy creek beds.
<i>Goodenia nuda</i>	P4	-	Has been previously found in drainage lines of red-brown loamy sand or sandy loam and in disturbed roadside areas	Possible. Suitable habitat in creeks and roadsides.
<i>Gymnanthera cunninghamii</i>	P3	-	Sandy soils, creeks.	Possible. Suitable habitat in sandy creeks.
<i>Nicotiana umbratica</i>	P3	-	Typically grows in shelter of large boulders on rocky outcrops and in shallow soils	Possible. Suitable habitat in granite outcrop areas.
<i>Phyllanthus hebecarpus</i>	P3	-	Granite boulders/outcropping	Possible. Suitable habitat in granite outcrop areas.
<i>Quoya zonalis</i>	EN	EN	Steep, rocky, sandstone conglomerate and granite slopes in skeletal, brown, sandy loam soils of the Capricorn Land System	Unlikely to occur. No suitable habitat.
<i>Rothia indica</i> subsp. <i>australis</i>	P3	-	Sandy soils. Seasonally inundated areas, sandhills and flats.	Likely. Suitable habitat in sandplains.
<i>Stylidium weeliwolli</i>	P3	-	Gritty sand soil, sandy clay. Edge of watercourses.	Possible. Sandy creek edges.
<i>Terminalia supranitifolia</i>	P3	-	Sand. Among basalt rocks.	Unlikely to occur.
<i>Themeda</i> sp. <i>Panorama</i> (J. Nelson et al. NS 102)	P1	-	Has been found growing along watercourses and creek lines and on rocky substrate	Possible. Suitable habitat along rivers and creeks and outcrops.
<i>Triodia basitricha</i>	P3	-	Occurs on rocky and gravelly slopes of mountains or low hills.	Unlikely to occur.
<i>Triodia chichesterensis</i>	P3	-	Occurs on sand or loam over rocky or gravelly substrates, often with quartzite.	Present. Suitable habitat includes low rises with rocky soils containing quartzite.



Vigna triodiophila	P3	-	Local record among dolerite boulders on very steep upper slope. Stony red-brown clay loam.	Unlikely to occur.
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#### 4.1.2 Significant Vegetation

There are no TECs listed under the BC Act or EPBC Act known to occur within the Survey Area. One P 3 Ecological Community is located approximately 30 km west of the Survey Area; the Gregory Land System (Figure 4-2).

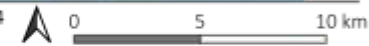


### Legend

-  Survey Areas
-  Gregory Land System  
Priority 3 Ecological Community



Scale: @ A4  
1: 300,000



Coordinate System: GDA 2020 MGA Zone 50  
Projection: Transverse Mercator



Author: TB      Approved: EH      Date: 26/07/2023

## Threatened and Priority Ecological Communities

### 4.1.3 Introduced Flora Species

Dandjoo returned two introduced flora species, *Cenchrus ciliaris* and *Flaveria trinervia*, both categorised as S11-Permitted under the BAM Act. Eleven introduced flora species have been recorded locally by previous surveys (MMWC Environmental 2016a; APM 2022a,b), including two Declared pests also listed as WONS.

Table 4-2 lists the introduced flora species recorded within 30 km of the Survey Area.

**Table 4-2. Introduced Flora Records within 30 km of the Survey Area**

Species	Common Name	BAM Act Listing	WONS
<i>Aerva javanica</i>	Kapok Bush	Permitted – S11	No
<i>Cenchrus ciliaris</i>	Buffel Grass	Permitted – S11	No
<i>Cenchrus setiger</i>	Birdwood Grass	Permitted – S11	No
<i>Chloris barbata</i>	Purpletop Chloris	Permitted – S11	No
<i>Cynodon dactylon</i>	Couch Grass	Permitted – S11	No
<i>Flaveria trinervia</i>	Speedy Weed	Permitted – S11	No
<i>Malvastrum americanum</i>	Spiked malvastrum	Permitted – S11	No
<i>Opuntia stricta</i>	Common Prickly Pear	Declared Pest – S11(2) (C3 Restricted)	Yes
<i>Passiflora foetida</i> var. <i>hispida</i>	Stinking Passion Flower	Permitted – S11	No
<i>Tamarix aphylla</i>	Athel Pine	Declared Pest – S22(2) (Exempt)	Yes
<i>Triumfetta pentandra</i>	-	Permitted – S11	No

## 4.2 FIELD SURVEY

### 4.2.1 Flora

A total of 143 species of flora were recorded within the Survey Area, comprising 139 native species and four introduced species. Two specimens in the collection (1.4% of the collection) could not be unambiguously identified beyond genus level due to the lack of flowering parts or fruiting bodies.

The Fabaceae (pea family, 37 native), Poaceae (grass family, 31 native, two introduced), Malvaceae (12 native species), and Amaranthaceae (seven native species, one introduced) were the most species-rich families recorded. Twenty-eight families represented by 74 genera were recorded across the Survey Area.

The complete list of plant species recorded within the Survey Area is presented in Appendix F. The mean species richness was 15 species per quadrat. This is lower than other local surveys including the MMWC

Environmental (2016a) Pilgangoora baseline survey which included 49 detailed sites with an average species richness of 25, the Infill Biological Survey (APM 2023b) with 17 detailed sites and an average richness of 32, TSF Option 2 and 5 Survey (APM 2022b) with 19 detailed sites and an average species richness of 23, and the Lynas Find Survey (APM 2022a) with 23 detailed sites and an average species richness of 20. The low species richness is likely a consequence of survey season and seasonal conditions.

A species accumulation curve (Appendix F) was performed, returning a modelled Michaelis-Menton species richness of 155, indicating that the floristic survey was approximately 93% complete.

The survey recorded 26 species not previously encountered at the Pilgangoora Project. These species are identified in Appendix F and bring the total richness for the Pilgangoora Project area to 288 including subspecies, and varieties.

Floristic groups identified in the cluster analysis were organised into vegetation types and are discussed in the following section.

The introduced flora species recorded are detailed in Section 4.2.6.

#### 4.2.2 Vegetation Types

Seven vegetation types are described for the Survey Area, as summarised in Table 4-3 and detailed below.

**Table 4-3. Vegetation Types**

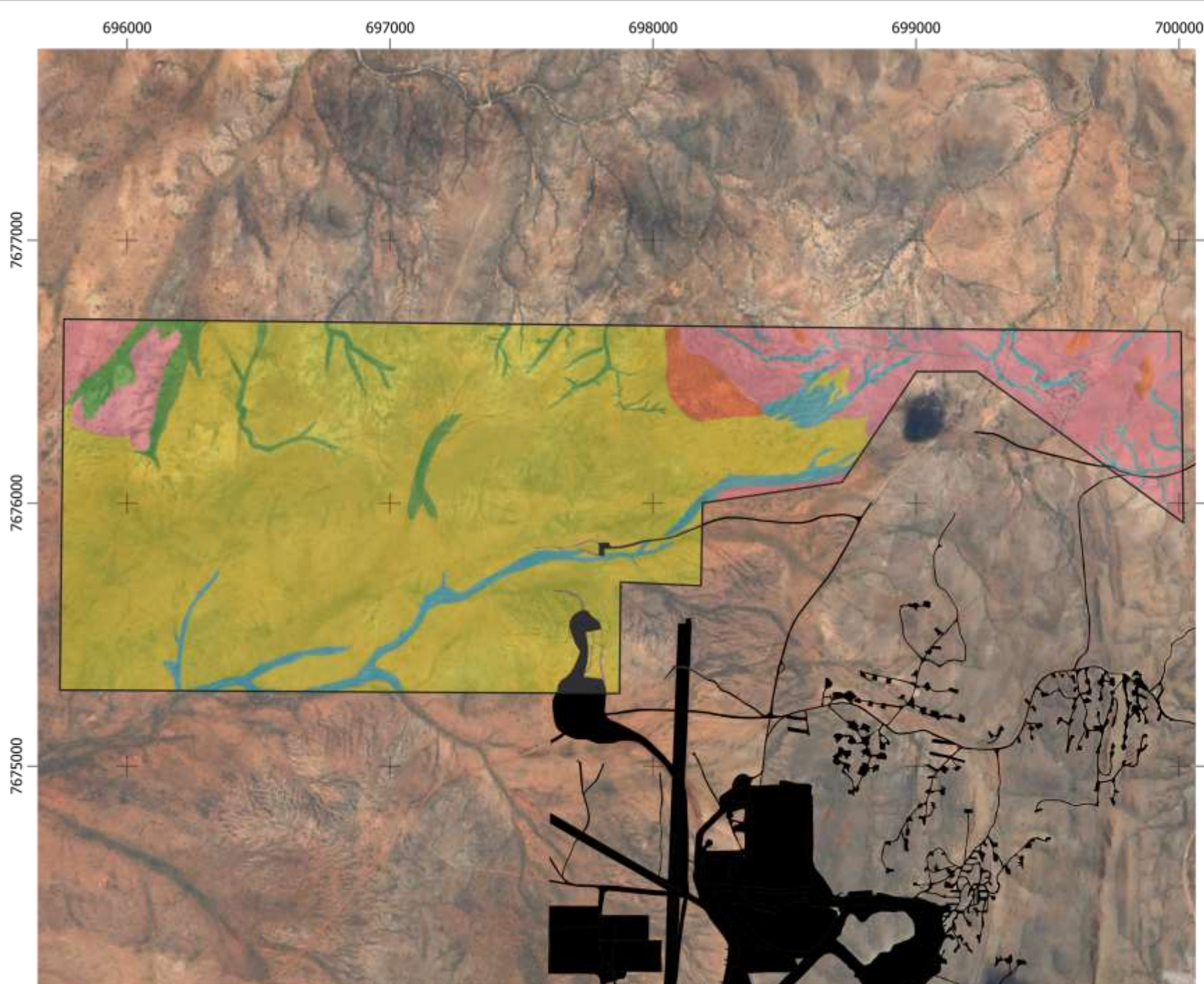
Code	Landform	Vegetation Description	ha	%
12a	Undulating plains	Isolated low <i>Corymbia hamersleyana</i> over <i>Acacia adsurgens</i> , <i>Acacia inaequilatera</i> and <i>Grevillea wickhamii</i> sparse tall shrubland with mid hummock grassland of <i>Triodia lanigera</i> , <i>Triodia wiseana</i> and <i>Triodia epactia</i> .	824.7	71.0
7b	Drainage depressions	Low open woodland of <i>Corymbia hamersleyana</i> ; over <i>Acacia acradenia</i> , <i>Acacia adsurgens</i> and <i>Indigofera rugosa</i> mid open shrubland and <i>Triodia wiseana</i> , <i>Triodia epactia</i> and <i>Triodia chichesterensis</i> hummock grassland.	136.7	11.8
15a	Sandy Creek	Low open woodland of <i>Corymbia hamersleyana</i> over <i>Acacia cowleana</i> , <i>Acacia adsurgens</i> and <i>Indigofera rugosa</i> mid open shrubland with <i>Triodia epactia</i> , <i>Triodia lanigera</i> and <i>Triodia wiseana</i> hummock grassland.	31.8	2.7
9a	Stony plains and rises	Mid isolated shrubs of <i>Acacia inaequilatera</i> , <i>Acacia acradenia</i> and <i>Hibiscus sturtii</i> with <i>Triodia wiseana</i> , <i>Triodia epactia</i> and <i>Triodia chichesterensis</i> hummock grassland.	97.8	8.4
9c	Granite outcrops and rises	Isolated low <i>Corymbia hamersleyana</i> over <i>Acacia adsurgens</i> , <i>Acacia cowleana</i> and <i>Acacia maitlandii</i> mid sparse shrubland with <i>Triodia lanigera</i> , <i>Triodia wiseana</i> and <i>Triodia epactia</i> hummock grassland.	9.3	0.8

4b	Major Drainage Line	Low open woodland of <i>Eucalyptus victrix</i> and <i>Corymbia hamersleyana</i> over <i>Cajanus cinereus</i> , <i>Acacia cowleana</i> and <i>Acacia pyrifolia</i> mid sparse shrubland with <i>Triodia epactia</i> , <i>Cenchrus ciliaris</i> and <i>Triodia angusta</i> mid open hummock and tussock grassland.	13.4	1.2
16a	Claypans	Open herbfield of <i>Sida fibulifera</i> , <i>Eriachne mucronata</i> and <i>Neptunia dimorphantha</i> .	14.1	1.2
D	-	Disturbed – clear of vegetation	34.1	2.9

As the Survey Area is continuous with other surveys conducted for the Pilbara Minerals Pilgangoora Project, the vegetation coding system previously used at the site has been retained and extended. Vegetation communities have been compared to those previously recorded on the site using structural comparison and common species assemblages. Where communities share a high level of similarity, the vegetation code previously applied has been used here and a discussion of similarity presented.

The DBCA fire history database indicates that the western half of the northern Survey Area was burned in 2017/2018, and the eastern half burned in 2013/2014. The south-eastern portion of the southern Survey Area was burned in 2019/2020, and the south-western portion in 2009/2010. On-ground observations supported these remotely recorded fire records. Post fire-regeneration has occurred in all areas and time since fire was considered in the assessment of vegetation condition.

Distribution of vegetation types at a scale of 1: 20,000 is shown in Figure 4-3 a and b. The dendrogram resulting from the cluster analysis is shown in Appendix C, followed by the site data sheets and photos.



**Legend**

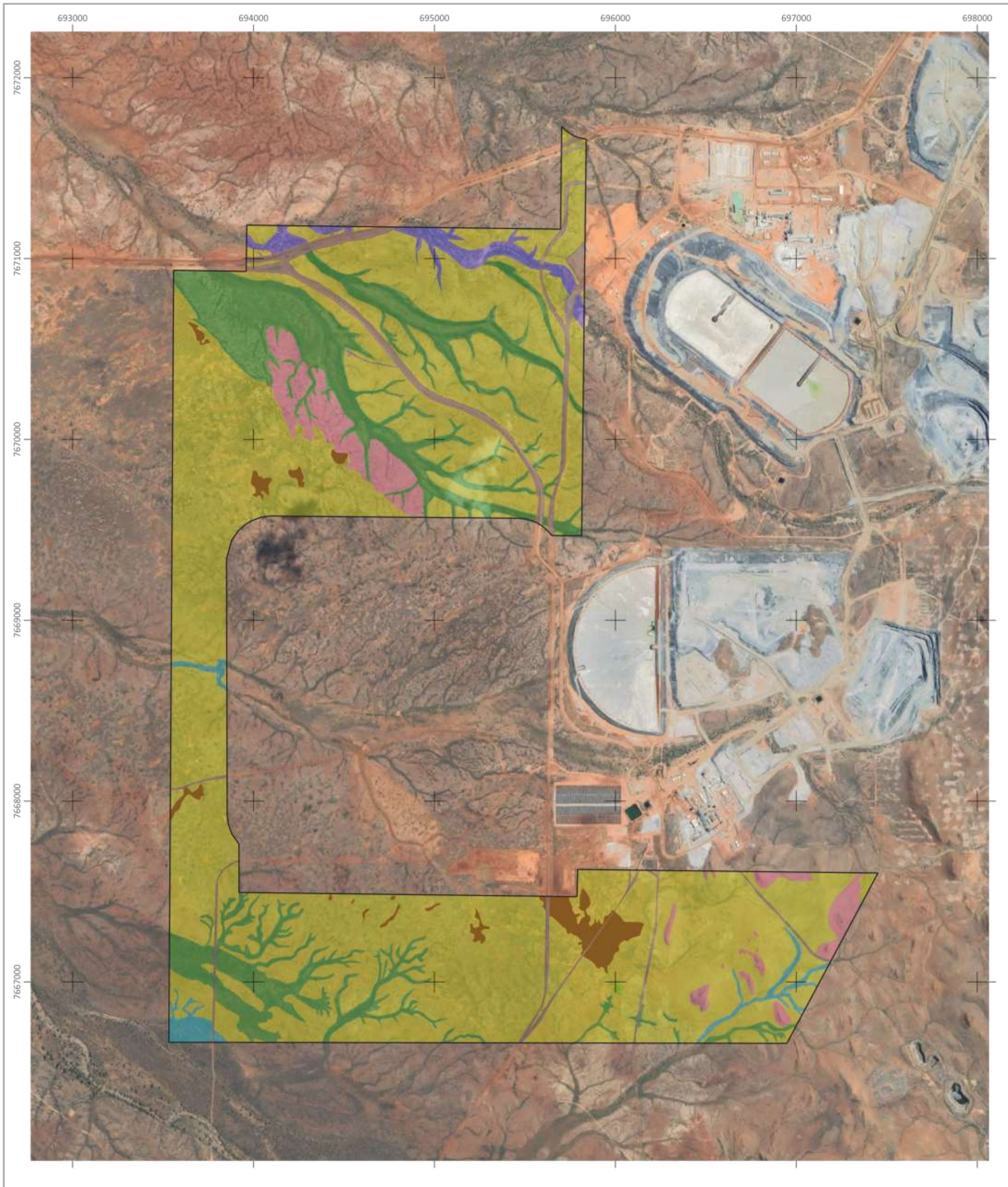
- 7b: Low open woodland of *Corymbia hamersleyana* over *Acacia acradenia* open mid shrubland and *Triodia wiseana* hummock grassland in drainage depressions
- 9a: Mid *Acacia inaequilatera* isolated shrubs with *Triodia wiseana* hummock grassland on stony plains and rises
- 9c: Isolated low *Corymbia hamersleyana* over *Acacia adsurgens* mid sparse shrubland with *Triodia lanigera* hummock grassland on granite outcrops and rises
- 12a: Isolated low *Corymbia hamersleyana* over *Acacia adsurgens* sparse tall shrubland with mid hummock grassland of *Triodia lanigera* on undulating plains
- 15a: Low open woodland of *Corymbia hamersleyana* over *Acacia cowleana* open mid shrubland with *Triodia epactia* hummock grassland in sandy creeks
- D: Disturbed
- Pilgangoora Project

Scale: @ A4  
 1: 20,000

Coordinate System: GDA 2020 MGA Zone 50  
 Projection: Transverse Mercator

Author: EH      Approved: ML      Date: 16/09/2023

**Vegetation  
Northern Survey Area**



Author: EH      Approved: ML      Date: 17/09/2023

### Vegetation Southern Survey Area

Prepared for:  
  
 Scale: @ A4  
 1: 20,000  
 Figure: 4-3b  


#### Legend

- 4b: Low open woodland of *Eucalyptus victrix* over *Cajanus cinereus* mid sparse shrubland with *Triodia epactia* mid open hummock grassland in riverine areas.
- 7b: Low open woodland of *Corymbia hamersleyana* over *Acacia acradenia* open mid shrubland and *Triodia wiseana* hummock grassland in drainage depressions
- 9a: Mid *Acacia inaequilatera* isolated shrubs with *Triodia wiseana* hummock grassland on stony plains and rises
- 12a: Isolated low *Corymbia hamersleyana* over *Acacia adsurgens* sparse tall shrubland with mid hummock grassland of *Triodia lanigera* on undulating plains
- 15a: Low open woodland of *Corymbia hamersleyana* over mid *Acacia cowleana* open mid shrubland with *Triodia epactia* hummock grassland in sandy creeks
- 16a: Open herbfield of *Sida fibulifera* *Eriachne mucronata* and *Neptunia dimorphantha* on claypans
- D: Disturbed
- Pilgangoora Project

**Landform: Major Drainage Line**

**Vegetation Type: 4b**

Low open woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* over mid *Cajanus cinereus*, *Acacia cowleana*, and *Acacia pyrifolia* sparse shrubland with *Triodia epactia*, *Cenchrus ciliaris* and *Triodia angusta* mid open hummock and tussock grassland.

*Eucalyptus victrix* is uncommon in the area with occurrence restricted to these larger drainage channels. Whilst attaining only low heights, some trees attain a diameter at breast height larger than those in the surrounding habitats. Additional shrub species present included *Gossypium robinsonii*, *Acacia trachycarpa*, *Crotolaria cunninghamii*, *Acacia bivenosa*, *Petalostylis labicheoides*, *Corchorus incanus*, *Indigofera monophylla*, *Hibiscus burtonii*, *Hibiscus sturtii*, *Indigofera rugosa* and *Senna glutinosa*.

The groundcover was diverse with a large number of sparsely distributed herbs and annual grasses. Common groundcover species also included *Enneapogon lindleyanus*, *Themeda triandra*, *Cymbopogon ambiguus*, *Eriachne mucronata*, *Chrysopogon fallax*, *Euphorbia careyi*, *Euphorbia mitchelliana*, *Goodenia microptera*, *Heteropogon contortus*, *Rynchosia minima*, *Scaevola amblyanthera*, *Sida clementii*, *Solanum diversiflorum*, and *Tephrosia rosea*.

This community occurs in the deeper drainage feature with deep incised channels. Soils are loamy to sandy loam, with surface gravel or large rocks present in places. A higher species richness was recorded in this habitat as the soils have a higher moisture retention and the canopy density offers a greater amount of shade than surrounding habitats, allowing annuals to persist in drier conditions.



**Plate 4-1. Major Drainage Line 4b**

Condition: Impacts from cattle grazing are moderate to severe, the agricultural weed *Cenchrus ciliaris* occurs and occasional tracks are present. The condition of this vegetation is Good to Very Good.

Detailed sites: N11, N15. Total richness: 57 species. Average richness: 39 species.

Introduced/exotic taxa: \**Cenchrus ciliaris*.

Conservation significant species: none.

**Landform: Drainage Depressions**

**Vegetation Type: 7b**

Low open woodland of *Corymbia hamersleyana* over *Acacia acradenia*, *Acacia adsurgens* and *Indigofera rugosa* open mid shrubland and *Triodia wiseana*, *Triodia epactia* and *Triodia chichesterensis* hummock grassland.

The tree layer dominated by *Corymbia hamersleyana* is denser than the surrounding undulating plains and trees occur as low clumps averaging 4 to 5 m tall. *Eucalyptus leucophloia* was also present in a small area in the north of the survey area and was recorded in one quadrat. The shrub layer is also denser than the surrounding undulating plains. Common shrubs also included *Corchorus incanus*, *Acacia inaequilatera*, *Acacia bivenosa*, *Indigofera monophylla* and *Petalostylis labicheoides*.

Common groundcover species also included *Cassytha capillaris*, *Cajanus cinereus*, *Senna notabilis*, *Euphorbia mitchelliana* and *Ptilotus australasius*.

This community occurs in the larger drainage depressions between the plains and the creeks. Soils are loamy and or sandy, often with surface gravel present. The distinction between plain, drainage depression and creek is sometimes ambiguous. The depressions are part of the surface drainage network but often lack a defined channel and the sandy soils provide rapid infiltration of surface water, preventing the prolonged availability of surface water and the development of pools. Small areas of drainage depression often occurs within the undulating plains areas in parcels too small to be individually mapped. In general, the difference to Vegetation type 12a is that there is a denser canopy and mid shrub layer and a greater abundance of the soft spinifex *Triodia epactia*.



**Plate 4-2. Drainage Depression**

Condition: Impacts from cattle grazing are moderate, occasional tracks are present and the weeds \**Cenchrus ciliaris*, \**Cenchrus setiger* and \**Aerva javanica* are present at low density. The condition of this vegetation is Very Good.

Detailed sites: N03, N17, N23, E09, E14, E17, E18, E27.

Total richness: 50 species. Average richness: 17.6 species

Introduced/exotic taxa: The exotic agricultural grasses \**Cenchrus ciliaris* and \**Cenchrus setiger* and the environmental weed \**Aerva javanica* were recorded at two sites in low abundance.

Conservation significant species: *Triodia chichesterensis* (0.1% cover at N017; 5% cover at N23; 10% cover at E18; and 10% cover at E27). Within this vegetation type *Triodia chichesterensis* was found to occur in areas where quartzite was the dominant rock type at the surface.

This vegetation type has not previously been described for the project but is not unique to the area. It occurs commonly within the plains areas where run-on occurs, but generally in patches too small to be sampled or mapped discretely. The community has been identified separately within the current study as larger areas (i.e., larger than 50 m x 50 m) are present that allows the assemblage to be identified distinctly. The community has been allocated the code 7b as the landform resembles community 7a as described for the Lynas Find deposit (APM 2022a), but with moderate changes in the floristic composition, likely due to the position lower in the landscape.

**Landform: Stony plains and rises**

**Vegetation Type: 9a**

Mid *Acacia inaequilatera*, *Acacia acradenia* and *Hibiscus sturtii* isolated shrubs with *Triodia wiseana*, *Triodia epactia* and *Triodia chichesterensis* hummock grassland.

The upper strata is absent in most cases, however *Ficus brachypoda* was present on the upper slopes of the largest outcrop. The shrub layer is very sparse with a combined cover of less than 1%. *Grevillea wickhamii*, *Petalostylis labicheoides*, *Senna glutinosa*, *Hakea loreus*, *Corchorus incanus* and *Grevillea pyramidalis* were present in at least one site.

The groundcover is the predominant layer. Groundcover species also present included *Triodia lanigera*, *Cassytha capillaris*, *Tribulus suberosus*, *Paspalidium clementii*, *Cymbopogon ambiguus*, *Euphorbia caryi*, *Euphorbia tanenensis*, *Senna notabilis* and *Triumfetta propinqua*.

This community occurs on stony plains and rises leading to the foothills and includes some outcrops of granite. This community was originally mapped for the Lynas Find area (APM, 2022) and was also recorded in the E45/2287 Infill Survey (APM 2023b). A defining characteristic is the dominance of the hummock grass layer, and the presence of *Triodia chichesterensis* in areas where quartzite is common at the surface.



**Plate 4-3. Stony plains and rises 9a**

Condition: Impacts from cattle grazing are very low, no weeds are present and occasional tracks are present. A light dust is noticeable in areas close to active operations. The condition of this vegetation is Very Good.

Detailed sites: N24, E1, E2, E12, E15, E21 Total richness: 30 species. Average richness: 9.4 species.

Introduced/exotic taxa: none

Conservation significant species: *Triodia chichesterensis* was recorded at 15% cover in quadrat N24 and 1% cover at E01.

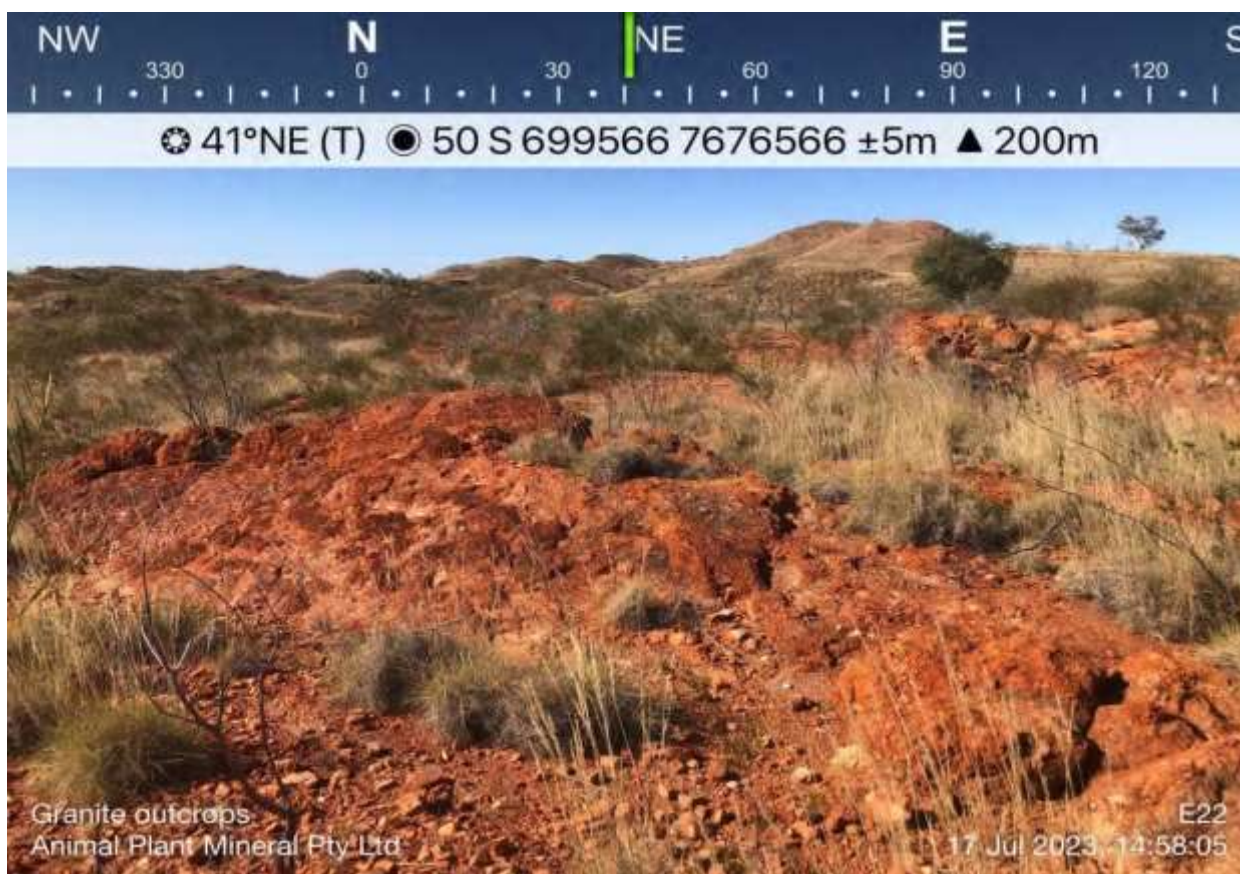
**Landform: Granite outcrops and rises****Vegetation Type: 9c**

Isolated low *Corymbia hamersleyana* over mid *Acacia adsurgens*, *Acacia cowleana* and *Acacia maitlandii* sparse shrubland with *Triodia lanigera*, *Triodia wiseana* and *Triodia epactia* hummock grassland.

*Eucalyptus leucophloia* was also present in a small area in the north of the survey area and was recorded in one quadrat within this vegetation type. Common shrubs also included *Indigofera monophylla*, *Acacia inaequilatera* and *Corchorus incanus*. *Acacia stellaticipes* and *Acacia spondylophylla* were also present in some sites.

Common groundcover species also included *Eriachne mucronata*, *Fimbristylis nuda*, *Goodenia stobbsiana* and *Dicrastyliis doranii*.

This community occurs where granite bedrock occurs close to the surface or as outcrops. In some occurrences the granite is visible as flat domes less than 1 m above ground level and up to 20 m in diameter. In other areas the outcropping is as boulders with small cracks and crevices present, and in other areas it is more elevated as low hills or ridges. In outcropping and hill/ridge areas, soil is limited to what is available in cracks, whereas in the dome areas, larger shallow pans of soil may be present. The soil is generally loamy clay or clay loam with gravel.



**Plate 4-4. Granite bedrock and outcrops**

Condition: Impacts from cattle grazing are very low, no weeds are present and occasional tracks are present. The condition of this vegetation is Very Good.

Detailed sites: E20, E22, E24, E25

Total richness: 30 species. Average richness: 11.6 species.

Introduced/exotic taxa: none

Conservation significant species: none

This vegetation type was closely aligned with 12a in the cluster analysis (Appendix C), but with a measurable change in the shrub composition and the minor presence of sedges and annual grasses likely due to the higher clay content of the soil. The assemblage has not previously been recorded and is assigned the code 9c.

**Landform: Undulating plains****Vegetation Type: 12a**

Isolated low *Corymbia hamersleyana* over *Acacia adsurgens*, *Acacia inaequilatera* and *Grevillea wickhamii* sparse tall shrubland with mid hummock grassland of *Triodia lanigera*, *Triodia wiseana* and *Triodia epactia*.

The tree layer is commonly sparse and often absent over large areas and is limited to low individual trees between 3 and 5 m tall. *Eucalyptus leucophloia* was also present in a small area in the north of the survey area and was recorded in one quadrat of this vegetation type. Other common shrub species included *Acacia cowleana*, *Acacia stellaticeps*, *Indigofera monophylla*, *Indigofera rugosa* and *Corchorus incanus*.

Groundcover was diverse. This is because of the broad distribution of the vegetation type resulting in a large area sampled and a high quadrat allocation, and also due to the microhabitats present within the vegetation unit that ranges from stonier microhabitats on higher elevations to clay rich habitats on lower elevation. Common species also included *Triodia angusta*, *Ptilotus austrolasius*, *Bonamia erecta*, *Goodenia stobbsiana*, *Ptilotus calostachyus*, *Cassytha capillaris* and *Bonamia pilbarensis*.

This community is the most commonly occurring vegetation type in the Survey Area and occurs on loamy sand soils of undulating plains, most often with small pebbles and stones at the surface. It has a broad distribution from some of the low hills into the lower plains and includes some of the smaller creeks where distinct riparian vegetation has not developed. The *Acacia* dominated mid story occurs in higher density in areas where run-on occurs. Shallow drainage depressions have been mapped and described as a separate community where the extent is of sufficient scale, but denser groves of shrubs often occur in this community at a scale too fine for individual mapping.

Mudflats have also been described as a separate community where the extent is sufficient, however in some areas the mudflats occur at a scale too fine for mapping separately. Quadrats N14 and E8 represent such areas and in the cluster analysis are identified as a discreet group as they are an intermediary between undulating plains and mudflat vegetation. The quadrats and area they represent have been included in the vegetation type 12a for consistency with the adjoining TSF 2 and 5 Survey Area (APM 2022b).

In areas of slightly higher elevation where this vegetation type occurs, the shrub layer is dominated by tall shrubs, however overall, the shrub layer is sparse at under 10% cover. The ground layer is dominated by the hard spinifex species *Triodia lanigera* and *Triodia wiseana* with the soft spinifex *Triodia epactia* sometimes occurring in locations that have higher soil water content.



**Plate 4-5. Typical site for community 12a Undulating Plains**

Condition: Impacts from cattle grazing are moderate, occasional tracks are present and some dust is evident in places close to the existing operations. One weed species was recorded. The condition of this vegetation is Very Good.

Detailed sites: N01, N02, N04, N05, N06, N07, N09, N10, N12, N14, N16, N18, N19, N21, N22, N27, N28, N29, N30, N31, E03, E06, E07, E08, E10, E11, E16, E19, E21, E23, E26, E28, E29.

Total richness: 70 species. Average richness: 12.7 species.

Introduced/exotic taxa: The exotic agricultural grass \**Cenchrus ciliaris* was recorded at one site in low abundance.

Conservation significant species: *Triodia chichesterensis* (5% cover at N01, 10% cover at N12, 35% cover at E23). Within this vegetation type *Triodia chichesterensis* was found to occur in areas where quartzite was the dominant rock type at the surface.

This vegetation type is synonymous to Vegetation type 12a described for the TSF Survey Area to the south (APM 2022b), and the E45 2287 Infill Survey (APM 2023b), with very minor changes in the abundances of the common *Triodia* and *Acacia* species present.

**Landform: Sandy Creek**

**Vegetation Type: 15a**

Low open woodland of *Corymbia hamersleyana* over *Acacia cowleana*, *Acacia adsurgens* and *Indigofera rugosa* mid open shrubland with *Triodia epactia*, *Triodia lanigera* and *Triodia wiseana* hummock grassland.

*Santalum lanceolatum* was also present in the overstory of one quadrat within this vegetation type. Common shrubs also included *Acacia coleii*, *Acacia inaequilatera*, *Corchorus incanus*, *Indigofera monophylla* and *Hibiscus sturtii*.

Common groundcover species also included *Bonamia erecta*, *Sporobolus australasicus*, *Chrysopogon fallax* and *Themeda triandra*.

This community occurs in and around the sandy bottomed creeks. Soils are red in colour and composed of sandy loam to loamy sand, with a small amount of surface gravel present. Riparian banks are often present with alluvial loamy soils. Creeks are all ephemeral with no permanent or semi-permanent pools present. This vegetation type is similar to Vegetation type 7b, but with a greater abundance of the soft spinifex *Triodia epactia* and annual grasses, the channel is defined, and the denser shrub layer is lacking. This vegetation type has previously been described and mapped in the E45/2287 Infill Survey Area (APM 2023b).



**Plate 4-6. Sandy Creek 15a**

Condition: Impacts from cattle grazing are moderate, the agricultural weed *\*Cenchrus ciliaris* is present in low abundance and occasional tracks are present. The condition of this vegetation is Very Good.

Detailed sites: N08, N13, N20, N25, N26 Total richness: 56 species. Average richness: 27.5 species.

Introduced/exotic taxa: *\*Cenchrus ciliaris* was recorded at N8 at 0.5% cover and at N13 at 0.1% cover.

Conservation significant species: none

**Landform: Claypans**

**Vegetation Type: 16a**

Open herbfield of *Sida fibulifera*, *Eriachne mucronata* and *Neptunia dimorphantha*.

The upper and midstory are absent in this community, with a low groundcover the dominant strata. Additional groundcover species present included *Eragrostis xerophila*, *Solanum diversiflorum*, *Sporobolus caroli*, *Portulaca oleraceae*, *Cynodon convergens*, *Ileilema* sp., *Rynchosia minima* and *Senna notabilis*.

This community occurs where calcrete occurs close to the surface in minor depressions and a clay soil has deposited to a shallow depth. The soil depth is insufficient to support shrub and tree development and a herb and annual grass layer predominates.



**Plate 4-7. Claypan 16a**

Condition: Impacts from cattle grazing are moderate to high, no weeds are present and occasional tracks are present. The condition of this vegetation is Good.

Detailed sites: E04, E05, E13.

Total richness: 13 species. Average richness: 7 species.

Introduced/exotic taxa: none

Conservation significant species: none

This vegetation type also occurs in smaller patches within the 12a community. As the community is dominated by herbaceous and annual taxa it is expected that the diversity of species would be higher following seasonal rainfall.

#### 4.2.3 Vegetation Condition

Vegetation condition across the Survey Area was within the categories Very Good, Good and Completely Degraded, with most of the Survey Area in Very Good condition (Table 4-4; Figure 4-4).

**Table 4-4. Vegetation condition within the Survey Area**

Vegetation Condition	Area (ha)	Area (%)
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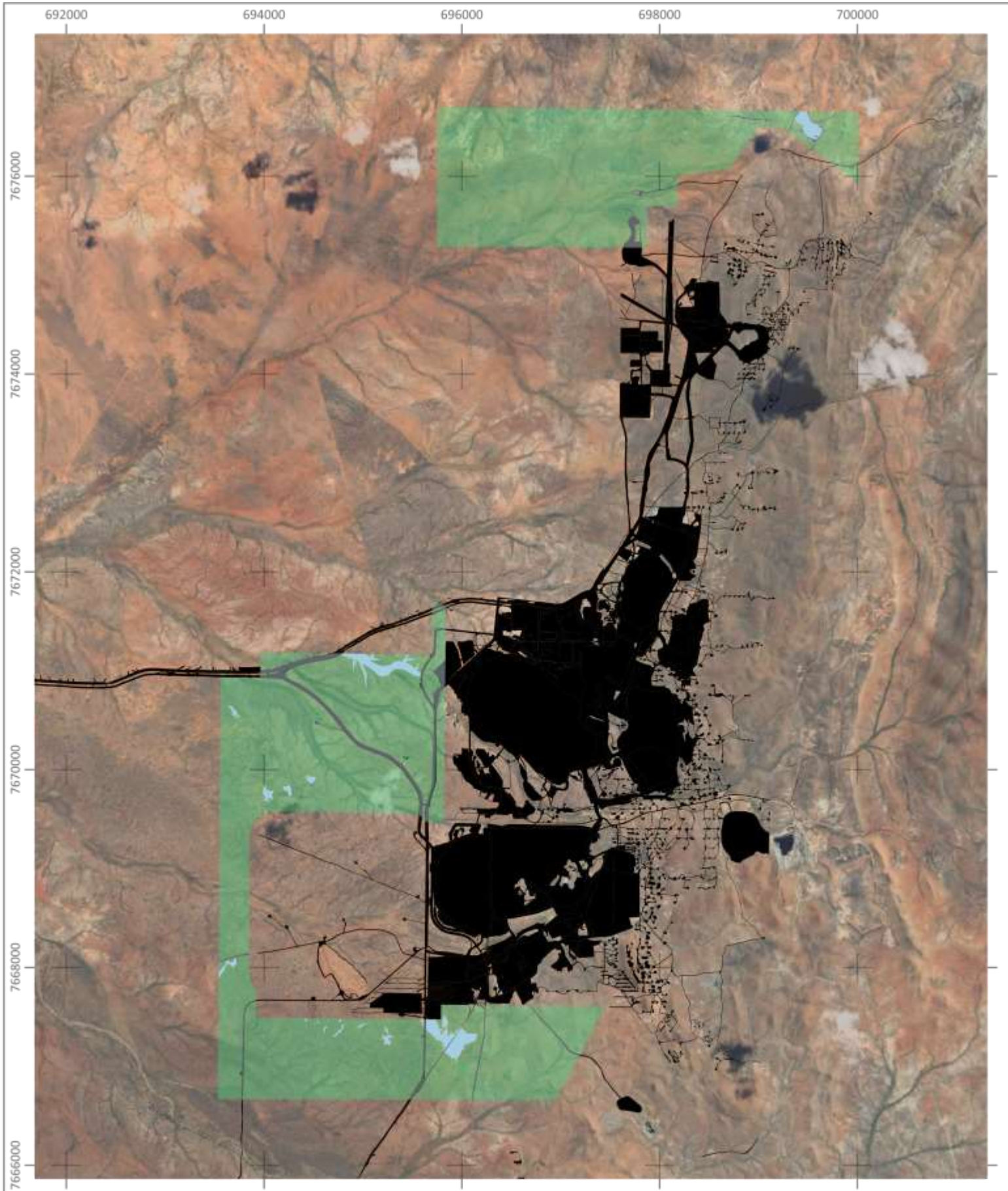
Very Good	1101.62	94.80
Good	26.27	2.26
Completely Degraded	34.10	2.93

The primary sources of disturbance on-site are low to moderate grazing impact from cattle and occasional tracks that support pastoralism activities. Additional tracks are present in support of the nearby mining activity. Near to some areas of active operations, a fine layer of dust was present.

Areas receiving a condition rating of Very Good had a low level of grazing activity and occasional tracks may be present.

Areas receiving a condition rating of Good had weeds present and/or a moderate level of grazing activity and occasional vehicle tracks.

Areas classified as Completely Degraded are cleared of vegetation and maintained in a vegetation free state.



Author: EH      Approved: ML      Date: 18/09/2023

### Vegetation Condition

- Legend**
- Very Good
  - Good
  - Completely Degraded
  - Pilgangoora Project



#### 4.2.4 Significant Flora

No species listed as T under the EPBC Act or BC Act were recorded during the survey.

One P3 species *Triodia chichesterensis*, was recorded during the survey.

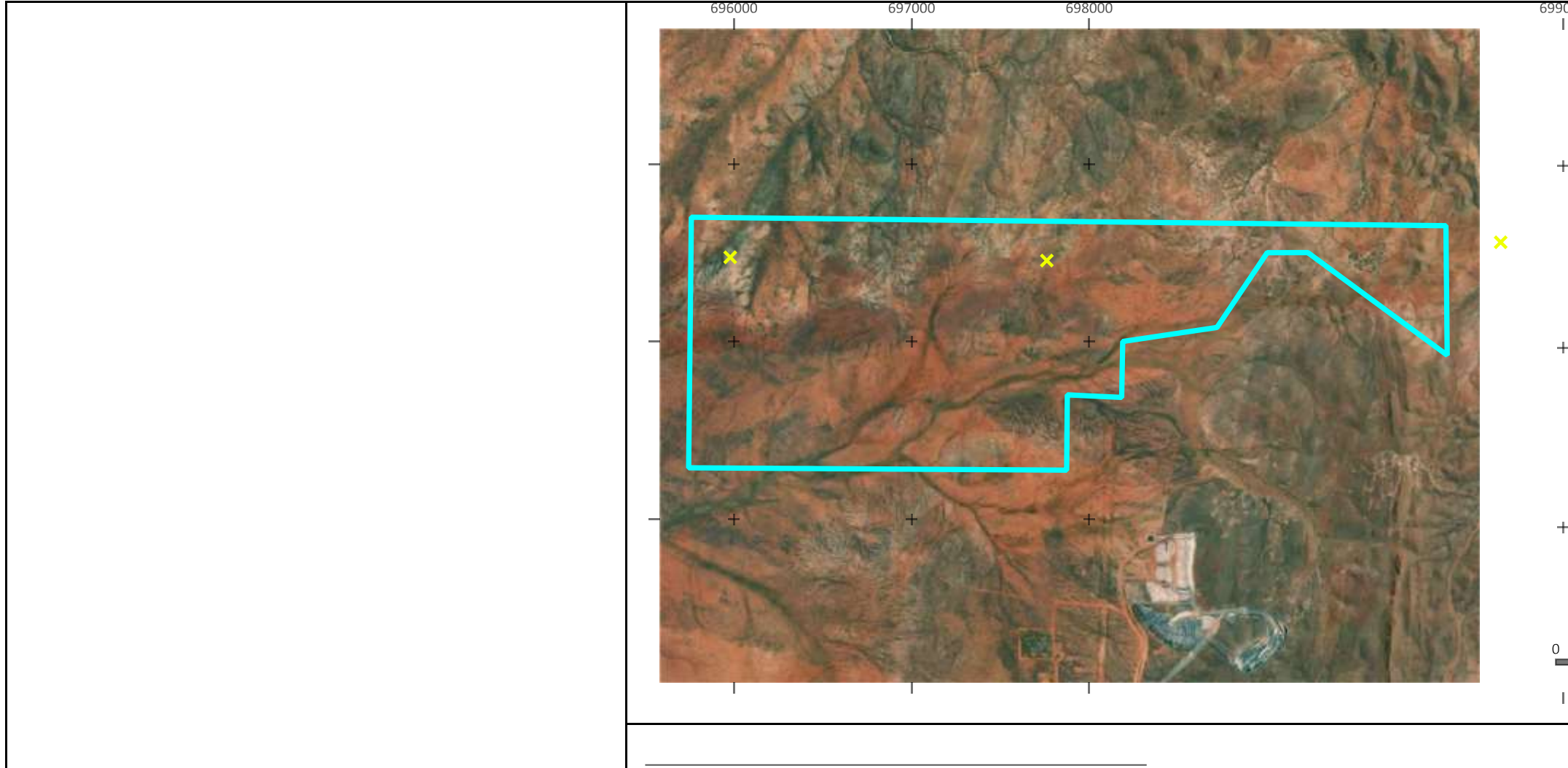
*Triodia chichesterensis* is described by Anderson et al. (2017). It is characterised by being a short-leaved species, distinguished by the combination of diminutive stature, glabrous leaf sheaths, relatively unbranched inflorescence, often short pedicels, and pubescent lemma midlobe. The short pedicels and pubescent lemma midlobe contrast with the typically longer pedicels and glabrous lemma midlobes of other short-leaved species in the complex (*T. nana*, *T. scintillans*, *T. vanleeuwenii*).

The species has a limited distribution and has been found only in a narrow area in the central Chichester region of the Pilbara of WA. The areas immediately to the west and east of its known distribution are poorly explored, but it is likely to be restricted to an area <100 km beyond current collections, given intensive collecting efforts in the Pilbara (Anderson et al. 2017).

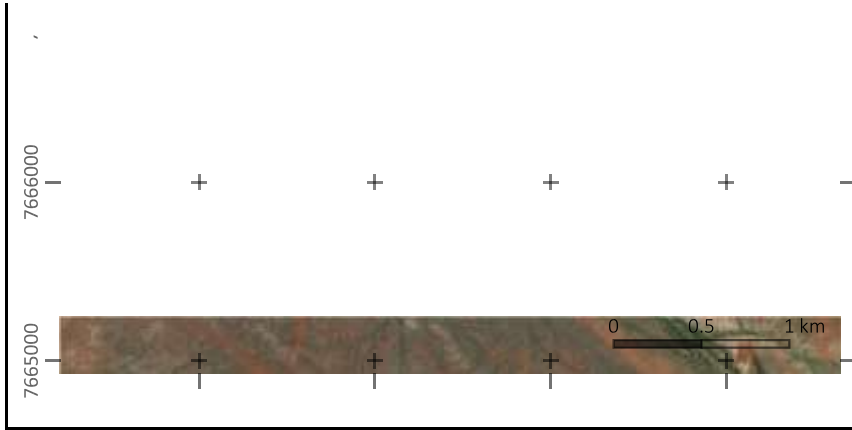
The Survey Area is in the central part of the range of this species, which is significant from the perspective of determining it from the closely related *Triodia lanigera* (Anderson et al. 2017). Where the two co-occur in the south it can be difficult to determine them based on morphological and distributional parameters. Where the two co-occur in the north, there is a subtle but consistent substrate change that marks the shift in species, with *T. lanigera* occurring on sandier soils and *T. chichesterensis* on rockier soils with quartzite pieces. In the northern species range, it can usually be morphologically distinguished from *T. lanigera* by its shorter and less hairy leaves and less branched inflorescences.

The species has been previously found within the Project on rocky soils with quartzite (APM, 2022a,b, APM, 2023). Within the Survey Area, the species was also recorded within sandy red soils with a substantial coverage of rocks and pebbles including quartzite. Quartzite is common in the area and *T. chichesterensis* is not present in all areas containing quartzite.

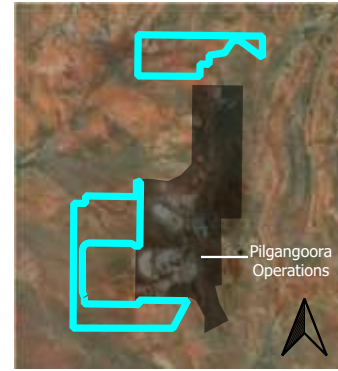
Collection records indicate that florets are observed between February and April and in August. At the time of the survey in July, no flowering material was available, and the species was determined using the vegetative characteristics only. Observations of the species made within the Survey Area are presented in Figure 4-5.







**Legend**  
Survey Areas  
Triodia



chichesterensis

#### 4.2.5 Significant Vegetation

No vegetation types occurring within the Survey Area are analogous to any known TEC’s or PEC’s.

One species associated with Groundwater Dependent Ecosystems was recorded. *Eucalyptus victrix* was recorded in vegetation type 4b in the Major Drainage Line. Individuals were relatively old with a large diameter at breast height compared to other trees in the surrounding habitats. *Eucalyptus victrix* is regarded as being a facultative phreatophyte that most likely draws most of its water requirement from the unsaturated zone but can use groundwater opportunistically as required (Pfautsch et al. 2014).

#### 4.2.6 Introduced Flora

Four introduced flora species were recorded in the Survey Area and are listed in Table 4-5. No Declared Weeds or WONS were recorded.

**Table 4-5. Introduced Flora Recorded within the Survey Area**

Species	Common name	Description
BAM Act S11 - Permitted		
<i>Aerva javanica</i>	Kapok	Erect, much-branched perennial herb, 0.4 - 1.6 m high. Flowers white from January to October. Often found growing on sandy soils and along drainage lines.
<i>Cenchrus ciliaris</i>	Buffel grass	Tufted or sometimes stoloniferous perennial, grass-like or herb. 0.2 - 1.5 m high. Flowers purple from February to October. Grows on white, red, or brown sand, stony red loam, or black cracking clay.
<i>Cenchrus setiger</i>	Birdwood Grass	Erect, tussocky, stoloniferous perennial, herb or grass-like, to 0.5 m high. Flowers cream to purple from April to May. Grown in brown sands, red loam and pindan soils on sand dunes, plains, rangelands, stony hillsides or floodplains.
<i>Tribulus terrestris</i>	Caltrop	Prostrate annual, herb, plants villous; leaflet pairs 4 - 7; cocci with distinct divergent, median spines 3 - 8 mm long. Flowers yellow from January to December. Often grows on sandy soils and in waste places.

The agricultural weeds *Cenchrus ciliaris* and *Cenchrus setiger* was recorded in drainage lines, occurring only occasionally and in generally low abundance. Where found, these weeds were grazed.

The environmental weed *Aerva javanica* was occurring only occasionally and in very low abundance within drainage lines, on stony plains and along disturbed roadsides.

The environmental weed *Tribulus terrestris* was recorded at one site and in very low abundance.

## 5 TERRESTRIAL VERTEBRATE FAUNA RESULTS

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## 5.1 DESKTOP STUDY

### 5.1.1 Significant Fauna

The DBCA database returned 16 species of significant fauna that have previously been recorded within 30 km of the Survey Area. Of these, three are listed as migratory bird species (**MI**) and one as Other Specifically Protected (**OS**). Record locations of significant fauna in relation to the Survey Area are shown in Figure 5-1. The database does not contain any records for T fauna within the Survey Area.

The PMST returned 13 additional species, five T, six MI and two that are both T and MI. These are species that do not have records within 30 km but where modelling has identified that suitable habitat is known to occur or may occur.

The literature review returned additional information about the locations and abundance of Northern quoll, Pilbara leaf-nosed bat, Ghost bat and Pebble mound-mouse records, including a scat for the T fauna Northern quoll, previously recorded within the Survey Area (APM 2023a).

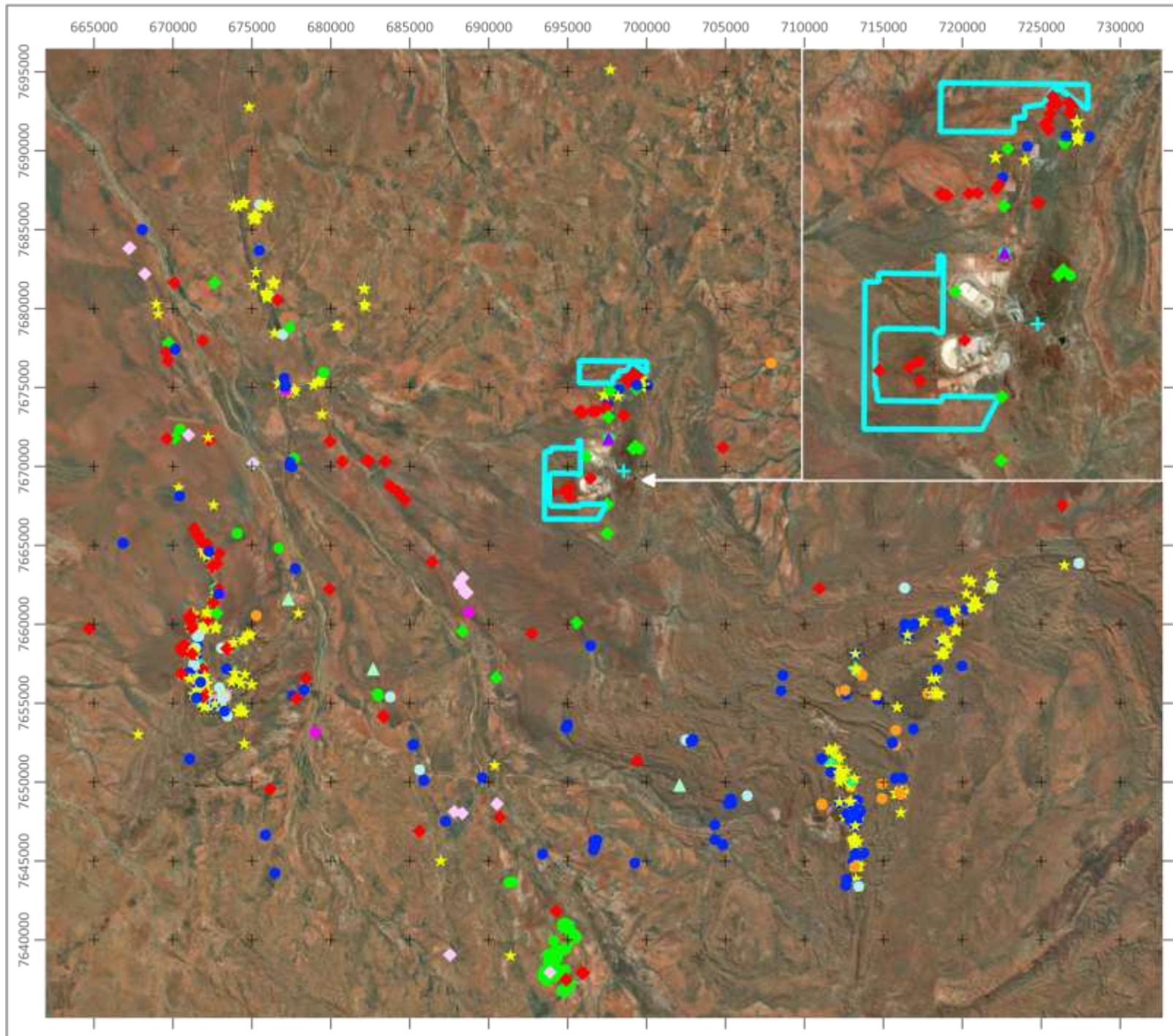
Database search results of T, P and MI fauna within 30 km of the Survey Area are listed in Table 5-1, with the outcome of the likelihood of occurrence assessment. The complete assessment including the preferred habitat relative to those available in the Survey Area and a summary of records in the local area is included in Appendix G.

### 5.1.2 Introduced Fauna

Dandjoo database records did not return any introduced fauna. A search of the superseded NatureMap database in September 2022 for a nearby area returned records for eight introduced fauna as listed below:

- Camel (*Camelus dromedarius*);
  - Cat (*Felis catus*);
  - Cattle (*Bos taurus*);
  - Dog (*Canis lupus*);
  - Donkey (*Equus asinus*)
  - Fox (*Vulpes vulpes*)
  - Horse (*Equus caballus*); and
  - House mouse (*Mus musculus*).
-





### Legend

- Survey Areas
- Endangered**
  - ★ Northern Quoll
- Vulnerable**
  - Bilby
  - Ghost Bat
  - Grey Falcon
  - Pilbara Leaf-nosed Bat
  - Pilbara Olive Python
- Priority 1**
  - + Gane's Blind Snake (Pilbara)
- Priority 2**
  - Northern Leaf-nosed Bat
- Priority 4**
  - ◆ Brush-tailed Mulgara
  - ◆ Long-tailed Dunnart
  - ◆ Spectacled Hare-Wallaby (mainland)
  - ◆ Western Pebble-mound Mouse
- Migratory**
  - ▲ Common Sandpiper
  - ▲ Fork-tailed Swift
  - ▲ Oriental Plover
- Other Specially Protected**
  - Peregrine Falcon

Scale: @ A4  
1: 350,000



Coordinate System: GDA 2020 MGA Zone 50  
Projection: Transverse Mercator

Author: TB      Approved: EH      Date: 26/07/2023

## Threatened and Priority Fauna Records

**Table 5-1. Significant fauna database records and likelihood of occurrence**

Species	Common Name	Conservation Code		Assessment of Occurrence
		BC Act	EPBC Act	
<i>Actitis hypoleucos</i>	Common sandpiper	MI	MI	
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	MI	MI	
<i>Calidris ferruginea</i>	Curlew sandpiper	CR	CR, MI	
<i>Calidris melanotos</i>	Pectoral sandpiper	-	MI	Unlikely. No saline or coastal habitats available.
<i>Numenius madagascariensis</i>	Eastern curlew	CR	CR, MI	Freshwater habitats are likely to be seasonally present in the claypans (gilgai) within the Stony Plains however the high evaporation rate means these habitats are unlikely to persist more than a few weeks at most. The major drainage line with granite bedrock has the potential for ephemeral pools however there are no permanent or semi-permanent pools evident.
<i>Glareola maldivarum</i>	Oriental pranticole	MI	MI	
<i>Hirundo rustica</i>	Barn swallow	MI	MI	
<i>Motacilla cinerea</i>	Grey wagtail	MI	MI	
<i>Motacilla flava</i>	Yellow wagtail	MI	MI	
<i>Apus pacificus</i>	Fork-tailed swift	MI	MI	Possible. Utilises a broad array of habitats.
<i>Charadrius veredus</i>	Oriental plover	MI	MI	Likely. Suitable habitat in the open plains.
<i>Polytelis alexandrae</i>	Princess parrot	-	VU	Unlikely, preferred feeding species are not present in high densities along the major drainage.
<i>Erythroriorchis radiatus</i>	Red goshawk	VU	VU	Unlikely. Not within the known range of the species distribution.

Falco hypoleucos	Grey falcon	VU	VU	Likely. All areas are suitable for foraging. No suitable nesting habitat.
Falco peregrinus	Peregrine falcon	OS	-	Likely. All areas are suitable for foraging. No suitable nesting habitat.

Species	Common Name	Conservation Code		Assessment of Occurrence
		BC Act	EPBC Act	
Pezoporus occidentalis	Night parrot	CR	EN	Possible. No local records. Habitat modelling includes the Survey Area at the extremity of the species potential extent. Foraging resources are limited.
Rostratula australis	Australian painted-snipe	EN	EN	Unlikely. No habitat occurs in the Survey Area. Vegetation too open to provide well vegetated shallows.
Dasyercus blythi	Brush-tailed mulgara	P4	-	Likely. Sandy plains habitat is suitable.
Dasyurus hallucatus	Northern quoll	EN	EN	Present. Suitable foraging habitat in the creeks but of low quality. Limited suitable denning and foraging habitat available in the Rocky Outcrops.
Lagorchestes conspicillatus leichardti	Spectacled hare-wallaby	P4	-	Present. Historic records nearby and suitable habitat is present in the Shallow Drainage Basins and Creeks habitat.
Macroderma gigas	Ghost bat	VU	VU	Likely. Foraging habitat available. No roosting habitat available.
Macrotis lagotis	Greater bilby	VU	VU	Possible. All habitats are suitable.
Pseudomys chapmani	Western pebble-mound mouse	P4	-	Present. Mounds located in the plains where suitable pebbles occur.
Rhinonicteris aurantia	Pilbara leaf-nosed bat	VU	VU	Present. No roosting habitat available, foraging habitats present.
Sminthopsis longicaudata	Long-tailed dunnart	P4	-	Unlikely. No suitable habitat.
Aniliios ganei	Gane's blind snake (Pilbara)	P1	-	Unlikely. No suitable habitat.

Liasis olivaceus subsp. baronni	Pilbara olive python	VU	VU	Unlikely. No suitable habitat.
Liopholis kintorei	Great desert skink	VU	VU	Unlikely. No records in the local area. May occur 10 km to the east.

## 5.2 FIELD SURVEY

### 5.2.1 Fauna Habitats

The Survey Area is characterised by sandy to stony undulating plains with first and second order ephemeral creeks and shallow drainage basins. Low rocky rises occur in the eastern extents in the north and south. There are higher ranges to the east and water sheds from these into the Survey Area through the minor drainages that continue to the west. The presence of water is ephemeral, and no permanent or semi-permanent water is available. Seasonal inundation is expected to occur within the claypan habitats, with the duration of inundation dependent on the amount of any given rainfall event, but is generally expected to be short (days to weeks) due to high evaporation rates. Vegetation is sparse on the rocky rises and plains, and densest in the shallow drainage basins.

The Survey Area has Moderate (burnt 2-5 years previously) to Very Old fire age. Recent fires recorded on the DBCA (2022) database indicate approximately 66 ha burned in 2019, 237 ha burned in 2017, five ha burnt in 2015, 58 ha burned in 2014, 17 ha burnt in 2012 and 88 ha burnt in 2009, totalling 39.5% of the Survey Area being burned in the past 25 years. Burns appear to be low to moderate intensity with larger woody vegetation frequently surviving and good post-fire establishment of ground cover and mid story shrubs.

Seven fauna habitats are described for the Survey Area and are summarised in Table 5-2 and described in detail below, including comparisons to previously described Fauna Habitats at the Pilgangoora Project.

**Table 5-2. Fauna Habitats within the Survey Area**

<b>Name</b>	<b>Area (ha)</b>	<b>Proportion (%)</b>
Stony Plains	765.45	65.41
Shallow Drainage basins and creeks	167.41	14.31
Low Hills	144.81	12.38
Platy Rock Outcrops	39.91	3.41
Major Drainage Line	13.50	1.15
Historic Mine Workings	4.32	0.37
Rocky Outcrop	0.86	0.06
Disturbed	34.10	2.91

The distribution of fauna habitats is shown in Figure 5-2. Photos of the habitat assessment locations are shown in Appendix D.





This habitat type is characterised by its red sandy loam soils with variable surface rock/pebble cover, but generally stones are present. The Stony Plains habitat is typical of those described by van Vreeswyk et al. (2004) where it is interspersed with granite domes in the extent of the Macroy Land System and interspersed with gilgai in the extent of the Satirist Land System.

The sandy substrate is suitable for burrowing species, a sparse Eucalypt overstorey is present, offering perching opportunities but with limited hollow development, sparse termite mounds are present. Granite domes have some exfoliating rock but microhabitats are limited to narrow and shallow cracks. Higher clay content soils in the gilgai may offer cracked clay in the dry season and shallow inundation following rain.

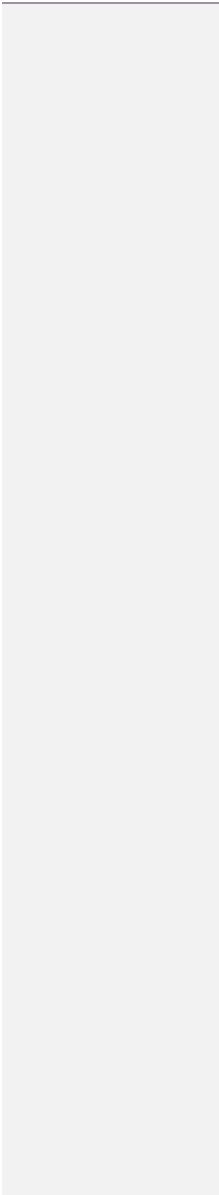
Vegetation consists of isolated low *Corymbia hamersleyana* over mid to tall *Acacia adsurgens*, *Acacia inaequilatera* and *Grevillea wickhamii* sparse tall shrubland with mid hummock grassland of *Triodia lanigera*, *Triodia wiseana* and *Triodia epactia*.

**Stony plains**

Survey Sites:

- C33(2)
- FH006
- FH006b
- FH007
- FH009
- FH010
- FH10a
- FH012
- FH012b
- FH014







**Shallow  
Drainage basins  
and creeks**

Survey Sites:  
C9/C33(1)  
C11/C30(1)  
C18/C36(1)  
C21x/C31(1)  
AS450007  
FH008  
FH015

Minor sandy bottomed ephemeral first and second order creeks, and shallow drainage depressions. The densest vegetation of the Survey Area occurs in this habitat type, with thick Acacia shrubs found in the drainage depressions, and on the edges of defined creek banks.

The sandy substrate indicates that water pooling is unlikely to occur, and no evidence of water pooling was observed.

Sand in the stream beds is suitable for burrowing species. Stands of trees occur but generally of insufficient size to have hollows and no fallen hollow branches were observed. Small amounts of litter were present. The dense vegetation provides cover for species sensitive to predation. This habitat may act as a wildlife corridor for birds, bats, mammals, and reptiles.

Cattle impacts were moderate. The weedy and fire prone introduced fodder grass genus *Cenchrus* is present in low frequency and density. Fires are of moderate frequency and low to moderate intensity.

The vegetation consists of low open woodland of *Corymbia hamersleyana*; over *Acacia acradenia*, *Acacia adsurgens* and *Indigofera rugosa* mid open shrubland and *Triodia wiseana*, *Triodia epactia* and *Triodia lanigera* hummock grassland.

This habitat type is synonymous with habitat FH2 described and mapped for the TSF Survey (APM 2022b) and Infill Survey (APM 2023b).



Gently undulating stony surfaces of quartzite, laterite or granite on shallow red sandy loam soils. This habitat is suitable for small species that construct shelters from small stones, however in most areas stones are too large for species such as Pebble mound mouse. This habitat type contains limited microhabitats providing limited vegetation with sparse midstory, very few, generally small trees lacking hollows, unsuitable substrate for burrowing, few to no logs and limited leaf litter. This habitat lacks structure and microhabitats and provides limited value to fauna.

The vegetation consists of mid isolated shrubs of *Acacia inaequilatera*, *Acacia acradenia* and *Hibiscus sturtii* with *Triodia wiseana*, *Triodia epactia* and *Triodia chichesterensis* hummock grassland.

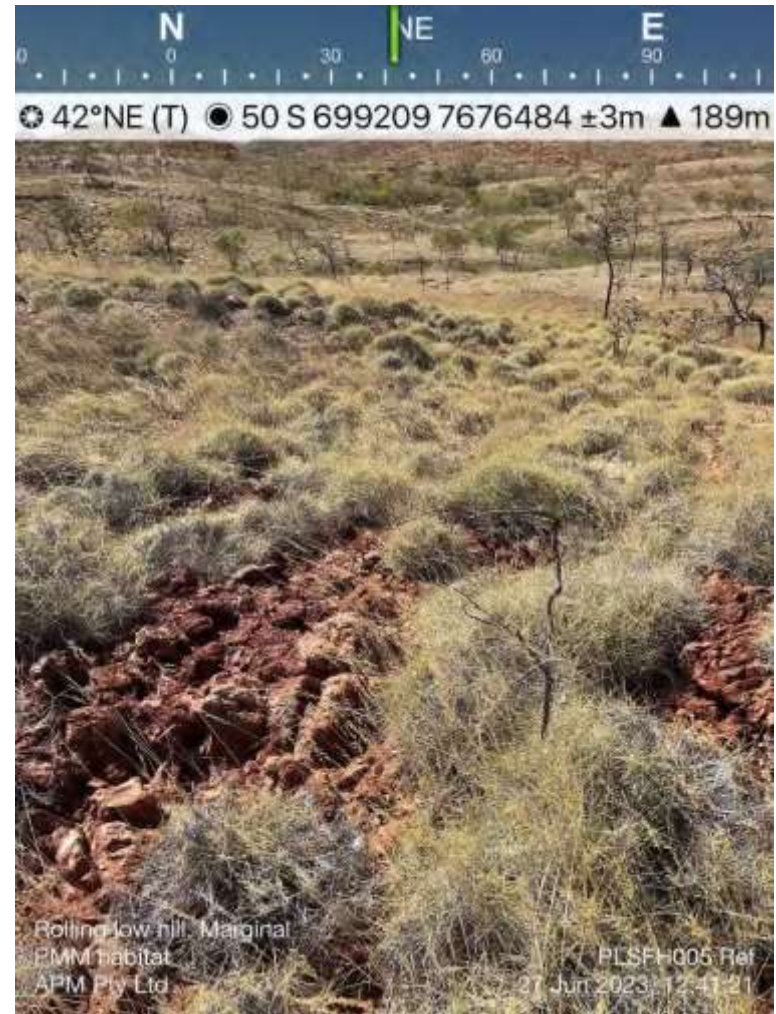
This habitat is the same as the FH3 Habitat described for Lynas Find (APM 2022a).

**Low hills**

Survey Sites:

FH004

FH005



**Platy Rock  
Outcrops**

Survey Sites:

- C21/32 (2)
- C34(2)
- FH001
- FH013

Rocky outcrops and ridges composed of platy, sharp, red granite or schist or blocky quartzite with >75% rock cover. Weathered bedrock provides cracks and crevices as important shelter sites for small ground dwelling reptiles and small mammals. Soils are hard and unsuitable for burrowing species due to the surface rock cover.

Crevices are restricted to shallow and narrow cracks in rocks, unsuitable for conservation significant species.

The vegetation consists of Mid isolated shrubs of *Acacia inaequilatera*, *Acacia acradenia* and *Hibiscus sturtii* with *Triodia wiseana*, *Triodia epactia* and *Triodia chichesterensis* hummock grassland.

This habitat is the same as 'Platy Rock Outcrops' of the Lynas Find Survey Area.





**Major  
Drainage Line**

Survey Sites:  
C14/16(1)  
C11/36(2)  
C6/10(1)  
AS642022  
AS45085  
FH011

Major sandy bottomed ephemeral drainage line, with exposed granite and large trees.

In areas where granite bedrock is exposed there is opportunity for ephemeral pools. Large trees are present in places that support many upright very large hollows and some hollow logs large enough for quoll. Fallen hollow timbers and crevices in granite provide opportunity for sheltering fauna. Dense tall vegetation provides shading and litter accumulation. Rainbow Bee Eater which was observed to have nests where incised steep clay edges were present. Sand in the stream beds is suitable for burrowing species.

Cattle impacts were moderate. The weedy and fire prone introduced fodder grass genus *Cenchrus* is present in low frequency and density. Fires are of moderate frequency and low to moderate intensity.

The vegetation consists of low open woodland of *Corymbia hamersleyana*; over *Acacia acradenia*, *Acacia adsurgens* and *Indigofera rugosa* mid open shrubland and *Triodia wiseana*, *Triodia epactia* and *Triodia lanigera* hummock grassland.





**Historic Mine workings**

Survey Sites:  
C20/32(1)  
AS660630 FH003

Appears to be old screening site. Many piles of gravel. Deep soil profile in some gullies (deposition). Drainage line dammed at 3 points. Entire closed valley disturbed by dams.

The gravel piles and areas of deposition provide soft substrate for burrowing animals and the presence of open surface water provides semi-permanent pools. The open vegetation and semi-permanent water are likely to provide suitable foraging habitat for Pilbara leafnosed bat.

Vegetation consists of *Eucalyptus leucophloia* and *Corymbia hamersleyana* low open woodland; *Acacia inaequalata*, *Acacia acradenia* and *Corchorus incanus* sparse mid shrubland over *Triodia epactia*, *Triodia chichesterensis* and *Triodia brizoides* mid hummock grassland.



Rocky outcrops composed of angular, red granite boulders, occurring on hill tops or in steeply incised drainage lines. Small crevices and overhangs present, which may provide important shelter sites for small and large reptiles such as goannas and snakes, and mammals such as the Northern quoll. No large caves are present that would be sufficient for the Pilbara leaf-nosed bat or Ghost bat roosting. Soils are shallow and occur in small pockets between rocks and are unsuitable for burrowing species. One hill supports a patch of Ficus (a known preferred food of the Northern quoll).

This fauna habitat is synonymous with the FH1 fauna habitat reported in (APM 2022a) and Infill Survey (2023) and the Rocky Hill habitat reported in 360 Environmental (2016). The occurrences in the northern extent of the Survey Area are continuous with previously mapped similar habitat at Lynas Find. In the southern extent of the Survey Area, occurrences are small, isolated outcrops, fragmented from the adjoining ranges by plains areas, but does contain the stand of Ficus.

**Rocky Outcrop**

Survey Sites:

C13/35(1)

C21/34(1)

C7/37(1) C21x(2)

C13/35(2)

C7/37(2)

AS660654

FH013

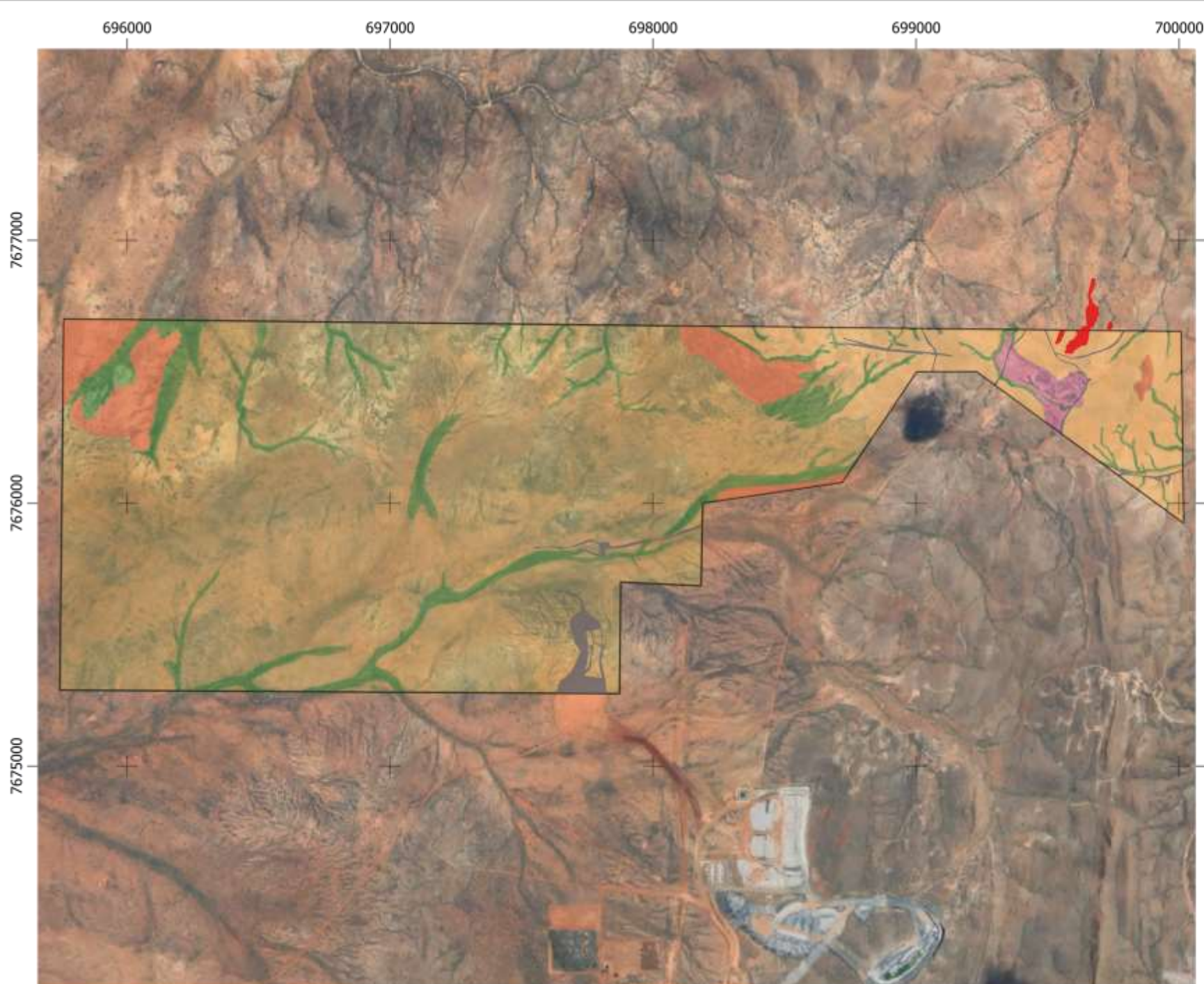
FH002



D Disturbed

Extent in Survey: Completely Degraded – cleared land.

10.76 ha (3.2%)



696000                      697000                      698000                      699000                      700000

7677000

7676000

7675000

- ### Legend
- Stony Plains
  - Shallow drainage basins and creeks
  - Low Hills
  - Major Drainage Line
  - Platy Rock Outcrop
  - Historic Mine Workings
  - Rocky Outcrop
  - Disturbed

Scale: @ A4  
 1: 20,000

0      200      400 m

Coordinate System: GDA 2020 MGA Zone 50  
 Projection: Transverse Mercator

Author: EH      Approved: ML      Date: 28/10/2023

## Fauna Habitats Northern Survey Area



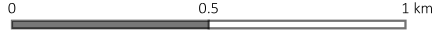
# Fauna Habitats Southern Survey Area

Prepared for:











Figure: 5-2b

Scale: @ A4  
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Coordinate System: GDA 2020 MGA Zone 50  
Projec on: Transverse Mercator

## Legend

-  Stony Plains
-  Shallow drainage basins and creeks
-  Low Hills
-  Major Drainage Line
-  Platy Rock Outcrop
-  Historic Mine Workings
-  Rocky Outcrop
-  Disturbed

## 5.2.2 Acoustic bat recorders

The recording dataset comprised a total of 49 recording nights from five bat detector units.

Acoustic processing of the bat detector recordings was conducted separately for each of Ghost bat and Pilbara leaf-nosed bat using methods optimised for the detection of their unique echolocation call types.

No calls of the Ghost bat were observed in the recordings. Call sequences of the target species Pilbara leaf-nosed bat were detected and are listed in Table 5-3.

**Table 5-3. Call sequences of the Pilbara leaf-nosed bat**

Serial	Night of	Passes	Sunset	Dusk	Dawn	Sunrise	Time of Detection	Time since
450085	14/7/2023	2	14/07/2023 17:39	14/07/2023 18:03	15/07/2023 6:18	15/07/2023 6:42	First: 22:59:42 Last: 0:27:25	Sunset: 5H 19M 57S Dawn: 6H 15M 0S
450085	15/7/2023	2	15/07/2023 17:40	15/07/2023 18:03	16/07/2023 6:18	16/07/2023 6:42	First: 22:57:54 Last: 1:43:31	Sunset: 5H 17M 46S Dawn: 4H 58M 44S
660630	17/7/2023	2	17/07/2023 17:40	17/07/2023 18:04	18/07/2023 6:18	18/07/2023 6:41	First: 22:34:08 Last: 1:14:19	Sunset: 4H 53M 15S Dawn: 5H 27M 32S
660654	14/07/2023	4	14/07/2023 17:39	14/07/2023 18:03	15/07/2023 6:18	15/07/2023 6:42	First: 21:08:43 Last: 23:28:39	Sunset: 3H 28M 58S Dawn: 7H 13M 46S
660654	16/07/2023	1	16/07/2023 17:40	16/07/2023 18:04	17/07/2023 6:18	17/07/2023 6:42	First 22:22:32 Last: 22:22:32	Sunset: 4H 42M 2S Dawn: 8H 19M 32S
660654	17/07/2023	1	17/07/2023 17:40	17/07/2023 18:04	18/07/2023 6:18	18/07/2023 6:41	First: 21:23:34 Last: 21:23:34	Sunset: 3H 42M 41S Dawn: 9H 18M 17S
660654	18/07/2023	3	18/07/2023 17:41	18/07/2023 18:05	19/07/2023 6:17	19/07/2023 6:41	First: 21:31:09 Last 23:09:21	Sunset: 3H 49M 53S Dawn: 7H 32M 17S
660654	22/07/2023	3	22/07/2023 17:42	22/07/2023 18:06	23/07/2023 6:16	23/07/2023 6:40	First 4:39:16 Last: 4:40:50	Sunset: 10H56M26S Dawn: 1H 59M 43S
660654	24/07/2023	1	24/07/2023 17:43	24/07/2023 18:07	25/07/2023 6:16	25/07/2023 6:39	First: 23:08:36 Last: 23:08:36	Sunset: 5H 24M 59S Dawn: 7H 31M 19S
660654	25/07/2023	1	25/07/2023 17:44	25/07/2023 18:07	26/07/2023 6:16	26/07/2023 6:39	First: 23:28:16 Last: 23:28:16	Sunset: 5H 44M 16S Dawn: 7H 11M 18S
660654	28/07/2023	1	28/07/2023 17:45	28/07/2023 18:08	29/07/2023 6:15	29/07/2023 6:38	First: 21:51:48 Last: 21:51:48	Sunset: 4H 6M 38S Dawn 8H 46M 37S

Table 5-3 shows the detection of echolocation call sequences was well after sunset and well before sunrise. No roosting habitat was recorded during the survey and therefore the activity is most likely to indicate individuals out foraging away from a diurnal roost.

The data is discussed further in Section 5.2.6

## 5.2.3 Motion triggered and time lapse cameras

Targeted fauna captured on camera are listed in Table 5-4. Northern quoll were captured on camera on six occasions across four cameras. The locations and habitats of the captures are discussed in Section 5.2.5.1.

**Table 5-4. Targeted fauna camera captures**

Camera	Species	Date	Time
MSC007(1)	Northern Quoll	09-Jul-23	0:27
MSC021(1)	Northern Quoll	09-Jul-23	2:07
MSC034(1)	Northern Quoll	28-Jun-23	3:00
MSC034(1)	Northern Quoll	28-Jun-23	5:12
MSC035(1)	Northern Quoll	28-Jun-23	1:39
MSC035(1)	Northern Quoll	28-Jun-23	5:02

Non-target captures returned a diversity of species, including introduced fauna. Table 5-5 lists the nontarget records from cameras.

**Table 5-5. Non-target captures from motion triggered and time lapse cameras**

Common name	Species	# captures
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	2
Common Bronzewing	<i>Phaps chalcoptera</i>	1
Common Rock Rat	<i>Zyomys argurus</i>	62
Cow	<i>Bos taurus</i>	6
Diamond Dove	<i>Geopelia cuneata</i>	1
Echidna	<i>Tachyglossus aculeatus acanthion</i>	1
Euro	<i>Macropus robustus</i>	3
Gecko	<i>Gehyra sp.</i>	26
Honey eater	-	1
Kaluta	<i>Dasykaluta rosamondae</i>	1
Little Button Quail	<i>Turnix velox</i>	2
Magpie Lark	<i>Grallina cyanoleuca</i>	4
Mulga Snake	<i>Pseudechis australis</i>	1
Painted finch	<i>Emblema pictum</i>	5
Peaceful Dove	<i>Geopelia striata placida</i>	5
Perentie	<i>Varanus giganteus</i>	8
Pilbara grasswren	<i>Amytornis whitei whitei</i>	2
Sandy inland Mouse	<i>Pseudomys hermannsbergensis</i>	2
Skink	<i>Morethia ruficauda exquisita</i>	2
Spinifex Pigeon	<i>Geophaps plumifera</i>	2
Spotted Nightjar	<i>Eurostopodus argus</i>	4
Western Crow	<i>Corvus orru ceciliae</i>	5
Western Ringtail Dragon	<i>Ctenophorus caudicinctus</i>	1

Willie wagtail	<i>Rhipidura leucophrys leucophrys</i>	10
Woolley's Pseudantechinus	<i>Pseudantechinus woolleyae</i>	1
Yellow-throated Minor	<i>Manorina flavigula</i>	2

Identifications were only made as far as necessary to rule out target species. Five captures of birds, one of a suspected Dasyurid or rodent and one of an indeterminate skink were of poor image quality and were unable to be identified.

Six captures were of cattle, which is expected as the land is within a station and pastoralism is the active land use within all surveyed areas.

#### 5.2.4 Traverses

During traverses, the following fauna signs were identified:

- One Northern quoll scat;
- Three closely located diggings and scats that cannot be excluded as bilby in origin;
- Eight Western pebble-mouse mounds (including two extinct mounds);
- One Wallaby scat pile in the shallow drainage line habitat that cannot be excluded as Spectacled hare-wallaby in origin; and
- Four Rainbow bee-eaters (*Merops ornatus*) and five Rainbow bee-eater nests.

Notes were taken on habitat quality, disturbances, and the availability/unavailability of habitat microniches.

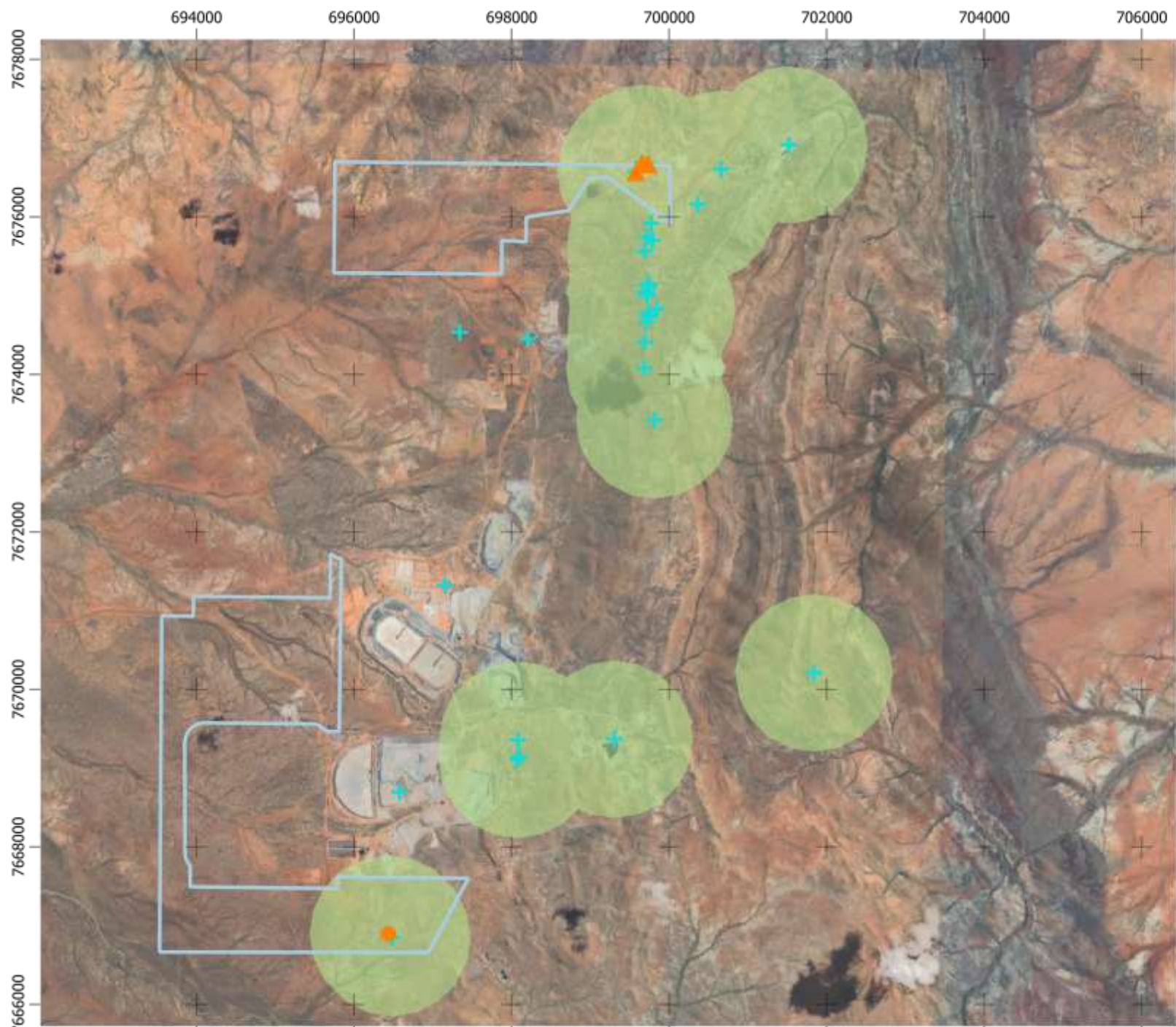
Signs of conservation significant fauna are discussed further in Section 5.2.5 below.

#### 5.2.5 Conservation Significant Fauna






##### 5.2.5.1 Northern Quoll

Northern quoll has been recorded on several occasions within the Pilgangoora Project Area (DBCA Database record, Ecologia Environmental 2018; Terrestrial Ecosystems 2020, APM 2022a, APM 2023b, APM unpublished data [Figure 5-3]). Locally this species seems to be most encountered in the boulder hill tops habitat of the north/south tending ridgeline running along the eastern half of the Pilgangoora Project Area. This is the most rugged landform in the local area, at the highest elevation. Boulders on the ridge tops form a mosaic of cracks and crevices large enough to provide denning habitat for the quoll. In some locations the habitat is able to support fig trees – a favoured food of Northern quoll.

Within 30 km of the Survey Area, species records predominantly occur within rocky outcrop habitats, but also occur in the Turner River and larger tributaries of the Turner River, 16 km to the west of the Survey Area. Quoll have been recorded near to mine infrastructure of the Pilgangoora Project on three occasions.




### Legend

-  NVCP Survey Area
- NVCP Area Northern Quoll Records
  -  Camera
  -  Scat
  -  Previous Northern Quoll Records
  -  1 km buffer Northern Quoll critical habitat



Scale: @ A4  
1: 70,000

 0 1 2 km

Coordinate System: GDA 2020 MGA Zone 50  
Projection: Transverse Mercator

Author: EH      Approved: ML      Date: 29/10/2023

## Northern Quoll

Habitat critical to the survival of the Northern quoll and populations important for the long-term survival of the Northern quoll are defined in CoA (2016) and are present in the Pilgangoora Project Area. Habitat critical to the survival of the Northern quoll previously recorded at the Pilgangoora Project Area includes:

- Rocky Outcrop habitat to the east of the Survey Area;
- areas of native vegetation within 1 km of Rocky Outcrop habitat; and
- dispersal and foraging habitat associated with or connecting the population within the Rocky Outcrop habitat to other nearby populations or foraging habitats.

Evidence of habitat usage within the Survey Area includes six camera captures across four camera locations and one scat collection. The camera captures were all in Rocky Outcrop habitat in the northeastern extent, with a high level of connectivity to previously recorded Northern quoll habitat and records. The scat was recorded in the south-eastern extent, also in Rocky Outcrop habitat, near to where a scat has previously been recorded (APM 2023a), but where deployed cameras did not capture individuals. The occurrence of Northern quoll habitat in the south-eastern extent occurs as isolated outcrops on top of hills surrounded by plain, and a stand of fig trees is present.

No quoll records or signs were recorded in major or minor drainage lines, despite the presence of large hollow bearing trees and boulders in the Major Drainage Line habitat. Whilst in other environs creek lines would be a dispersal and foraging habitat for Northern quoll, in the Survey Area this habitat type does not appear to be frequented by the species. It is unknown whether the population inhabiting the rocky hills to the east are connected with the Turner River population, but it would be expected that connectivity between the two populations would occur via the creeks and channels which provide greater cover and forage potential over the 16 km separation. However, there is currently no evidence of such usage and extensive survey effort across the Pilgangoora area has not recorded any quoll usage of drainage features.

All habitats occurring within the Survey Area may be utilised by the species, at some time, to forage and or during dispersal activities; however, their significance to the species will vary depending on resource availability and connectivity. At the time of survey there is little evidence of consistent use of the Survey Area by Northern quoll outside of the Rocky Outcrop habitat, however as the populations are critical to the survival of the Northern quoll, the area within 1 km of these habitats are also considered critical (Figure 5-3).

#### **5.2.5.2 Ghost Bat**

A recent review of Ghost bat (Bat Call WA 2021a) updates the knowledge base on ecology, threats, and survey requirements for the species.

Ghost bats move between a number of caves seasonally or as dictated by weather conditions and/or foraging opportunities, so they require a range of cave sites (Richards et al. 2008). They disperse widely when not breeding but may concentrate in relatively few roost sites when breeding. In the Pilbara, except for the large, abandoned mine colonies, Ghost bats are often present either singly or in small groups (usually less than 15). These have been shown to move periodically, either seasonally or as dictated by prey availability. Their vagrant foraging strategy relates to patchy, locally unreliable rainfall events (and prey biomass) across much of its foraging habitat in the Pilbara and elsewhere in other semi-arid parts of its broader Australian range. Hence the relatively small groups that must move from roost to roost to access their ephemeral patchy food resource.

Extensive survey activity in the last decade has led to the proposal of four categories of roosting habitat used by Ghost bats in the Pilbara (Cramer et al 2022; Bullen 2021a):

- Category 1 permanent diurnal roost;
- Category 2 regular diurnal roost; • Category 3 occasional diurnal roost; and
- Category 4 nocturnal feeding roosts.

Within the Survey Area there are no Category 1, 2, 3 or 4 roosts available to this species.

In the Pilbara, Ghost bats prefer to forage on productive plain areas with thin mature woodland over patchy or clumped tussock or hummock grass (*Triodia* spp.) on sand or stony ground. Isolated trees and trees on the edge of thin thickets on the plains, or trees along the edges of watercourse woodlands, appear to be preferred vantage points (Bullen unpublished data, reported in Bullen 2021). In the Survey Area there are scattered to clumped trees available for perching in all habitat types.

No Ghost bats were recorded during the acoustic survey, however acoustic recorders are not suited to Ghost bat detection during foraging as the species seldom uses its echolocation away from caves.

The Ghost bat is listed in the PMST as known to occur within the local area and the DBCA database has records for the species within a 30 km radius. APM (2023b) recorded Ghost bat on camera in a location 600 m north of the northern Survey Area in a Category 4 roost. Ghost bats are known to travel up to 15 km from a roost site for foraging and up to 30 km in one night to alternative roosting sites, indicating the Survey Area may be within range of Category 1, 2 or 3 roosts.

It is likely that the Survey Area offers foraging habitat to Ghost bat across all habitat types.

### 5.2.5.3 Pilbara Leaf-Nosed Bat

A recent review of Pilbara leaf-nosed bat (Bat Call WA 2022b) updates the knowledge base on ecology, threats, and survey requirements for the species. It is generally encountered in rocky areas that provide opportunity for roosting, in particular the ironstone Hamersley Range, the ridgelines granite boulder piles and disused mines of the eastern Pilbara, and along medium and major drainage lines that radiate away from rocky uplands.

Pilbara leaf-nosed bat roost during the day beyond the twilight zone in caves and underground mines with stable, warm and humid microclimates because of its poor ability to maintain its heat and water balance (Churchill et al. 1988; Jolly 1988; Churchill 1991; Baudinette et al. 2000; Armstrong 2001). The Pilbara leaf-nosed bat does not roost in overhangs (shallow structures where the rear wall can be observed from the entrance), as these do not support warm, humid microclimates (TSSC, 2016). A suggestion that this species becomes 'forest dwelling' in the wet season of the monsoonal northern areas (Churchill 1991, 1995) has not been supported, and is very unlikely in the Pilbara region (Armstrong 2001).

Roosts have been categorised according to importance to the survival of the species into four categories (TSSC 2016):

- Category 1 - Permanent diurnal maternity roosts where seasonal presence of young is proven;
- Category 2 - Permanent diurnal roosts where presence of young is unproven;

- Category 3 - Semi-permanent diurnal roosts; and
- Category 4 - Nocturnal refuge.

The Pilbara leaf-nosed bat was recorded locally during Targeted survey for individuals and roosts for the Pilgangoora Project (360 Environmental 2015, 2016). A Category 1 or 2 roost was located, and high-quality foraging habitat was identified at a major water body in an abandoned open cut pit. The roost site and confirmed foraging habitat are 1.5 km from the Survey Area to the north and east respectively and are shown in Figure 5-4. An estimate of the number of Pilbara leaf-nosed bat at the roost based on ultrasonic calls and video counts ranged between 25-50. There are additional known permanent diurnal category 1 or 2 Pilbara leaf-nosed bat roosts within 40 km of the Survey Area (Bat Call WA 2022b), and Category 4 Roosts have been recorded to the east of the Pilgangoora Project (APM 2023c). The Survey Area does not contain any Category 1, 2, 3 or 4 roosts.

Generally, the Pilbara leaf-nosed bat is most encountered within 20 km of its permanent diurnal roosts (Bullen 2013), but in the months where climatic conditions are least challenging for the species (April-May) they have been recorded further afield (Bat Call WA 2022b). Echolocation based records indicate that it can complete round trips of 50 km or longer in a night under favourable conditions (Bat Call WA 2022b).

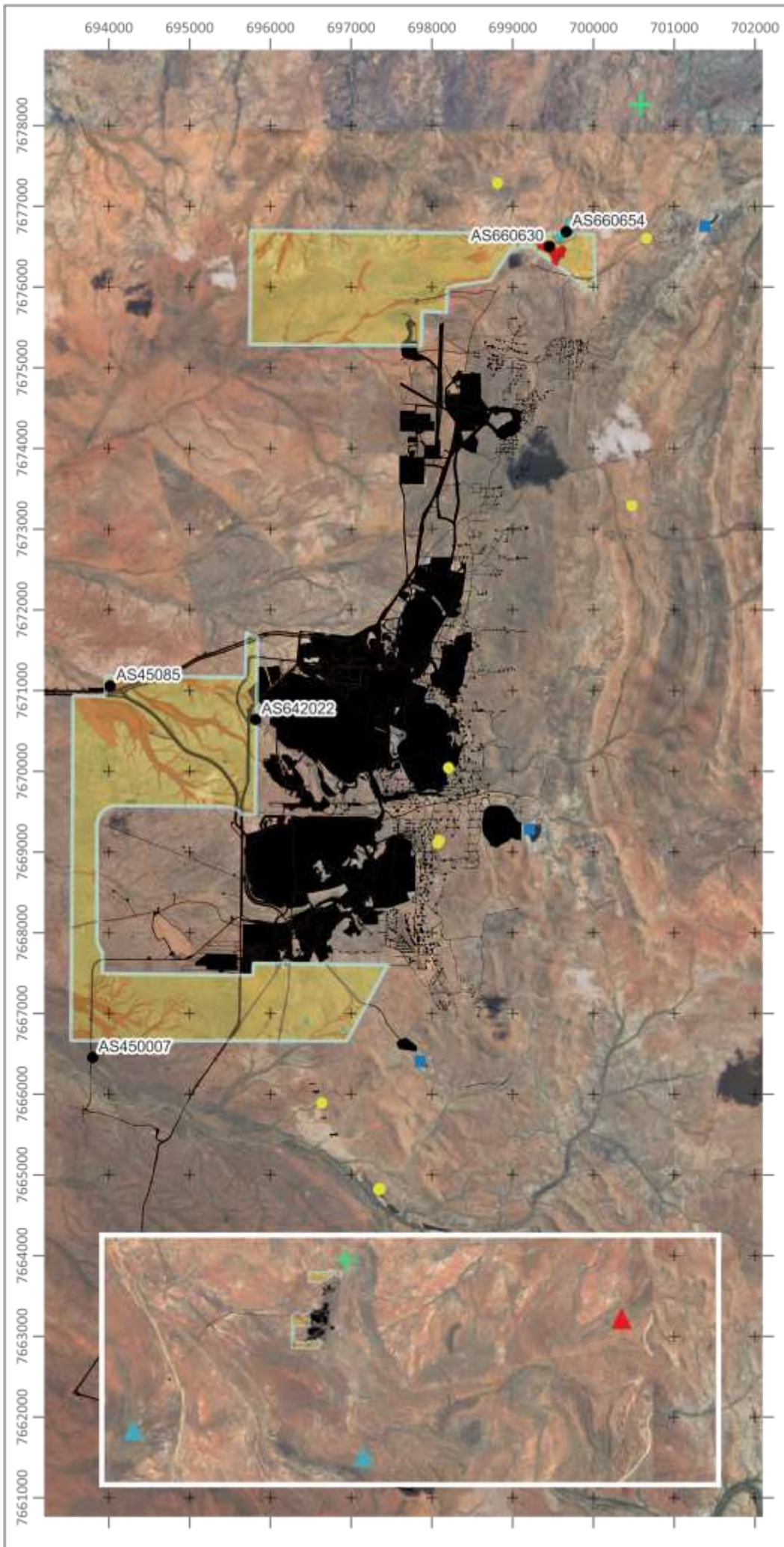
Twenty-one call sequences of the Pilbara leaf-nosed bat were recorded within the Survey Area at three locations, where two were reasonably close together. The call sequences were all between 9 pm and 4:40 am. The detection of echolocation call sequences well after sunset and well before sunrise, and away from areas of rocky outcrop containing deep caves, is indicative of individuals of this species out foraging away from a diurnal roost.

Foraging habitats used by the PLNB are prioritised by EPBC Conservation Advice (TSSC 2016) as:

- Priority 1 - Gorges with pools
- Priority 2 – Gullies
- Priority 3 – Rocky Outcrop
- Priority 4 – Major Watercourses
- Priority 5 – Open Grassland and Woodland.

Habitats in the Study Areas have been categorised using this Priority schedule and are shown in Figure 5-4 where the Historic Mine Workings are Priority 2, Rocky Outcrop habitat is considered Priority 3, Priority 4 areas include the Major Drainage Line and Shallow Drainage Basins and Creeks and the remaining habitats are Priority 5.

The call sequences were recorded in Rocky Outcrop habitat (15 passes), Major Drainage Line (4 passes) and Historic Mine Workings (2 passes).



**Legend**

- ▲ Confirmed Category 1 Roost
  - + Confirmed Category 1 or 2 Roost
  - ▲ Confirmed Category 2 or 3 Roost
  - Category 4 Roost
  - Previously recorded Priority 1 Foraging Habitat
- Foraging Habitat categories within the Survey Area
- Priority 2
  - Priority 3
  - Priority 4
  - Priority 5
- Acoustic bat recorder



Scale: @ A4  
1: 70,000

0 500 1,000 m

Coordinate System: GDA 2020 MGA Zone 50  
Projection: Transverse Mercator

Author: EH    Approved: ML    Date: 29/09/2023

**Pilbara leaf-nosed bat**

Prepared for:



#### 5.2.5.4 Grey Falcon

The Grey falcon occurs in most of the drier parts of Australia (Schoenjahn 2018). Its distribution is centred on inland drainage systems where there is an average annual rainfall of less than 500 mm. Its main habitat is timbered lowland plains, particularly Acacia shrublands that are crossed by tree-lined watercourses. It generally occurs at low densities across inland Australia (BirdLife International 2019).

The Grey falcon hunts far out into tussock grassland and open woodland. It nests in old nests made by other birds, usually nests in the tallest trees along watercourses, particularly river red gum (TSSC 2020). Prey species include doves, pigeons, small parrots and cockatoos, and finches, but a variety of other bird prey species has been recorded, as well as mammals and lizards (TSSC 2020).

Local records are centred on the Turner River and major tributaries. The closest record is 10 km from the Survey Area to the southeast. The Survey Area is suitable foraging habitat for this species, and within range of the population likely to be nesting in the Turner River riparian zone. Some large trees were present in the Major Drainage Line fauna habitat but no nests were observed.

#### 5.2.5.5 Night Parrot

The Survey Area is within the area where Night parrot is modelled as may occur. Very limited information is available on the Night parrot, however some information on habitat characteristics where the species has persisted is available.

DBCA (2017) summarises habitat characteristics. Night parrot roosting and nesting sites are in clumps of dense vegetation, primarily old and large spinifex (*Triodia*) clumps, but sometimes other vegetation types. Often the vegetation in these habitats will be naturally fragmented and therefore well protected from fire. Little is known about foraging sites, but favoured sites are likely to vary across the range of the species. In Queensland, Night parrots have been shown to feed in areas rich in herbs including forbs, grasses and grass-like plants, and it is likely that such areas may also be important in WA. *Triodia* is likely also to provide a good food resource for Night parrot, in times of mass flowering and seeding, but they also rely heavily on a range of other food species. *Sclerolaena* has been shown to be a source of food and moisture.

The species and growth pattern of the spinifex in some of the plains habitat in the Survey Area may be suitable for the Night parrot, however there are no patterns of fragmentation and fire records (DBCA 2022) and field observation show that burning is often landscape scale and at a moderate frequency. There are no samphire or chenopod habitats proximal to the Survey Area, however the drainage depressions may seasonally support a diversity of herbs and other potential forage species. Night parrots have been known to fly up to 40 km or more in a night during foraging expeditions, so foraging habitat is not necessarily within or adjacent to roosting areas.

An interim guideline for preliminary surveys of Night parrot in WA (DPAW 2017b) identifies when and where Night parrot surveys may be required. The Survey Area is on the north-western edge of the area classed as a high priority for survey. Due to the inclusion of the site in the high priority survey area and the presence of potentially suitable spinifex habitat, passive acoustic survey was conducted in three previous surveys (APM 2022a, APM 2022b and APM 2023b). No Night parrot calls were recorded and foot traverses have not encountered any signs or individuals of Night parrot.

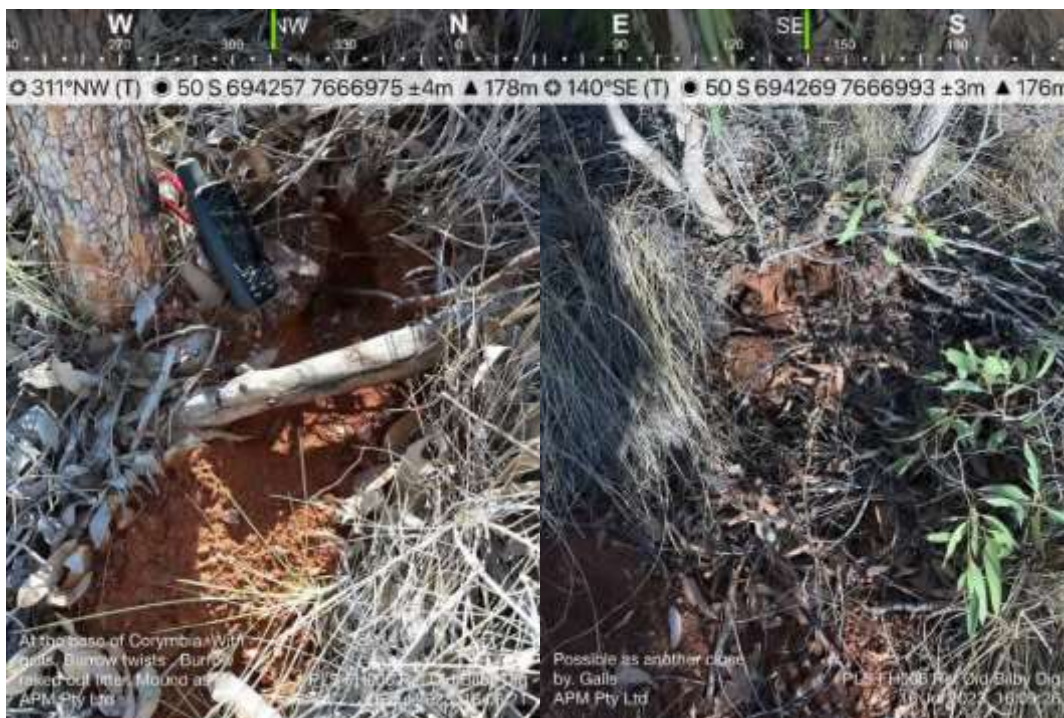
While the habitat is potentially suitable, there are no historic records of Night parrot in the area and very few records of extant individuals. While it remains possible that the species could colonise in the future, there is no evidence that they are currently present.

### 5.2.5.6 Greater Bilby

Extant populations of bilby occur in a variety of habitats, usually on landforms with level to low slope topography and light to medium soils (typically sandy for burrow excavation). Bilby occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial areas (Southgate 1990). Laterite and rock feature substrates are an important part of Greater bilby habitat, which support shrub species such as Acacia, and spinifex hummocks which are quite uniform and discrete, providing runways between hummocks, enabling easier movement and foraging (Southgate et al. 2007).

The species is identified by the PMST as known to occur within 30 km of the Survey Area. Database results returned 104 records within a 30 km radius of the Survey Area, the closest being one record to the east of Pilgangoora made in 1979. Recent records (2012-2016; 16 to 25 km west) are from surveys conducted for the rail and road corridors to the west. These records are surrounding the Turner River. The DBCA has a long-term bilby abundance monitoring program at the Turner River (DPAW 2017a).

Suitable habitat in the Survey Area includes the Stony Plains and Shallow Drainage Depressions and Creeks habitats. Extensive foot transects were walked across all habitats. No burrows were located. Indeterminate signs were recorded in three closely distributed locations. Diggings/scratchings were recorded as shown in Plate 5-1. The diggings/scratchings lacked attributes common to digging lizards and other species expected to occur, however they were not beneath a recognised bilby forage species, shallow and not fresh. Plate 5-2 shows footprints that may be attributed to bilby.



**Plate 5-1. Diggings that may be bilby in origin**



**Plate 5-2. Footprints that may be bilby in origin**

Department of Parks and Wildlife (2017a) provides a protocol for using signs to determine the presence of bilby. Under the protocol, diggings in the open can be used to flag potential bilby activity or potential past presence, but not to verify current presence with certainty. Additional searching was conducted to identify the presence of further signs, but no diggings near shrubs known to host root-dwelling larvae, scats or burrows were observed. Under the protocol the significance of the observed signs is Potential bilby activity - Presence not confirmed.

This species has the potential to occupy the Survey Area as bilbies can be relatively transient across their distribution. No burrows were observed suggesting any recent use may be for foraging only and transitory in nature.

#### 5.2.5.7 Western Pebble-mound Mouse

The Western pebble-mound mouse is endemic to the Pilbara where it is found on stony hillsides with hummock grassland (Menkhorst and Knight, 2010). This species builds pebble mounds from small stones, which typically cover areas from 0.5-9.0 m<sup>2</sup>. The mounds are characteristic of the species. Pebble mounds are restricted to areas with suitable class stones and are usually found on gentle slopes and spurs that are often vegetated by hard spinifex (Van Dyck and Strahan 2008). Active mounds are characterised by the conical shape of the mound with clear, distinct entrance holes (Anstee 1996). Mounds are often sited close to narrow ribbons of Acacia dominated scrub that grow along incised drainage lines (Van Dyck and Strahan 2008).

Targeted searches were performed using foot transects in suitable habitat. Eight mounds were recorded. The status of mounds was assessed according to the method published in Anstee (1996). The Anstee (1996) index is most accurate at predicting the status of mounds with very high (classified as active) or

very low (classed as inactive) scores. Mounds with intermediate activity could be either active or inactive, depending on whether they are in the process of being activated or degrading following abandonment. Mound locations and status are listed in Table 5-6, an example of an active mound is shown in Plate 5-3.

**Table 5-6. Western Pebble-mound mouse mound status and location**

Status	Location (GDA 2020; MGA zone 50)
Active	695841, 7676603
	695812, 7671480 699951, 7676327
Intermediate	697187, 7676582
	696721, 7676031 695078, 7666773
Inactive	694979, 7666774
	695015, 7666772

Suitable habitat occurs in the Stony Plains and Low Hills habitats where suitable size pebbles are available.



**Plate 5-3. An active Western pebble-mound mouse mound**

#### 5.2.5.8 Brush-tailed Mulgara

Brush-tailed mulgara is widespread, but patchily distributed in sandy regions of arid central Australia and WA. It inhabits hummock grass plains, sand ridges, and mulga shrubland on loamy soils (Menkhorst and Knight, 2010). It uses the open space between vegetation, a microhabitat that is known to support important prey species and may forage in termite mounds (Molyneux et al. 2018).

The Brush-tailed mulgara constructs burrows or utilises those of other species. Burrows may provide access to prey items, protection from predators and have thermoregulation benefits (Molyneux et al. 2018).

Local records are to the west of the Survey Area with the closest record 6 km to the southwest. Records originate from biological surveys assessing the impact of rail lines servicing the Pilbara region.

Suitable habitat occurs in the Stony Plains habitat in areas where the soils are sandy and suitable for burrowing, however the preferred sand dune habitat is not present.

Targeted searches were conducted in suitable habitat for signs (tracks and burrow entrances) of the Mulgara. No evidence of Mulgara presence was observed. Whilst the habitat is suitable, there is no evidence that Mulgara are currently present in the Survey Area.

#### 5.2.5.9 Spectacled Hare-wallaby (mainland)

The Spectacled hare-wallaby inhabits tropical tussock or hummock grassland with mid-dense or sparse tree and shrub cover (Menkhorst and Knight, 2010). In the Pilbara this species has declined drastically, possibly due to fox predation and because frequent burning of spinifex grassland has prevented the development of the large hummocks required for shelter (Van Dyck and Strahan 2008).

There are many local records, in the surrounding foothills and plains habitats. These records are from the early 1990's.

Scats recorded during targeted searches may be attributable to Spectacled hare-wallaby (Plate 5-4).

The species was not recorded during the detailed and reconnaissance fauna surveys for the Pilgangoora Project (See Section 3.1.2), with the absence of the species attributed to the broader regional decline. Scats were recorded at two sites during the TSF Infill Survey which were determined to be likely of belonging to the Spectacled hare-wallaby. The habitats available in the Survey Area, particularly in the Shallow Drainage Depressions and Creeks where the scats were recorded, offer a denser cover of vegetation that may be providing sufficient shelter from predation for the species to persist locally.

It is not possible from the available evidence to comprehensively determine the presence of Spectacled hare-wallaby in the Survey Area. Rothschild rock wallaby (*Petrogale rothschildi*) has been recorded at the project and is of similar size to the Spectacled hare-wallaby, however the species is known to stay close to suitable shelter habitat (DPAW 2013) that is not present in or near the Survey Area where the scats were recorded.



**Plate 5-4. Wallaby scats**

#### 5.2.5.10 Rainbow Bee-eater

In WA the Rainbow bee-eater is considered to be a Migratory bird protected under an international agreement. As such it is listed as Specially Protected under the Wildlife Conservation Act 1950 and listed under Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice. The listing applies to 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), relating to the protection of migratory birds.

The Rainbow bee-eater was removed from the list of Migratory species under the EPBC Act on the 9<sup>th</sup> June 2016. The species remains on the Marine listing and is subject to 254 of the EPBC Act, which makes it an offence to kill or injure Marine listed species when occurring in or on a Commonwealth area. The Survey Area is not in or on a Commonwealth area.

The species remains listed as IA on the Western Australian Fauna Checklist, however it does not appear to have any special protection outside of Commonwealth areas.

At the Survey Area, four Rainbow bee-eater individuals were observed and five nest locations were recorded. Locations are listed in Table 5-7.

**Table 5-7. Locations of Rainbow bee-eater observations**

<b>Status</b>	<b>Location (GDA 2020; MGA zone 50)</b>	
Individuals	694528	7671258
	695106	7671029
	695390	7671066
	695410	7671052
Nests	694492	7671219
	695036	7671097
	695100	7671046
	695219	7670961
	695728	7670883

### 5.2.6 Introduced Fauna

The field survey identified the presence of one introduced fauna species, being cattle (*Bos taurus*). As the area is actively used for pastoralism, the presence of cattle is expected.

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## 6 CONCLUSIONS

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### 6.1 FLORA

The flora and vegetation survey recorded a total of 143 taxa within the Survey Area which is comparable to the number of taxa recorded in other previous local surveys: 120 taxa (67 genera from 28 families) recorded by APM (2022b) for TSF Options 2 and 5, 118 taxa (67 genera and 25 families) recorded by APM (2023b) for the TSF Infill Survey, 116 taxa (63 genera from 26 families) recorded by APM (2022a) at the Lynas Find Deposit; 195 taxa (101 genera and 39 families) recorded by MMWC Environmental (2016a) at the Pilgangoora Project, and 122 taxa (67 genera and 38 families) recorded by Outback Ecology (2009) at Wodgina.

The flora and vegetation of the Survey Area is generally typical of the Pilbara, and of the adjacent lands surrounding the Survey Area.

### 6.2 FLORA OF CONSERVATION SIGNIFICANCE

No T flora was recorded in the Survey Area. One P3 species was recorded.

*Triodia chichesterensis* was recorded within a variety of vegetation types. It co-occurs with the closely related *Triodia lanigera* and, as is common in the northern part of the species range, the distribution of the two species is generally substrate based with *T. chichesterensis* restricted to areas where quartzite is commonly found at the surface. Quartzite is common in the local area and not all areas containing quartzite host *T. chichesterensis*.

An additional three species were determined likely to occur based upon the availability of suitable habitat. One of these, *Euploca mutica* (P3) is a perennial species, identifiable from vegetative parts and would have been detectable at the time of survey. Two species (*Euphorbia clementii* [P3] and *Rothia indica* subsp. *australis* [P3]) are annual species. Seasonal conditions were unsuitable for the presence of these species to be detected.

### 6.3 INTRODUCED FLORA

No weeds Declared under the BAM Act or classed as WoNS were recorded in the Survey Area. Four weeds were recorded, two species of agricultural grass *Cenchrus ciliaris* and *Cenchrus setiger* and the environmental weeds *Aerva javana* (Kapok) and *Tribulus terrestris* (Caltrop). Occurrence was infrequent and where present, they occurred in low numbers.

Declared weeds known to occur in the region are perennial species able to be identified from vegetative parts. The absence of Declared weeds within the Survey Area is reported with a high level of confidence.

### 6.4 VEGETATION OF CONSERVATION SIGNIFICANCE

There are no recognised TECs or PECs located within or adjacent to the Survey Area.

None of the vegetation types described for the Survey Area are analogous to any known TECs or PECs. The nearest record of a TEC or PEC to the Survey Area is the Gregory Land System (P3 PEC), approximately 50 km away.

The Chichester Subregion includes seven Ecosystems at Risk which are subject to a range of threatening processes (Kendrick and McKenzie 2001). None of these ecosystems are relevant to the Survey Area.

One species associated with Groundwater Dependent Ecosystems was recorded. *Eucalyptus victrix* was recorded in vegetation type 4b in the Major Drainage Line. Individuals were relatively old with a large diameter at breast height compared to other trees in the surrounding habitats. *Eucalyptus victrix* is regarded as being a facultative phreatophyte that most likely draws the majority of its water requirement from the unsaturated zone but can use groundwater opportunistically as required (Pfautsch et al. 2014).

Regional Vegetation Associations within and nearby the Survey Area as described by Beard have over 99% pre-European Vegetation extent remaining. Conservation significance ranking of vegetation associations occurring within the Survey Area are of 'Least Concern'.

## 6.5 FAUNA OF CONSERVATION SIGNIFICANCE

The Northern quoll is known to occur in the local area and critical habitat has previously been identified in the ridgeline to the east of the Survey Area. The Survey Area contains habitat that is of value to the Northern quoll for denning, foraging and dispersal. This habitat is described and mapped as the Rocky Outcrop habitat. The Rocky Outcrop habitat and the area within 1 km is habitat critical to the survival of the Northern quoll (CoA 2016).

The Pilbara leaf-nosed bat is known to occur in the local area and diurnal roosts occur within the range of the Survey Area. There are no roosts suitable for the Pilbara leaf-nosed bat in the Survey Area. The conservation ranking of foraging habitat in the Survey Area is limited to small areas of Priority 2 and 3 foraging habitat with the majority being Priority 4 and 5. For the majority of the site, the species may occasionally use the habitats for foraging or in transit to other more productive areas. One location recorded a higher number of calls than other locations. This is a rocky outcrop habitat in the northeastern extent of the Survey Area, nearest to the known Category 1/2 roost less than 2 km to the north. Individuals may be visiting this Priority 3 foraging habitat, or it may be in the flight path of individuals travelling to other higher quality foraging habitats, or both. Records ranged from one to four passes per night, with calls logged on eight out of 17 active recording nights. Other local high quality foraging habitats have been found to record 40 or more call sequences over a period of three nights (360 Environmental 2016b).

The Greater bilby is known to occur in the region, however there are no locally confirmed modern records. Some signs were observed that cannot be excluded as originating from bilby, however the significance of the observed signs is Potential bilby activity - Presence not confirmed. Even if the signs were confirmed to belong to bilby, the occurrence would be transitory and indicates that limited forage was available, and therefore the Study Areas do not present important habitat for this species.

The Ghost bat is known to occur in the local area and diurnal roosts are known to occur within range of the Survey Area. The Survey Area is suitable foraging habitat for the Ghost bat. The Ghost bat was not recorded during the acoustic survey, however, the method has limitation with detection of the species. The species is likely to occur within the Survey Area at some time, for foraging purposes only.

The Grey falcon is known to occur in the local area and the Survey Area is within foraging range of the species. Grey falcon nesting in the Turner River area are likely to visit the Survey Area at some times for the purpose of foraging only.

The survey recorded two active, four intermediate and two extinct Pebble-mound mouse mounds. The Pebble mound mouse is known to occur in the area and its presence within the Survey Area is confirmed. The suitability of mound building habitat is confined by the availability of suitable size pebbles, which occur on the Stony Plains and Low Hills habitats.

The Spectacled hare-wallaby has not previously been confirmed to occur on site in modern times but was historically extant in the area. Scats have been collected on two occasions that are considered likely to be from this species. The most suitable habitat for the species is the Shallow Drainage Basins and Creeks habitat that contains dense vegetation that can provide suitable cover to evade introduced predators.

Habitats that would be subject to inundation in the Survey Area are limited to the claypans or gilgai within the Stony Plains habitat. Due to the high evaporation rate and low vegetation cover these are unlikely to retain water for more than a short period and are unlikely to sustain habitat suitable for migratory shorebirds. There are no nationally or internationally significant aggregations of migratory species known to occur within or near the Survey Area.

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## APPENDICES

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## **APPENDIX A: CONSERVATION AND DECLARED CATEGORIES**

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Conservation categories for threatened species and communities protected under Federal legislation are defined under the *Environment Protection and Biodiversity Conservation Act 1999* and the *Environment Protection and Biodiversity Conservation Regulations 2000* are listed in Tables A.1. and A.2.

**Table A.1: Categories and definitions for threatened flora and fauna species listed under the *Environment Protection and Biodiversity Conservation Act 1999*.**

Conservation Category	Definition
<b>Extinct</b>	Taxa with no reasonable doubt that the last member of the species has died.
<b>Extinct in the wild</b>	Taxa known to survive only in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
<b>Critically Endangered (CR)</b>	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
<b>Endangered (E)</b>	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
<b>Vulnerable (V)</b>	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
<b>Conservation dependent (CD)</b>	Taxa are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied: <ul style="list-style-type: none"> <li>i) the taxa is a species of fish;</li> <li>ii) the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximized;</li> <li>iii) the management plan is in force under a law of the Commonwealth or of a State or Territory; and iv) Cessation of the management plan would adversely affect the conservation status of the taxa.</li> </ul> Fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.

**Table A.2: Definitions for Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999*.**

Conservation Category	Definition
<b>Critically endangered</b>	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.
<b>Endangered</b>	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
<b>Vulnerable</b>	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.



For Section 182 of the EPBC Act and 179 of the EPBC Act Threatened Ecological Communities and Native species are in the Critically Endangered, Endangered or Vulnerable category if they meet any of the criteria for the category mentioned in Table A.3:

**Table A.3: Criteria for listing Threatened Species and Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Regulations 2000***

Threatened Species				
Item	Criterion	Category		
		Critically Endangered	Endangered	Vulnerable
1	It has undergone, is suspected to have undergone, or is likely to undergo in the immediate future:	A very severe reduction in numbers	A severe reduction in numbers	A substantial reduction in numbers
2	Its geographic distribution is precarious for the survival of the species and is:	Very restricted	Restricted	limited
3	The estimated total number of mature individuals is: And: (a) Evidence suggests that the number will continue to decline at: or (b) The number is likely to continue to decline and its geographic distribution is:	Very low	Low	limited
		A very high rate	A high rate	A substantial rate
		Precarious for its survival	Precarious for its survival	Precarious for its survival
4	The estimated total number of mature individuals is:	Extremely low	Very low	low
5	The probability of its extinction in the wild is at least:	50% in the immediate future	20% in the near future	10% in the medium term future
Threatened Ecological Communities				
Item	Criterion	Category		
		Critically Endangered	Endangered	Vulnerable
1	Its decline in geographic distribution is:	Very severe	Severe	substantial
2	Its geographic distribution is: And the nature of its distribution makes it likely that the action of a threatening process could cause it to be lost in:	Very restricted	restricted	limited
		The immediate future	The near future	The medium term future
3	For a population of a native species that is likely to play a major role in the community, there is a: To the extent that restoration of the community is not likely to be possible in:	Very severe decline	Severe decline	Substantial decline
		The immediate future	The near future	The medium term future
4	The reduction in its integrity across most of its geographic distribution is:	Very severe	severe	substantial

	As indicated by degradation of the community or its habitat, or disruption of important community processes, that is:	Very severe	severe	substantial
5	The rate of continuing detrimental change is: As indicated by	Very severe	severe	substantial
	(a) A rate of continuing decline in its geographic distribution, or a population of a native species that is believed to play a major role in the community, that is: or	Very severe	severe	serious
	(b) Intensification, across most of its geographic distribution, in degradation, or disruption of important community processes, that is:	Very severe	severe	serious
6	A quantitative analysis shows that its probability of extinction, or extreme degradation over all its geographic distribution, is:	At least 50% in the immediate future	At least 20% in the near future	At least 10% in the medium term future

In Western Australia, the *Biodiversity Conservation Act 2016* (BC Act) provides for the statutory listing of Threatened Ecological Communities, under the categories listed in Table A.4.

**Table A.4: Definitions and criteria for Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable Ecological Communities. Department of Environment and Conservation (2013).**

<b>PD : Presumed Totally Destroyed</b>
<p>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.</p> <p>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):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats <b>or</b></p> <p>B) All occurrences recorded within the last 50 years have since been destroyed.</p>
<b>CR : Critically Endangered</b>
<p>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.</p> <p>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):</p> <p>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):</p> <p>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);</p> <p>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.</p> <p>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).</p>
<b>En : Endangered</b>
<p>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):</p> <p>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):</p> <p>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);</p> <p>ii) modification throughout its range is continuing such that in the short term future (within approximately</p>

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).

#### **VU : Vulnerable**

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.

In Western Australia, 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. 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 (Table A.4).

**Table A.5: Definitions and criteria for Priority Ecological Communities Department of Environment and Conservation (2013).**

<p><b>P1: Priority One – Poorly-known ecological communities</b></p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally <math>\leq 5</math> occurrences or a total area of <math>\leq 100</math> ha). 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.</p>
<p><b>known ecological communities</b></p> <p>Communities that are known from few occurrences with a restricted distribution (generally <math>\leq 10</math> occurrences or a total area of <math>\leq 200</math> ha). At least some occurrences are not believed to be under immediate 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.</p>
<p><b>communities</b></p> <p>(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:</p> <p>(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;</p> <p>(iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</p> <p>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.</p>
<p><b>P4: Priority Four</b></p> <p>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.</p> <p>(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.</p> <p>(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.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
<p><b>P5: Priority Five – Conservation dependent ecological communities</b></p> <p>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.</p>

In Western Australia, 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 listed in Table A.6.

The definition of flora includes algae, fungi and lichens. The definition of 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 A.6: Conservation codes for Western Australian flora and fauna under the *Biodiversity Conservation Act 2016* (DBCAs 2019).**

Code	Conservation Category	Definition
<b>Threatened species</b>		
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.		
<b>CR</b>	<b>Critically Endangered</b>	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.
<b>EN</b>	<b>Endangered</b>	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
<b>VU</b>	<b>Vulnerable</b>	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.
<b>Extinct species</b>		
Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.		

<b>EX</b>	<b>Extinct</b>	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.
<b>EW</b>	<b>Extinct in the Wild</b>	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.
<b>Specially protected species</b>		
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.		
<b>MI</b>	<b>Migratory Species</b>	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.
<b>CD</b>	<b>Species of special conservation interest (conservation dependent fauna)</b>	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.
<b>OS</b>	<b>Other Specially protected species</b>	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.

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.

**Table A.7: Priority species under Western Australian *Biodiversity Conservation Act 2016*.**

<b>P1: Priority One – Poorly known taxa</b>
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.
<b>Poorly known taxa</b>
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.
<b>Priority Three – Poorly known taxa</b>
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.
<b>P4: Priority Four: Rare, near threatened and other taxa in need of monitoring</b>
<p>((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.</p> <p>(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.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

The management of introduced species in Western Australia is regulated through the *Biosecurity and Agriculture Management Act 2007* (BAM Act). The BAM Act seeks to establish a biosecurity regulatory scheme to prevent serious animal and plant pests from entering the State and becoming established, and to minimise the spread and impact of any that are already present within the State.

The list of declared pests is provided under the BAM Act. Declared animal and plant pests fall into three categories as Gazetted under the *Biosecurity and Agriculture Management Regulations 2013*. These categories are outlined in Table A.7.

**Table A.8: Declared pests control categories as gazetted under the *Biosecurity and Agriculture Management Regulations 2013*.**

Category	Description
<b>C1 (Exclusion)</b>	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
<b>C2 (Eradication)</b>	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
<b>C3 (Management)</b>	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

## References

Department of Biodiversity Conservation and Attractions (2019) Conservation Codes for Western Australian Flora and Fauna. Last updated 3 January 2019. Accessed 25/04/20.

[https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation\\_code\\_definitions.pdf](https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions.pdf)

Department of Environment and Conservation (2013). Definitions, categories and criteria for threatened and priority ecological communities. Accessed 25/04/20

[https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions\\_categories\\_and\\_criteria\\_for\\_threatened\\_and\\_priority\\_ecological\\_communities.pdf](https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf)

BIOLOGICAL SURVEY – PILGANGOORA PROJECT

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## APPENDIX B: PMST SEARCH RESULTS

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Australian Government

Department of Climate Change, Energy,  
the Environment and Water

# 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. Please see the caveat for interpretation of information provided here.

Report created: 25-Aug-2023

[Summary](#)

[Details](#)

[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

# Summary

## Matters of National Environment 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](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance (Ramsar)</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	14
<a href="#">Listed Migratory Species:</a>	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 <https://www.dcceew.gov.au/parks-heritage/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.

<a href="#">Commonwealth Lands:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None

<a href="#">Listed Marine Species:</a>	16
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None
<a href="#">Habitat Critical to the Survival of Marine Turtles:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">EPBC Act Referrals:</a>	23
<a href="#">Key Ecological Features (Marine):</a>	None
<a href="#">Biologically Important Areas:</a>	1
<a href="#">Bioregional Assessments:</a>	None
<a href="#">Geological and Bioregional Assessments:</a>	None

## Details

### Matters of National Environmental Significance

#### Listed Threatened Species

[\[ Resource Information \]](#)

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.  
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

<a href="#">Erythrotriorchis radiatus</a> Red Goshawk [942]	Endangered	Species or species habitat may occur within area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pezoporus occidentalis</a> Night Parrot [59350]	Endangered	Species or species habitat may occur within area
<a href="#">Polytelis alexandrae</a> Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area

## MAMMAL

<a href="#">Dasyurus hallucatus</a> Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
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Scientific Name	Threatened Category	Presence Text
<a href="#">Macroderma gigas</a> Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Macrotis lagotis</a> Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Rhinonicteris aurantia (Pilbara form)</a> Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
<b>PLANT</b>		
<a href="#">Quoya zonalis listed as Pityrodia sp. Marble Bar (G.Woodman &amp; D.Coultas GWDC Opp 4)</a> Pilbara Foxglove [91588]	Endangered (listed as Pityrodia sp. Marble Bar)	Species or species habitat known to occur within area
<b>REPTILE</b>		
<a href="#">Liasis olivaceus barroni</a> Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Liopholis kintorei</a> Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[ <u>Resource Information</u> ]

Scientific Name	Threatened Category	Presence Text
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#### 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 area

[Motacilla cinerea](#)

Grey Wagtail [642]

Species or species habitat may occur within area

[Motacilla flava](#)

Yellow Wagtail [644]

Species or species habitat likely to occur within area

#### Migratory Wetlands Species

Scientific Name	Threatened Category	Presence Text
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Other Matters Protected by the EPBC Act		
Listed Marine Species		<a href="#">[ Resource Information ]</a>

Scientific Name	Threatened Category	Presence Text
Bird		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
<a href="#">Bubulcus ibis as Ardea ibis</a> Cattle Egret [66521]		within area overfly marine area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
<a href="#">Chalcites osculans as Chrysococcyx osculans</a> Black-eared Cuckoo [83425]		Species or species

Scientific Name	Threatened Category	Presence Text
		Species or species habitat may occur within area overfly marine area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Grey Wagtail [642]		<a href="#">Motacilla cinerea</a>

Scientific Name	Threatened Category	Presence Text
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area
<a href="#">Rostratula australis as Rostratula benghalensis (sensu lato)</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area

## Extra Information

EPBC Act Referrals				[ Resource Information ]
Title of referral	Reference	Referral Outcome	Assessment Status	
<a href="#">Lynas Find Project</a>	2023/09471		Assessment	
<a href="#">Controlled action</a>				
<a href="#">Abydos Direct Shipping Ore (DSO) Project, Stage 2</a>	2013/6985	Controlled Action	Post-Approval	
<a href="#">Abydos Direct Shipping Ore Project</a>	2012/6345	Controlled Action	Post-Approval	
	2010/5513	Controlled Action	Post-Approval	
<a href="#">Additional Rail Infrastructure between Herb Elliott Port Facility and Cloudbreak Mine Site</a>				

Scientific Name	Threatened Category	Presence Text
<a href="#">Development of the Wodgina Direct Shipping Ore Project, Stage 2</a>	2011/5975	Controlled Action Post-Approval Species or species habitat may occur
<a href="#">Miralga Creek Project, Pilbara region, WA</a>	2019/8601	Controlled Action Post-Approval
<a href="#">North Star Hematite Project</a>	2012/6530	Controlled Action Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
<b>Controlled action</b>			
<a href="#"><u>North Star Magnetite Project</u></a>	2012/6689	Controlled Action	Post-Approval
<a href="#"><u>Panoram Copper-Zinc mine</u></a>	2007/3310	Controlled Action	Completed
	2010/5424	Controlled Action	Post-Approval
<a href="#"><u>Roy Hill to Port Hedland Rail Line and Associated Infrastructure</u></a>			
<a href="#"><u>Wodgina Direct Shipping Ore Project</u></a>	2009/5167	Controlled Action	Post-Approval
<b>Not controlled action</b>			
<a href="#"><u>Development of iron ore resources in eastern Pilbara region, including port at P</u></a>	2004/1562	Not Controlled Action	Completed
<a href="#"><u>Expansion of the Talison Minerals Storage Facility, Wodgina Mine</u></a>	2008/4675	Not Controlled Action	Completed
<a href="#"><u>Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia</u></a>	2015/7522	Not Controlled Action	Completed
<a href="#"><u>Pilbara Bulk Ore Transport System Project, WA</u></a>	2016/7637	Not Controlled Action	Completed
<a href="#"><u>Pilbara Transmission Project, Pilbara, WA</u></a>	2018/8349	Not Controlled Action	Completed
<a href="#"><u>Rail and Port Facilities</u></a>	2001/474	Not Controlled Action	Completed

<a href="#">Sulphur Springs Copper-Zinc Mining Project, Pilbara Region, WA</a>	2013/6899	Not Controlled Action	Completed
<a href="#">Wodgina Lithium Mine Expansion, Pilbara, NT</a>	2018/8194	Not Controlled Action	Completed

#### Not controlled action (particular manner)

<a href="#">Additional Rail Infrastructure</a>	2012/6314	Not Controlled Action (Particular Manner)	Post-Approval
<a href="#">Atlas Boodarie Link Project, WA</a>	2012/6506	Not Controlled Action (Particular Manner)	Post-Approval
<a href="#">Mine the Hercules Deposit under the Wodgina Direct Shipping Ore Project Stage 3</a>	2013/6789	Not Controlled Action (Particular Manner)	Post-Approval

#### Referral decision

Title of referral	Reference	Referral Outcome	Assessment Status
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#### Referral decision

<a href="#">Mine the Hercules Deposit under the Wodgina Direct Shipping Ore Project ??? Stage 3</a>	2013/6777	Referral Decision	Completed
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#### Seabirds

#### Biologically Important Areas

Scientific Name	Behaviour	Presence
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#### [Ardenna pacifica](#)

Wedge-tailed Shearwater [84292]	Breeding	Known to occur
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# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

## 3 DATA SOURCES

### Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions 4

## LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

## Acknowledgements

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

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)

- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

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

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

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## **APPENDIX C: DETAILED FLORA AND VEGETATION SURVEY SITES**

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PILBARA MINERALS LIMITED

NVCP Application Area – Biological Survey  
Appendix C – Detailed Flora and Vegetation Sites

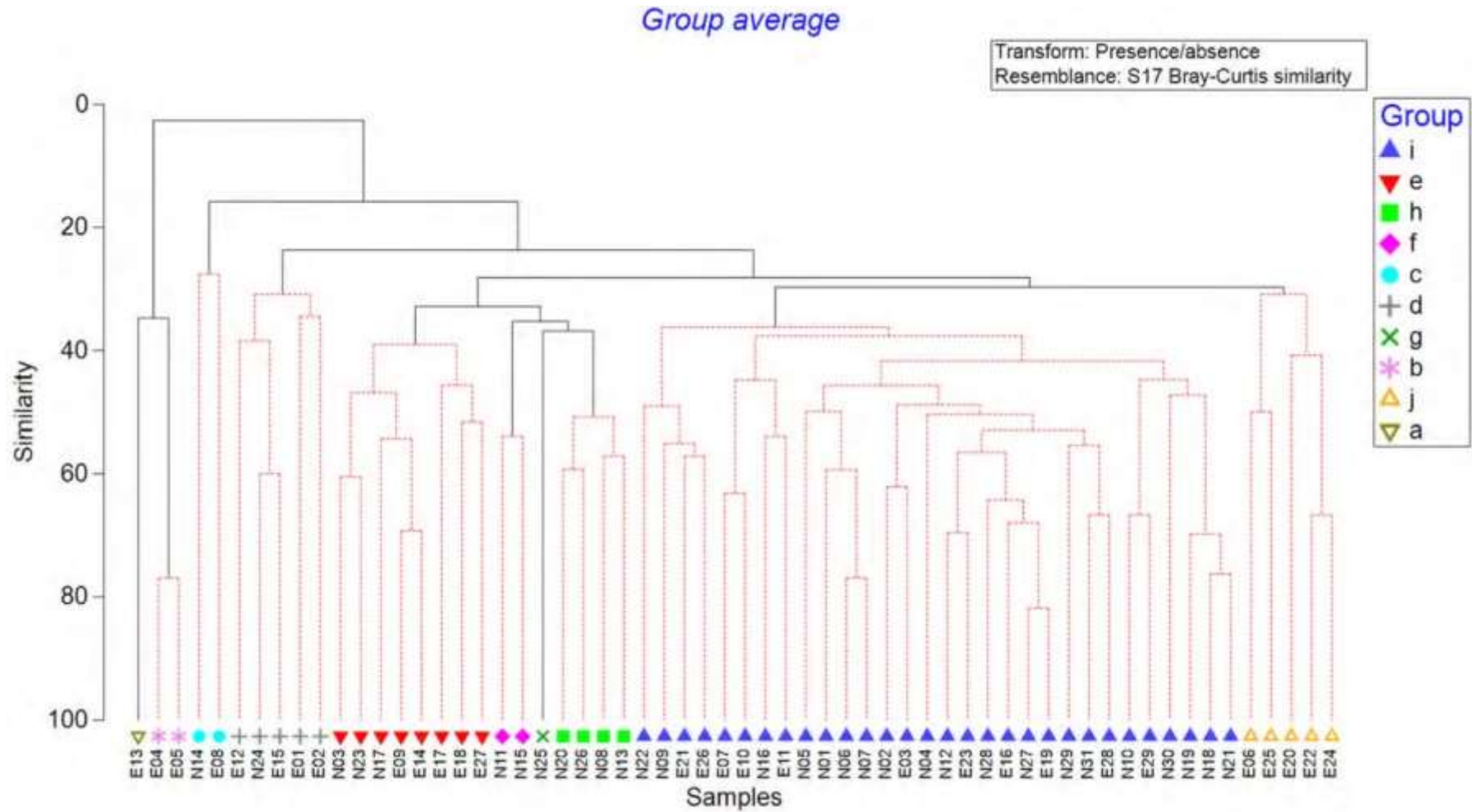


Figure C-1. Dendrogram resulting from the cluster analysis of detailed vegetation sites

Pilbara Minerals Limited

<b>Site:</b> N01	<b>WP-NW-(E)</b> 695413	<b>(N)</b> 7671041
<b>Date:</b> 14/07/2023	<b>WP-NE-(E)</b> 695427	<b>(N)</b> 7671061
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 695505	<b>(N)</b> 7671000
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 695490	<b>(N)</b> 7670979



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	< 5 years
<b>Soil Type:</b>	Loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 5 cm, angular	<b>Surface Rocks Cover (%):</b>	60
<b>Rock Type:</b>	Granite, Quartzite		
<b>Landform</b>	Stony slope toe between stony hills		
<b>Slope aspect</b>	Slight gradient to North		
<b>Vegetation Description</b>	Hummock grassland of <i>Triodia</i> with scattered emergent trees and tall shrubs		
<b>Condition</b>	Very good		
<b>Disturbances</b>	None		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4	1	<i>Corymbia hamersleyana</i>
<b>Midstorey</b>	2	5	<i>Grevillea wickhamii</i> , <i>Acacia adsurgens</i> , <i>Acacia acradenia</i>
<b>Understorey</b>	1.2	50	<i>Triodia epactia</i> , <i>T. angusta</i> , <i>Eriachne benthamii</i>
<b>Conservation Significant Flora:</b> <i>Triodia chichesterensis</i> (P3)			

<b>Site:</b> N03	<b>WP-NW-(E)</b> 695996	<b>(N)</b> 7666998
<b>Date:</b> 14/07/2023	<b>WP-NE-(E)</b> 696047	<b>(N)</b> 7666986
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 696040	<b>(N)</b> 7666937
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 695993	<b>(N)</b> 7666951

<b>Site:</b> N02	<b>WP-NW-(E)</b> 696663	<b>(N)</b> 7667334
<b>Date:</b> 14/07/2023	<b>WP-NE-(E)</b> 696708	<b>(N)</b> 7667322
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 696688	<b>(N)</b> 7667277
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 696653	<b>(N)</b> 7667284



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	< 5 years
<b>Soil Type:</b>	Loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	2 – 20 cm, Angular	<b>Surface Rocks Cover (%):</b>	75
<b>Rock Type:</b>	Basalt, Quartzite		
<b>Landform</b>	Rocky hillslope midslope		
<b>Slope aspect</b>	Moderate west slope		
<b>Vegetation Description</b>	<i>Triodia</i> hummock grassland		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Fairly recent fire		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	0.1	<i>Acacia inaequilatera</i>
<b>Midstorey</b>	1.2	0.5	<i>Acacia acradenia</i>
<b>Understorey</b>	0.8	40	<i>Triodia wiseana</i> , <i>T. lanigera</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N04	<b>WP-N-(E)</b> 696527	<b>(N)</b> 7666762
<b>Date:</b> 14/07/2023	<b>WP-E-(E)</b> 696540	<b>(N)</b> 7666752
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 696475	<b>(N)</b> 7666676
<b>Site Type / Size:</b> Quadrat, 25 x 100 m	<b>WP-W-(E)</b> 696455	<b>(N)</b> 7666689



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Clay loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	0.5 – 2 cm, Rounded	<b>Surface Rocks Cover (%):</b>	2
<b>Rock Type:</b>	Ironstone		
<b>Landform</b>	Depression and low drainage line with no defined channel		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Open woodland of <i>Corymbia hamersleyana</i> with mixed grass understorey		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Some cattle grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4.5	10	<i>Corymbia hamersleyana</i> , <i>Acacia inaequilatera</i>
<b>Midstorey</b>	1.2	5	<i>Acacia cowleana</i> , <i>Cajanus cinereus</i> , <i>Petalostylis labicheoides</i>
<b>Understorey</b>	0.4	20	<i>Indigofera rugosa</i> , <i>Triodia epactia</i> , <i>T. wiseana</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N05	<b>WP-NW-(E)</b> 696084	<b>(N)</b> 7667455
<b>Date:</b> 14/07/2023	<b>WP-NE-(E)</b> 696131	<b>(N)</b> 7667461
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 696134	<b>(N)</b> 7667414
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 696089	<b>(N)</b> 7667406



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.5 – 50 cm, Rounded	<b>Surface Rocks Cover (%):</b>	40
<b>Rock Type:</b>	Granite, Quartzite		
<b>Landform</b>	First order drainage line with defined channel		
<b>Slope aspect</b>	Very mild slope to SW		
<b>Vegetation Description</b>	Sparse woodland with hummock grass understorey		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Moderate cattle grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4	2	<i>Corymbia hamersleyana</i> , <i>Acacia inaequilatera</i>
<b>Midstorey</b>	1.2	5	<i>Acacia acradenia</i> , <i>Grevillea wickhamii</i>
<b>Understorey</b>	0.9	30	<i>Triodia epactia</i> , <i>T. wiseana</i> , <i>T. angusta</i> .
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N06	<b>WP-N-(E)</b> 695741	<b>(N)</b> 7666845
<b>Date:</b> 15/07/2023	<b>WP-E-(E)</b> 695772	<b>(N)</b> 7666804
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 695724	<b>(N)</b> 7666780
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 695697	<b>(N)</b> 7666820



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Clay loam	<b>Soil Colour:</b>	Red / Brown
<b>Surface Rocks Size/Shape:</b>	0.5 – 5 cm, Angular	<b>Surface Rocks Cover (%):</b>	15
<b>Rock Type:</b>	Quartzite, Ironstone, Granite		
<b>Landform</b>	Flat open plain of poor drainage		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Hummock grassland with occasional emergent tree		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3.5	0.5	Acacia inaequilatera, Corymbia hamersleyana
<b>Midstorey</b>	1.5	0.2	Acacia acradenia, Acacia adsurgens
<b>Understorey</b>	0.9	40	Triodia epactia,
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N07	<b>WP-N-(E)</b> 695327	<b>(N)</b> 7666891
<b>Date:</b> 15/07/2023	<b>WP-E-(E)</b> 695363	<b>(N)</b> 7666858
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 695331	<b>(N)</b> 7666821
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 695293	<b>(N)</b> 7666854



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	2 years
<b>Soil Type:</b>	Loam / clay loam	<b>Soil Colour:</b>	Brown / red
<b>Surface Rocks Size/Shape:</b>	0.5 – 15 cm, Angular	<b>Surface Rocks Cover (%):</b>	70
<b>Rock Type:</b>	Quartzite		
<b>Landform</b>	Flat, stony plain		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Hummock grass plain with occasional emergent tree		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Recent fire, Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	0.5	Acacia inaequilatera
<b>Midstorey</b>	0.8	5	Acacia adsurgens, Acacia acradenia (resprouting post fire)
<b>Understorey</b>	0.8	30	Triodia epactia, T. wiseana
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N08	<b>WP-NW-(E)</b> 693648	<b>(N)</b> 7666785
<b>Date:</b> 15/07/2023	<b>WP-NE-(E)</b> 693697	<b>(N)</b> 7666790
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 693699	<b>(N)</b> 7666743
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 693649	<b>(N)</b> 7666736



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 10 cm, Angular	<b>Surface Rocks Cover (%):</b>	55
<b>Rock Type:</b>	Quartzite, Ironstone, Granite		
<b>Landform</b>	Flat, stony plain		
<b>Slope aspect</b>	Flat plain		
<b>Vegetation Description</b>	Triodia hummock grassland with some Acacia shrubs		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	0.5	Acacia inaequilatera
<b>Midstorey</b>	1.8	5	Acacia acradenia , A. adsurgens
<b>Understorey</b>	0.8	40	Triodia epcatia, T. lanigera
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N09	<b>WP-N-(E)</b> 693629	<b>(N)</b> 7667437
<b>Date:</b> 15/07/2023	<b>WP-E-(E)</b> 693678	<b>(N)</b> 7667420
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 693662	<b>(N)</b> 7667374
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 693618	<b>(N)</b> 7667388



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 1 cm, Rounded	<b>Surface Rocks Cover (%):</b>	2
<b>Rock Type:</b>	Ironstone, Quartzite		
<b>Landform</b>	Frontage country upslope of drainage line		
<b>Slope aspect</b>	Slight slope towards major drainage line to south		
<b>Vegetation Description</b>	Corymbia open woodland with hummock grass understorey		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Some cattle grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4.5	5	Corymbia hamersleyana
<b>Midstorey</b>	2	10	Acacia cowleana, Acacia colei, Grevillea wickhamii
<b>Understorey</b>	0.7	30	Triodia epcatia, Chrysopogon fallax
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N10	<b>WP-N-(E)</b> 694552	<b>(N)</b> 7671021
<b>Date:</b> 15/07/2023	<b>WP-E-(E)</b> 694580	<b>(N)</b> 7670982
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 694538	<b>(N)</b> 7670958
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 694508	<b>(N)</b> 7670996



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	< 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.2 – 10 cm, Angular / Rounded	<b>Surface Rocks Cover (%):</b>	20
<b>Rock Type:</b>	Ironstone / quartz		
<b>Landform</b>	Flat, stony plain		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Triodia hummock grassland		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	0.1	Acacia inaequilatera
<b>Midstorey</b>	1.4	2	Acacia adsurgens, A. acradenia, Senna artemisioides
<b>Understorey</b>	0.7	60	Triodia lanigera, T. angusta
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N11	<b>WP-N-(E)</b> 694120	<b>(N)</b> 7671135
<b>Date:</b> 15/07/2023	<b>WP-E-(E)</b> 694149	<b>(N)</b> 7671098
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 694109	<b>(N)</b> 7671070
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 694082	<b>(N)</b> 7671105



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.5 – 5 cm, Angular	<b>Surface Rocks Cover (%):</b>	75
<b>Rock Type:</b>	Quartzite, Bluestone		
<b>Landform</b>	Stony plain adjacent to drainage line		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Hummock grassland with very occasional emergent tree		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	0.1	Corymbia hamersleyana, Acacia inaequilatera
<b>Midstorey</b>	1.2	5	Acacia bivenosa, Acacia adsurgens
<b>Understorey</b>	0.7	40	Triodia lanigera, T. wiseana, T. epactia
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N12	<b>WP-NW-(E)</b> 695527	<b>(N)</b> 7670057
<b>Date:</b> 15/07/2023	<b>WP-NE-(E)</b> 695576	<b>(N)</b> 7670047
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 695539	<b>(N)</b> 7670009
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 695586	<b>(N)</b> 7669999



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loam	<b>Soil Colour:</b>	Loam
<b>Surface Rocks Size/Shape:</b>	5 – 200+ cm, Rounded	<b>Surface Rocks Cover (%):</b>	10
<b>Rock Type:</b>	Granite, quartzite		
<b>Landform</b>	Riparian area with gallery woodland on a second order stream		
<b>Slope aspect</b>	Very moderate slope. Stream flowing west.		
<b>Vegetation Description</b>	Open riparian woodland		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Moderate cattle grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	6	5	Eucalyptus victrix, Corymbia hamersleyana
<b>Midstorey</b>	1.6	10	Acacia trachycarpa, A. pyrifolia, Cajanus cinereus
<b>Understorey</b>	0.6	15	Mixed perennial grasses
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N13	<b>WP-NW-(E)</b> 693617	<b>(N)</b> 7668772
<b>Date:</b> 16/07/2023	<b>WP-NE-(E)</b> 693717	<b>(N)</b> 7668740
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 693705	<b>(N)</b> 7668720
<b>Site Type / Size:</b> Quadrat, 25 x 100 m	<b>WP-SW-(E)</b> 693612	<b>(N)</b> 7668748



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.5 – 20 cm, Angular	<b>Surface Rocks Cover (%):</b>	70
<b>Rock Type:</b>	Granite, quartzite		
<b>Landform</b>	Flat, rocky plain		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Hummock Triodia grassland with scattered Acacia shrubs		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2.5	1	Grevillea wickhamii, Acacia inaequilatera
<b>Midstorey</b>	1.6	10	Acacia acradenia, Petalostylis labicheoides
<b>Understorey</b>	0.7	60	Triodia wiseana, T. epactia, T. chichesterensis
<b>Conservation Significant Flora:</b> Triodia chichesterensis (P3)			

<b>Site:</b> N14	<b>WP-NW-(E)</b> 693889	<b>(N)</b> 7669785
<b>Date:</b> 16/07/2023	<b>WP-NE-(E)</b> 693939	<b>(N)</b> 7669780
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 693926	<b>(N)</b> 7669730
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 693877	<b>(N)</b> 7669737



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Sandy loam
<b>Surface Rocks Size/Shape:</b>	0.1 – 10 cm, Rounded	<b>Surface Rocks Cover (%):</b>	20
<b>Rock Type:</b>	Granite, Quartzite		
<b>Landform</b>	Small dry stony second order channel 5 m wide, well defined		
<b>Slope aspect</b>	Very low gradient west flowing		
<b>Vegetation Description</b>	Open gallery woodland along riparian fringe with hummock grassland 15 m from channel		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Some cattle grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	5	5	Corymbia hamersleyana
<b>Midstorey</b>	2.5	5	Acacia pyrifolia, A. cowleana, Petalostylis labicheoides
<b>Understorey</b>	0.8	25	Mixed perennial grasses
<b>Conservation Significant Flora:</b> None			



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam / clay loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 5 cm, Angular / Rounded	<b>Surface Rocks Cover (%):</b>	60
<b>Rock Type:</b>	Granite, Quartzite		
<b>Landform</b>	Flat stony plain interspersed with gilgai clay formations around 400 m <sup>2</sup>		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Triodia hummock grassland with occasional shrub Acacia emergent and perennial grasses + herbs on gilgai soils		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Midstorey</b>	2	2	Acacia adsurgens, Acacia bivenosa
<b>Understorey</b>	0.7	50	Triodia angusta, T. brizoides, Dichanthium sericeum
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N15	<b>WP-N-(E)</b> 695427	<b>(N)</b> 7671061
<b>Date:</b> 16/07/2023	<b>WP-E-(E)</b> 695505	<b>(N)</b> 7671000
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 695490	<b>(N)</b> 7670979
<b>Site Type / Size:</b> Quadrat, 25 x 100 m	<b>WP-W-(E)</b> 695413	<b>(N)</b> 7671041



<b>Seasonal Conditions:</b>	Dry river bed	<b>Age Since Last Fire:</b>	> 10 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 20 cm, Rounded	<b>Surface Rocks Cover (%):</b>	20
<b>Rock Type:</b>	Granite		
<b>Landform</b>	Ephemeral second order river (stream width 10 m) steep bank on south west side (3.5 m)		
<b>Slope aspect</b>	Very low gradient flow to the west		
<b>Vegetation Description</b>	Gallery open woodland along riparian band and within the channel. Tussock grassland upslope.		
<b>Condition</b>	Good		
<b>Disturbances</b>	Close to mining operation - moderate dust cover, occasional tracks, moderate grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	5	10	Eucalyptus victrix, Corymbia hamersleyana
<b>Midstorey</b>	2.2	5	Acacia cowleana, Cajanus cinereus
<b>Understorey</b>	0.8	15	Mixed perennial grasses
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N17	<b>WP-NW-(E)</b> 693785	<b>(N)</b> 7670694
<b>Date:</b> 16/07/2023	<b>WP-NE-(E)</b> 693833	<b>(N)</b> 7670700
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 693838	<b>(N)</b> 7670649
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 693788	<b>(N)</b> 7670644

<b>Site:</b> N16	<b>WP-N-(E)</b> 695053	<b>(N)</b> 7670424
<b>Date:</b> 16/07/2023	<b>WP-E-(E)</b> 695093	<b>(N)</b> 7670395
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 695054	<b>(N)</b> 7670364
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 695015	<b>(N)</b> 7670393



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Orange
<b>Surface Rocks Size/Shape:</b>	0.1 – 30 cm, Angular	<b>Surface Rocks Cover (%):</b>	80
<b>Rock Type:</b>	Calcrete, Quartzite		
<b>Landform</b>	Sloping, stony plain		
<b>Slope aspect</b>	Low gradient slope to the east		
<b>Vegetation Description</b>	Hummock Triodia grassland with occasional emergent trees		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2.5	2	Acacia inaequilatera, Grevillea wickhamii, Corymbia hamersleyana
<b>Understorey</b>	0.5	60	Triodia wiseana, T. angusta
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N18	<b>WP-N-(E)</b> 696092	<b>(N)</b> 7675661
<b>Date:</b> 17/07/2023	<b>WP-E-(E)</b> 696108	<b>(N)</b> 7675614
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 696068	<b>(N)</b> 7675584
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 696051	<b>(N)</b> 7675632



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 0.5 cm, Angular	<b>Surface Rocks Cover (%):</b>	80
<b>Rock Type:</b>	Granite, quartzite, ironstone		
<b>Landform</b>	Upper slope of low stony rise in the plain		
<b>Slope aspect</b>	Low gradient to the east		
<b>Vegetation Description</b>	Hummock grasses with occasional emergent tree		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	5	1	Corymbia hamersleyana, Acacia inaequilatera
<b>Midstorey</b>	2	5	Acacia acradenia, A. bivenosa, A. adsurgens
<b>Understorey</b>	0.6	55	Triodia wiseana, T. epactia
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N19	<b>WP-N-(E)</b> 696399	<b>(N)</b> 7675866
<b>Date:</b> 17/07/2023	<b>WP-E-(E)</b> 696438	<b>(N)</b> 7675837
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 696403	<b>(N)</b> 7675803
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 696360	<b>(N)</b> 7675832



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	< 5 years
<b>Soil Type:</b>	Sand	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 5 cm, Rounded	<b>Surface Rocks Cover (%):</b>	25
<b>Rock Type:</b>	Quartzite, Ironstone		
<b>Landform</b>	Broad, flat, sandy plain		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Tussock grassland with occasional emergent shrubs		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	1	Corymbia hamersleyana
<b>Midstorey</b>	2.5	2	Acacia acradenia, A. adsurgens, A. cowleana
<b>Understorey</b>	0.7	45	Triodia lanigera
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N20	<b>WP-NW-(E)</b> 696515	<b>(N)</b> 7675378
<b>Date:</b> 17/07/2023	<b>WP-NE-(E)</b> 696608	<b>(N)</b> 7675421
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 696618	<b>(N)</b> 7675399
<b>Site Type / Size:</b> Quadrat, 25 x 100 m	<b>WP-SW-(E)</b> 696526	<b>(N)</b> 7675359



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loamy sand	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 5 cm, Angular	<b>Surface Rocks Cover (%):</b>	40
<b>Rock Type:</b>	Quartzite, Ironstone		
<b>Landform</b>	Stony flay plain		
<b>Slope aspect</b>	Flat, no slope		
<b>Vegetation Description</b>	Tussock grassland with occasional emergent tree		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3.5	1	Acacia inaequilatera
<b>Midstorey</b>	2.5	5	Acacia cowleana, A. adsurgens, A. acradenia
<b>Understorey</b>	0.8	40	Triodia lanigera
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N21	<b>WP-NW-(E)</b> 695790	<b>(N)</b> 7675442
<b>Date:</b> 17/07/2023	<b>WP-NE-(E)</b> 695838	<b>(N)</b> 7675436
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 695857	<b>(N)</b> 7675389
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 695806	<b>(N)</b> 7675394



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loamy sand	<b>Soil Colour:</b>	Loamy sand
<b>Surface Rocks Size/Shape:</b>	0.1 – 5 cm, Angular	<b>Surface Rocks Cover (%):</b>	5
<b>Rock Type:</b>	Quartzite, Ironstone		
<b>Landform</b>	Shallow drainage line across stony sandy plain		
<b>Slope aspect</b>	Very slight slope draining to west		
<b>Vegetation Description</b>	Dense Acacia shrubland in drainage channel. Tussock grassland away from the channel.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3.5	1	Corymbia hamersleyana
<b>Midstorey</b>	3	30	Acacia cowleana, Acacia adsurgens
<b>Understorey</b>	0.5	10	Mixed perennial grasses
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N22	<b>WP-N-(E)</b> 699835	<b>(N)</b> 7676289
<b>Date:</b> 17/07/2023	<b>WP-E-(E)</b> 699857	<b>(N)</b> 7676246
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 699815	<b>(N)</b> 7676220
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 699794	<b>(N)</b> 7676262



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 10 cm, Rounded	<b>Surface Rocks Cover (%):</b>	25
<b>Rock Type:</b>	Quartzite, Ironstone		
<b>Landform</b>	Open, flat, sandy plain		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Tussock Triodia grassland with some emergent Acacia shrubs		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	1	Acacia cowleana, Grevillea wickhamii
<b>Midstorey</b>	1.6	2	Acacia adsurgens
<b>Understorey</b>	0.7	40	Triodia lanigera
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N23	<b>WP-N-(E)</b> 699531	<b>(N)</b> 7676456
<b>Date:</b> 17/07/2023	<b>WP-E-(E)</b> 699560	<b>(N)</b> 7676420
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 699524	<b>(N)</b> 7676388
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 699493	<b>(N)</b> 7676388



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	1 – 20 cm, Angular	<b>Surface Rocks Cover (%):</b>	80
<b>Rock Type:</b>	Granite, Quartz		
<b>Landform</b>	Rocky toe slope of granite hills with first order drainage line		
<b>Slope aspect</b>	Very moderate slope to the east		
<b>Vegetation Description</b>	Hummock Triodia grassland with scattered emergent Eucalyptus		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing, Occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4	1	Eucalyptus leucophloia
<b>Midstorey</b>	2.5	0.5	Acacia inaequilatera
<b>Understorey</b>	0.4	30	Triodia lanigera, Triodia brizoides
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N24	<b>WP-NW-(E)</b> 699167	<b>(N)</b> 7676549
<b>Date:</b> 17/07/2023	<b>WP-NE-(E)</b> 699217	<b>(N)</b> 7676552
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 699219	<b>(N)</b> 7676500
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 699169	<b>(N)</b> 7676502



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sand	<b>Soil Colour:</b>	Grey
<b>Surface Rocks Size/Shape:</b>	0.1 – 50 cm, Angular / Platy	<b>Surface Rocks Cover (%):</b>	20
<b>Rock Type:</b>	Granite		
<b>Landform</b>	Rocky hillslope and drainage line - modified by old mine working and construction, estimated 50 years abandoned		
<b>Slope aspect</b>	Slight gradient to west		
<b>Vegetation Description</b>	Hummock Triodia grassland with emergent Eucalypts		
<b>Condition</b>	Good		
<b>Disturbances</b>	Old working site, rock dam on the creekline		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4	2	Eucalyptus leucophloia, Corymbia hamersleyana
<b>Midstorey</b>	2.2	5	Acacia acradenia, A. inaequilatera
<b>Understorey</b>	0.5	40	Triodia epactia, T. chichesterensis, T. brizoides
<b>Conservation Significant Flora:</b> Triodia chichesterensis (P3)			

<b>Site:</b> N25	<b>WP-N-(E)</b> 698917	<b>(N)</b> 7676546
<b>Date:</b> 17/07/2023	<b>WP-E-(E)</b> 698966	<b>(N)</b> 7676530
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 698944	<b>(N)</b> 7676484
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 698897	<b>(N)</b> 7676498



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	0.1 – 30 cm, Angular	<b>Surface Rocks Cover (%):</b>	90
<b>Rock Type:</b>	Granite		
<b>Landform</b>	Foliated eroded granite hillslopes		
<b>Slope aspect</b>	Moderate slope east		
<b>Vegetation Description</b>	Hummock Triodia grassland with scattered emergent trees (Acacia inaequilatera)		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4	0.1	Acacia inaequilatera
<b>Midstorey</b>	1	0.1	Acacia acradenia
<b>Understorey</b>	0.4	50	Triodia wiseana, T. chichesterensis
<b>Conservation Significant Flora:</b> Triodia chichesterensis (P3)			

<b>Site:</b> N26	<b>WP-NW-(E)</b> 697137	<b>(N)</b> 7675654
<b>Date:</b> 18/07/2023	<b>WP-NE-(E)</b> 697185	<b>(N)</b> 7675668
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 697198	<b>(N)</b> 7675620
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 697150	<b>(N)</b> 7675605



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 5 cm, Angular	<b>Surface Rocks Cover (%):</b>	80
<b>Rock Type:</b>	Granite		
<b>Landform</b>	Toe slope of a rocky rise that ends in a small first order stream channel		
<b>Slope aspect</b>	Slight gradient facing north		
<b>Vegetation Description</b>	Hummock Triodia grassland on toe slope with very open Corymbia hamersleyana woodland in the channel		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Old mine workings. Small ephemeral dam constructed approx. 50 years ago.		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3.5	2	Corymbia hamersleyana, Acacia inaequilatera
<b>Midstorey</b>	1.8	5	Acacia acradenia, Grevillea wickhamii
<b>Understorey</b>	0.4	45	Triodia angusta, T. lanigera
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N27	<b>WP-N-(E)</b> 696917	<b>(N)</b> 7676125
<b>Date:</b> 18/07/2023	<b>WP-E-(E)</b> 696947	<b>(N)</b> 7676086
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 696897	<b>(N)</b> 7676075
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 696869	<b>(N)</b> 7676115



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.5 – 5 cm, Angular	<b>Surface Rocks Cover (%):</b>	10
<b>Rock Type:</b>	Quartzite, Ironstone		
<b>Landform</b>	Shallow drainage line within rocky flat plain		
<b>Slope aspect</b>	Very slight slope to west		
<b>Vegetation Description</b>	Hummock Triodia grassland with scattered emergent trees in the drainage line		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Some cattle grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4	2	Corymbia hamersleyana, Acacia inaequilatera
<b>Midstorey</b>	1.2	15	Acacia cowleana, A. adsurgens, Indigofera rugosa
<b>Understorey</b>	0.8	60	Triodia epactia, T. wiseana, Chrysopogon fallax, Themeda triandra
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N28	<b>WP-N-(E)</b> 697224	<b>(N)</b> 7676588
<b>Date:</b> 18/07/2023	<b>WP-E-(E)</b> 697242	<b>(N)</b> 7676541
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 697196	<b>(N)</b> 7676521
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 697179	<b>(N)</b> 7676569



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.5 – 5 cm, Angular	<b>Surface Rocks Cover (%):</b>	70
<b>Rock Type:</b>	Quartzite, Ironstone		
<b>Landform</b>	Top of a low rise on a stony plain		
<b>Slope aspect</b>	Slight slope to the east		
<b>Vegetation Description</b>	Hummock Triodia grassland with scattered emergent trees and shrubs		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	0.5	Acacia inaequilatera
<b>Midstorey</b>	1.5	5	Acacia adsurgens, Acacia stellaticeps
<b>Understorey</b>	0.6	45	Triodia lanigera, T. wiseana
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N29	<b>WP-N-(E)</b> 697365	<b>(N)</b> 7676109
<b>Date:</b> 18/07/2023	<b>WP-E-(E)</b> 697400	<b>(N)</b> 7676075
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 697371	<b>(N)</b> 7676035
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 697337	<b>(N)</b> 7676070



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loamy sand	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 5 cm, Angular	<b>Surface Rocks Cover (%):</b>	80
<b>Rock Type:</b>	Quartzite, Granite		
<b>Landform</b>	Stony toe slope of a stony hill on a flat plain		
<b>Slope aspect</b>	South facing low slope		
<b>Vegetation Description</b>	Hummock grassland with scattered emergent trees		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	0.5	Acacia inaequilatera
<b>Midstorey</b>	1.8	0.5	Acacia adsurgens, A. acradenia , Indigofera rugosa
<b>Understorey</b>	0.6	45	Triodia lanigera, T. wiseana, T. brizoides
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N30	<b>WP-N-(E)</b> 698463	<b>(N)</b> 7676307
<b>Date:</b> 18/07/2023	<b>WP-E-(E)</b> 698485	<b>(N)</b> 7676261
<b>Botanist:</b> NP and TB	<b>WP-S-(E)</b> 698437	<b>(N)</b> 7676244
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-W-(E)</b> 698414	<b>(N)</b> 7676289



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sand	<b>Soil Colour:</b>	Sand
<b>Surface Rocks Size/Shape:</b>	0.1 – 2 cm, Angular	<b>Surface Rocks Cover (%):</b>	20
<b>Rock Type:</b>	Granite, Quartzite, Ironstone		
<b>Landform</b>	On the lower section of undulating plain at the lower part of the break of slope		
<b>Slope aspect</b>	Very gentle south facing slope		
<b>Vegetation Description</b>	Hummock Triodia grassland with scattered emergent trees		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4	2	Corymbia hamersleyana, Acacia inaequilatera
<b>Midstorey</b>	1.2	2	Acacia acradenia, Indigofera rugosa
<b>Understorey</b>	0.8	50	Triodia wiseana, T. lanigera, T. epactia
<b>Conservation Significant Flora:</b> None			



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sand	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 5 cm, Angular	<b>Surface Rocks Cover (%):</b>	30
<b>Rock Type:</b>	Granite, Quartzite		
<b>Landform</b>	Flat undulating plain		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Hummock Triodia grassland with scattered emergent trees		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4	1	Corymbia hamersleyana
<b>Midstorey</b>	1.6	1	Acacia adsurgens, A. bivenosa
<b>Understorey</b>	0.7	40	Triodia lanigera, T. epactia, Paraneurachne muelleri
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> N31	<b>WP-NW-(E)</b> 697479	<b>(N)</b> 7675598
<b>Date:</b> 18/07/2023	<b>WP-NE-(E)</b> 697528	<b>(N)</b> 7675607
<b>Botanist:</b> NP and TB	<b>WP-SE-(E)</b> 697538	<b>(N)</b> 7675557
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 697491	<b>(N)</b> 7675548



<b>Seasonal Conditions:</b>	Dry	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loamy sand	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.1 – 10 cm, Angular	<b>Surface Rocks Cover (%):</b>	10
<b>Rock Type:</b>	Quartzite, Granite		
<b>Landform</b>	Flat sandy, stony plain		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Hummock Triodia grassland with emergent shrubs and trees in run-on area		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	0.5	Acacia inaequilatera
<b>Midstorey</b>	1.8	2	Acacia adsurgens, A. acradenia
<b>Understorey</b>	0.7	60	Triodia wiseana, T. lanigera, T. epactia
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E01	<b>WP-NW-(E)</b> 696781	<b>(N)</b> 7667628
<b>Date:</b> 14/07/2023	<b>WP-NE-(E)</b> 696831	<b>(N)</b> 7667629
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 696831	<b>(N)</b> 7667578
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 696781	<b>(N)</b> 7667579



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loam in cracks	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	10 – 100 cm, Platy	<b>Surface Rocks Cover (%):</b>	90
<b>Rock Type:</b>	Platy Granite		
<b>Landform</b>	Platy granite outcrop. No crevices or caves. Very little soil in cracks. Conical shapes.		
<b>Slope aspect</b>	Hillcrest and upper slopes		
<b>Vegetation Description</b>	Scattered mid Acacia inaequilatera over scattered Hibiscus sturtii, Acacia acradenia and Euphorbia tanenensis mid shrubs. Low hummock grassland of Triodia wiseana, T. chichesterensis and Cymbopogon ambiguus		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Light Lithium dust in soil cracks, occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	1.8	0.5	Acacia inaequilatera
<b>Midstorey</b>	0.7	1	Acacia acradenia, Hibiscus sturtii, Euphorbia tanenensis
<b>Understorey</b>	0.3	50	Triodia wiseana, T. chichesterensis and Cymbopogon ambiguus
<b>Conservation Significant Flora:</b> Triodia chichesterensis (P3)			

<b>Site:</b> E02	<b>WP-NW-(E)</b> 696413	<b>(N)</b> 7666939
<b>Date:</b> 14/07/2023	<b>WP-NE-(E)</b> 696463	<b>(N)</b> 7666939
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 696461	<b>(N)</b> 7666889
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 696412	<b>(N)</b> 7666890



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	15 cm – 100 cm, Angular	<b>Surface Rocks Cover (%):</b>	50
<b>Rock Type:</b>	Granite, Quartzite		
<b>Landform</b>	Granite outcrop. Small crevices/cracks		
<b>Slope aspect</b>	Crest and upper slopes of hill		
<b>Vegetation Description</b>	Tall sparse <i>A. inaequilatera</i> and <i>Ficus brachypoda</i> over <i>A. acradenia</i> , <i>Triodia wiseana</i> and <i>T. epactia</i> hummock grassland.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	None		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2.5	1	<i>Ficus brachypoda</i> , <i>Acacia inaequilatera</i>
<b>Midstorey</b>	1	1	<i>Acacia acradenia</i> , <i>Senna glutinosa</i>
<b>Understorey</b>	0.5	50	<i>Triodia epactia</i> , <i>T. wiseana</i> , <i>T. lanigera</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E04	<b>WP-NW-(E)</b> 695891	<b>(N)</b> 7667205
<b>Date:</b> 15/07/2023	<b>WP-NE-(E)</b> 695940	<b>(N)</b> 7667206

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<b>Site:</b> E03	<b>WP-NW-(E)</b> 696792	<b>(N)</b> 7667186
<b>Date:</b> 14/07/2023	<b>WP-NE-(E)</b> 696842	<b>(N)</b> 7667186
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 696842	<b>(N)</b> 7667136
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 696793	<b>(N)</b> 7667136



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red / brown
<b>Surface Rocks Size/Shape:</b>	3 – 10 cm, Angular	<b>Surface Rocks Cover (%):</b>	40
<b>Rock Type:</b>	Granite, Quartzite		
<b>Landform</b>	Hill crest and upper slopes		
<b>Slope aspect</b>	Crest		
<b>Vegetation Description</b>	Tall sparse <i>Acacia inaequilatera</i> over <i>T. wiseana</i> hummock grassland.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	1	<i>Acacia inaequilatera</i>
<b>Midstorey</b>	1	1	<i>Greville wickhamii</i> , <i>Acacia orthocarpa</i>
<b>Understorey</b>	0.3	50	<i>Triodia wiseana</i> , <i>T. lanigera</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E05	<b>WP-NW-(E)</b> 695700	<b>(N)</b> 7667364
<b>Date:</b> 15/07/2023	<b>WP-NE-(E)</b> 695750	<b>(N)</b> 7667364

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<b>Botanist:</b> EH		<b>WP-SE-(E)</b> 695941		<b>(N)</b> 7667155	
<b>Site Type / Size:</b> Quadrat, 50 x 50 m		<b>WP-SW-(E)</b> 695891		<b>(N)</b> 7667155	
<b>Seasonal Conditions:</b>	Dry season, dry soil.		<b>Age Since Last Fire:</b>	> 5 years	
<b>Soil Type:</b>	Clay loam		<b>Soil Colour:</b>	Brown	
<b>Surface Rocks Size/Shape:</b>	2 – 5 cm, Rounded and Angular		<b>Surface Rocks Cover (%):</b>	5	
<b>Rock Type:</b>	Granite, Quartzite				
<b>Landform</b>	Drainage depression, seasonally inundated.				
<b>Slope aspect</b>	Flat, slightly draining to NW				
<b>Vegetation Description</b>	Herb field of <i>Sida fibulifera</i> , <i>Portulacca oleraceae</i> and <i>Solanum diversiflorum</i>				
<b>Condition</b>	Good				
<b>Disturbances</b>	High intensity cattle grazing, altered hydrology - now drains to NW				
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>		
<b>Understorey</b>	0.1	30	<i>Sida fibulifera</i> , <i>Portulacca oleraceae</i> and <i>Solanum diversiflorum</i>		
<b>Conservation Significant Flora:</b> None					

<b>Botanist:</b> EH		<b>WP-SE-(E)</b> 695750		<b>(N)</b> 7667314	
<b>Site Type / Size:</b> Quadrat, 50 x 50 m		<b>WP-SW-(E)</b> 695700		<b>(N)</b> 7667314	
<b>Seasonal Conditions:</b>	Dry season, dry soil.		<b>Age Since Last Fire:</b>	> 10 years	
<b>Soil Type:</b>	Clay loam		<b>Soil Colour:</b>	Brown	
<b>Surface Rocks Size/Shape:</b>	2 – 4 cm, Blocky		<b>Surface Rocks Cover (%):</b>	10	
<b>Rock Type:</b>	Granite, Quartzite				
<b>Landform</b>	Drainage depression. Seasonally inundated.				
<b>Slope aspect</b>	Flat. Slight drainage to NW				
<b>Vegetation Description</b>	Herb field of <i>Sida fibulifera</i> , <i>Neptunia dimorphantha</i> and <i>Eragrostis xerophila</i>				
<b>Condition</b>	Good				
<b>Disturbances</b>	High intensity grazing. Change to surface hydrology.				
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>		
<b>Understorey</b>	0.1	30	<i>Sida fibulifera</i> , <i>Neptunia dimorphantha</i> and <i>Eragrostis xerophila</i>		
<b>Conservation Significant Flora:</b> None					

<b>Site:</b> E06	<b>WP-NW-(E)</b> 694723	<b>(N)</b> 7667316
<b>Date:</b> 15/07/2023	<b>WP-NE-(E)</b> 694773	<b>(N)</b> 7667315
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 694772	<b>(N)</b> 7667265
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 694723	<b>(N)</b> 7667265

<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Clay sand	<b>Soil Colour:</b>	Red / orange
<b>Surface Rocks Size/Shape:</b>	2 – 4 cm	<b>Surface Rocks Cover (%):</b>	50
<b>Rock Type:</b>	Granite, Quartzite.		
<b>Landform</b>	Plain, occasional drainage depressions of mud (see E04 and E05). Moderately drained but likely saturates following rain.		
<b>Slope aspect</b>	Flat - drains to internal mud areas and small channels		
<b>Vegetation Description</b>	Sparse <i>Acacia adsurgens</i> mid shrubs <i>Triodia hummock</i> grassland.		
<b>Condition</b>	Very good		
<b>Disturbances</b>	No evidence of disturbance except occasional tracks and moderate grazing.		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Midstorey</b>	1.8	1	<i>Acacia adsurgens</i>
<b>Understorey</b>	0.4	50	<i>Triodia wiseana</i> , <i>T. lanigera</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E08	<b>WP-NW-(E)</b> 693763	<b>(N)</b> 7667849
<b>Date:</b> 15/07/2023	<b>WP-NE-(E)</b> 693813	<b>(N)</b> 7667850
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 693813	<b>(N)</b> 7667799

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<b>Site:</b> E07	<b>Date:</b> 15/07/2023	<b>Botanist:</b> EH
<b>Site Type / Size:</b> Revele, 50 x 50 m	<b>WP-(E)</b> 694293	<b>(N)</b> 7667259

<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loamy sand	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	2 – 5 cm	<b>Surface Rocks Cover (%):</b>	30
<b>Rock Type:</b>	Granite, Quartzite		
<b>Landform</b>	Plains, shallow drainage		
<b>Slope aspect</b>	Gentle slope to SW (direction of drainage lines)		
<b>Vegetation Description</b>	Shrubland mid <i>A. adsurgens</i> , <i>A. bivenosa</i> . Mid <i>Triodia hummock</i> grassland.		
<b>Condition</b>	Very good		
<b>Disturbances</b>	No evidence, occasional tracks, low grazing.		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Midstorey</b>	1.8	40	<i>Acacia adsurgens</i> , <i>A. acradenia</i> , <i>Grevillea wickhamii</i>
<b>Understorey</b>	0.5	40	<i>Triodia wiseana</i> , <i>T. lanigera</i> , <i>T. angusta</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E09	<b>WP-NW-(E)</b> 693791	<b>(N)</b> 7670863
<b>Date:</b> 15/07/2023	<b>WP-NE-(E)</b> 693841	<b>(N)</b> 7670863
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 693841	<b>(N)</b> 7670813

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<b>Site Type / Size:</b> Quadrat, 50 x 50 m		<b>WP-SW-(E)</b> 693763		<b>(N)</b> 7667800	
Stony plains Animal Plant Mineral Pty Ltd E8 15 Jul 2023, 11:28:27					
<b>Seasonal Conditions:</b>	Dry season, dry soil.		<b>Age Since Last Fire:</b>	> 5 years	
<b>Soil Type:</b>	Clay loam		<b>Soil Colour:</b>	Brown	
<b>Surface Rocks Size/Shape:</b>	2 – 5 cm, Rounded		<b>Surface Rocks Cover (%):</b>	20	
<b>Rock Type:</b>	Granite, Quartzite				
<b>Landform</b>	Plains with internal drainage, higher rises are stony with spinifex, lower areas are clay, often cracking with annual tussock grass				
<b>Slope aspect</b>	Internally draining but gentle slope to drainage lines				
<b>Vegetation Description</b>	Mid grassland of <i>Triodia</i> hummock and mixed annual tussock grasses.				
<b>Condition</b>	Good				
<b>Disturbances</b>	Low intensity grazing, infrequent tracks				
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>		
<b>Understorey</b>	0.5	60	<i>Eriachne mucronata</i> , <i>Triodia wiseana</i> , <i>Paspalidium clementii</i>		
<b>Conservation Significant Flora:</b> None					

<b>Site:</b> E10	<b>WP-NW-(E)</b> 695180	<b>(N)</b> 7669934
<b>Date:</b> 15/07/2023	<b>WP-NE-(E)</b> 695230	<b>(N)</b> 7669934
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 695230	<b>(N)</b> 7669883
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 695179	<b>(N)</b> 7669883

<b>Site Type / Size:</b> Quadrat, 50 x 50 m		<b>WP-SW-(E)</b> 693790		<b>(N)</b> 7670804	
Shallow drainage depression Animal Plant Mineral Pty Ltd E9 15 Jul 2023, 14:38:14					
<b>Seasonal Conditions:</b>	Dry season, dry soil.		<b>Age Since Last Fire:</b>	> 5 years	
<b>Soil Type:</b>	Sandy loam		<b>Soil Colour:</b>	Pale brown	
<b>Surface Rocks Size/Shape:</b>	0.5 – 2 cm, Rounded		<b>Surface Rocks Cover (%):</b>	25	
<b>Rock Type:</b>	Granite, Quartzite				
<b>Landform</b>	Shallow drainage depression on a plain				
<b>Slope aspect</b>	Gently draining to the SE				
<b>Vegetation Description</b>	Corymbia hamersleyana low open woodland. <i>Acacia acradenia</i> , <i>A. inaequilatera</i> , <i>A. adsurgens</i> open shrubland. <i>Triodia wiseana</i> hummock grassland.				
<b>Condition</b>	Very Good				
<b>Disturbances</b>	None evident, occasional tracks				
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>		
<b>Overstorey</b>	4	5	<i>Corymbia hamersleyana</i>		
<b>Midstorey</b>	1.9	20	<i>Acacia acradenia</i> , <i>A. inaequilatera</i> , <i>A. adsurgens</i>		
<b>Understorey</b>	0.5	50	<i>Triodia wiseana</i>		
<b>Conservation Significant Flora:</b> None					

<b>Site:</b> E11	<b>WP-NW-(E)</b> 695328	<b>(N)</b> 7669656
<b>Date:</b> 16/07/2023	<b>WP-NE-(E)</b> 695378	<b>(N)</b> 7669655
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 695378	<b>(N)</b> 7669605
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 695330	<b>(N)</b> 7669606



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	1 – 5 cm, Rounded	<b>Surface Rocks Cover (%):</b>	30
<b>Rock Type:</b>	Ironstone, Quartzite, Calcrete		
<b>Landform</b>	Stony rise. Undulating plains with stony rises of Triodia grassland interspersed with drainage depressions of Acacia shrubland		
<b>Slope aspect</b>	Toe of rise, no aspect. Gently sloping to depressions.		
<b>Vegetation Description</b>	Sparse, tall shrubland of Grevillea wickhamii. Sparse mid shrubland of Acacia. Mid hummock grassland of Triodia wiseana.		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Occasional tracks.		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2.5	1	Grevillea wickhamii
<b>Midstorey</b>	1	1	Acacia acradenia
<b>Understorey</b>	0.3	70	Triodia wiseana
<b>Conservation Significant Flora:</b> None			



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy clay loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	1 – 5 cm, Angular/Rounded	<b>Surface Rocks Cover (%):</b>	30
<b>Rock Type:</b>	Ironstone, Granite, Quartzite		
<b>Landform</b>	Drainage depression. No formed channel, but lower elevation than surrounding plains.		
<b>Slope aspect</b>	Gently sloping to NE (direction of drainage channel)		
<b>Vegetation Description</b>	Corymbia hamersleyana low scattered trees. Acacia adsurgens mid shrubland. Triodia epactia hummock grassland.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Moderate intensity cattle grazing, occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3.5	0.5	Corymbia hamersleyana
<b>Midstorey</b>	1.9	50	Acacia adsurgens, Grevillea wickhamii
<b>Understorey</b>	0.3	40	Triodia epactia
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E12	<b>WP-NW-(E)</b> 694659	<b>(N)</b> 7669978
<b>Date:</b> 16/07/2023	<b>WP-NE-(E)</b> 694709	<b>(N)</b> 7669978
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 694709	<b>(N)</b> 7669929
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 694659	<b>(N)</b> 7669927



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy clay loam	<b>Soil Colour:</b>	Red / Brown
<b>Surface Rocks Size/Shape:</b>	1-5 cm, Rounded / Angular	<b>Surface Rocks Cover (%):</b>	50
<b>Rock Type:</b>	Calcrete, Quartzite		
<b>Landform</b>	Stony rise		
<b>Slope aspect</b>	East, towards drainage		
<b>Vegetation Description</b>	Scattered tall <i>Acacia inaequilatera</i> shrubs. <i>Triodia wiseana</i> hummock grassland.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Midstory</b>	3	0.1	<i>Acacia inaequilatera</i> , <i>A. adsurgens</i> , <i>Petalostylis labicheoides</i>
<b>Understorey</b>	0.4	50	<i>Triodia wiseana</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E14	<b>Date:</b> 16/07/2023	<b>Botanist:</b> EH
<b>Site Type / Size:</b> Revele, 50 x 50 m	<b>WP-(E)</b> 694409	<b>(N)</b> 7670329

<b>Site:</b> E13	<b>Date:</b> 16/07/2023	<b>Botanist:</b> EH
<b>Site Type / Size:</b> Revele, 50 x 50 m	<b>WP-(E)</b> 694499	<b>(N)</b> 7669910



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Clay loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	1 – 3 cm, Rounded	<b>Surface Rocks Cover (%):</b>	5
<b>Rock Type:</b>	Ironstone, Quartzite		
<b>Landform</b>	Drainage depression. Seasonally inundated. Poorly drained		
<b>Slope aspect</b>	Flat, internally draining		
<b>Vegetation Description</b>	Herb field of <i>Eriachne mucronata</i> and <i>Cynodon convergens</i>		
<b>Condition</b>	Good		
<b>Disturbances</b>	Moderate intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Understorey</b>	0.1	15	<i>Eriachne mucronata</i> , <i>Cynodon convergens</i> , <i>Neptunia dimorphantha</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E15	<b>Date:</b> 16/07/2023	<b>Botanist:</b> EH
<b>Site Type / Size:</b> Revele, 50 x 50 m	<b>WP-(E)</b> 694217	<b>(N)</b> 7670390



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy clay loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	1 – 5 cm, Angular/Rounded	<b>Surface Rocks Cover (%):</b>	30
<b>Rock Type:</b>	Ironstone, Granite, Quartzite		
<b>Landform</b>	Drainage depression		
<b>Slope aspect</b>	Gently sloping in direction of drainage channel		
<b>Vegetation Description</b>	Acacia shrubland with scattered <i>Corymbia hamersleyana</i>		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
Overstorey	2.5	2	<i>Corymbia hamersleyana</i> , <i>Acacia inaequilatera</i>
Midstorey	1.5	20	<i>Acacia acradenia</i> , <i>Acacia bivenosa</i>
Understorey	0.35	50	<i>Triodia wiseana</i> , <i>T. epactia</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E16	<b>WP-NW-(E)</b> 695768	<b>(N)</b> 7671359
<b>Date:</b> 16/07/2023	<b>WP-NE-(E)</b> 695820	<b>(N)</b> 7671359
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 695820	<b>(N)</b> 7671309
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 695770	<b>(N)</b> 7671310



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	1 – 3 cm, Rounded	<b>Surface Rocks Cover (%):</b>	80
<b>Rock Type:</b>	Quartzite, Ironstone		
<b>Landform</b>	Stony rise		
<b>Slope aspect</b>	N/A		
<b>Vegetation Description</b>	Triodia wiseana hummock grassland with scattered <i>Acacia inaequilatera</i>		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	None		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
Overstorey	2.5	0.1	<i>Acacia inaequilatera</i>
Midstorey	1.5	0.1	<i>Grevillea wickhamii</i> , <i>Petalostylis labicheoides</i>
Understorey	0.3	40	<i>Triodia wiseana</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E17	<b>WP-NW-(E)</b> 696136	<b>(N)</b> 7676436
<b>Date:</b> 17/07/2023	<b>WP-NE-(E)</b> 696186	<b>(N)</b> 7676437
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 696186	<b>(N)</b> 7676386
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 696136	<b>(N)</b> 7676386



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	1 – 4 cm, Angular	<b>Surface Rocks Cover (%):</b>	60
<b>Rock Type:</b>	Ironstone, Quartzite		
<b>Landform</b>	Stony rise		
<b>Slope aspect</b>	N/A		
<b>Vegetation Description</b>	Scattered low <i>Corymbia hamersleyana</i> . Scattered tall <i>Acacia</i> shrubs. <i>Triodia wiseana</i> hummock grassland		
<b>Condition</b>	Good		
<b>Disturbances</b>	Dust from processing and occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	5	1.5	<i>Corymbia hamersleyana</i> , <i>Acacia inaequilatera</i>
<b>Midstorey</b>	2	0.5	<i>Acacia adsurgens</i> , <i>A. acradenia</i> , <i>Grevillea wickhamii</i>
<b>Understorey</b>	0.3	40	<i>Triodia wiseana</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E18	<b>Date:</b> 17/07/2023	<b>Botanist:</b> EH
<b>Site Type / Size:</b> Revele, 50 x 50 m	<b>WP-(E)</b> 695979	<b>(N)</b> 7676475



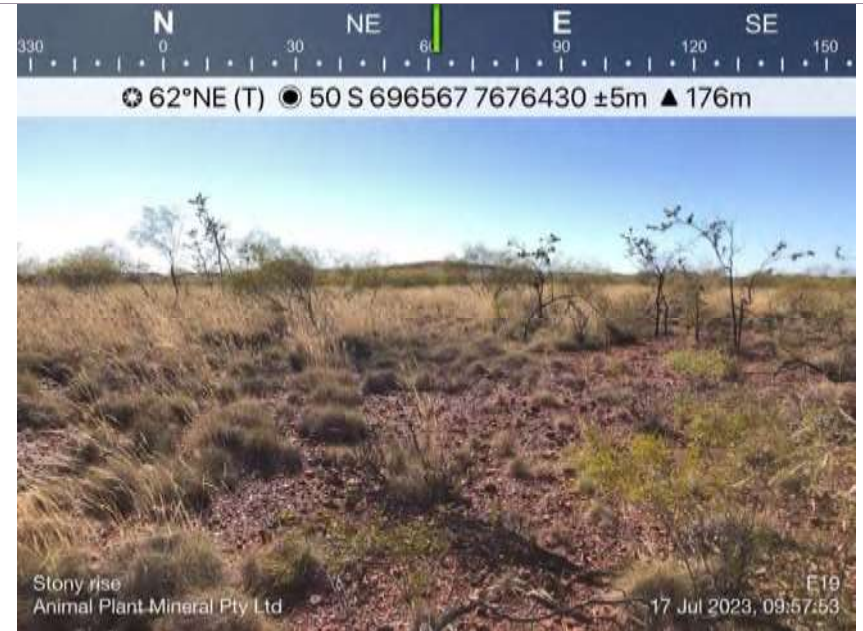
<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sand	<b>Soil Colour:</b>	Red
<b>Surface Rocks Size/Shape:</b>	0.5 – 1 cm, Angular	<b>Surface Rocks Cover (%):</b>	5
<b>Rock Type:</b>	Quartzite		
<b>Landform</b>	Shallow drainage depression		
<b>Slope aspect</b>	Gentle slope to north		
<b>Vegetation Description</b>	<i>Corymbia hamersleyana</i> open woodland. <i>Acacia cowleana</i> open shrubland. <i>Triodia epactia</i> hummock grassland.		
<b>Condition</b>	Good		
<b>Disturbances</b>	Moderate grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4	5	<i>Corymbia hamersleyana</i>
<b>Midstorey</b>	1.8	15	<i>Acacia cowleana</i>
<b>Understorey</b>	0.4	60	<i>Triodia epactia</i> , <i>T. wiseana</i> , <i>Chrysopogon fallax</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E19	<b>WP-NW-(E)</b> 696560	<b>(N)</b> 7676483
<b>Date:</b> 17/07/2023	<b>WP-NE-(E)</b> 696610	<b>(N)</b> 7676482
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 696610	<b>(N)</b> 7676432
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 696560	<b>(N)</b> 7676432



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	2 – 5 cm, Angular	<b>Surface Rocks Cover (%):</b>	60
<b>Rock Type:</b>	Granite, Quartzite, Laterite		
<b>Landform</b>	Stony rise sloping towards North to shallow gully		
<b>Slope aspect</b>	North		
<b>Vegetation Description</b>	Corymbia hamersleyana low scattered. Acacia inaequilatera tall sparse shrubland. Triodia wiseana hummock grassland.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2.5	1.5	Corymbia hamersleyana, Acacia inaequilatera
<b>Midstorey</b>	1.5	0.5	Acacia bivenosa, Acacia maitlandii
<b>Understorey</b>	0.3	30	Triodia wiseana, T. chichesterensis
<b>Conservation Significant Flora:</b> Triodia chichesterensis (P3)			

<b>Site:</b> E20	<b>Date:</b> 17/07/2023	<b>Botanist:</b> EH
<b>Site Type / Size:</b> Revele, Approx 50 x 50 m	<b>WP-(E)</b> 699870	<b>(N)</b> 7676467



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red brown
<b>Surface Rocks Size/Shape:</b>	1 – 10 cm, Angular	<b>Surface Rocks Cover (%):</b>	50
<b>Rock Type:</b>	Ironstone, Granite, Quartzite		
<b>Landform</b>	Stony rise. Lowest rise of a range higher to North		
<b>Slope aspect</b>	Crest and upper slope		
<b>Vegetation Description</b>	Tall sparse shrubland of Acacia inaequilatera. Open shrubland of Acacia adsurgens. Triodia wiseana hummock grassland.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3	0.5	Acacia inaequilatera
<b>Midstorey</b>	1.6	10	Acacia adsurgens, A. acradenia
<b>Understorey</b>	0.3	40	Triodia wiseana, T. lanigera
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E21	<b>WP-NW-(E)</b> 699703	<b>(N)</b> 7676460
<b>Date:</b> 17/07/2023	<b>WP-NE-(E)</b> 699753	<b>(N)</b> 7676459
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 699752	<b>(N)</b> 7676410
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 699703	<b>(N)</b> 7676409



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Silty loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	1 – 20 cm, Blocky / Angular	<b>Surface Rocks Cover (%):</b>	70
<b>Rock Type:</b>	Quartzite, Granite		
<b>Landform</b>	Hill crest and upper slopes. Rocky outcrop/low hill.		
<b>Slope aspect</b>	Crest and all upper slopes		
<b>Vegetation Description</b>	Scattered mid Acacia inaequilatera, scattered low shrubs of Acacia. Triodia lanigera hummock grassland.		
<b>Condition</b>	Excellent		
<b>Disturbances</b>	None		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2	0.1	Acacia inaequilatera
<b>Midstorey</b>	1.5	1.5	Acacia spondylophylla, Senna artemisioides
<b>Understorey</b>	0.2	30	Triodia lanigera
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E22	<b>WP-NW-(E)</b> 699558	<b>(N)</b> 7676621
<b>Date:</b> 17/07/2023	<b>WP-NE-(E)</b> 699608	<b>(N)</b> 7676621
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 699608	<b>(N)</b> 7676571
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 699559	<b>(N)</b> 7676571



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	4 – 10 cm, Blocky / Platy	<b>Surface Rocks Cover (%):</b>	70
<b>Rock Type:</b>	Granite		
<b>Landform</b>	Mid to lower slope of a granite outcrop/low hill.		
<b>Slope aspect</b>	North		
<b>Vegetation Description</b>	Isolated tall Acacia inaequilatera shrubs over open mid shrubland of Acacia acradenia and Acacia maitlandii over Triodia lanigera hummock grassland.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Low intensity grazing		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2	0.05	Acacia inaequilatera
<b>Midstorey</b>	1	15	Acacia acradenia , A. maitlandii, A. stellaticeps
<b>Understorey</b>	0.3	30	Triodia lanigera

<b>Conservation Significant Flora:</b>			
<b>Site:</b> E23	<b>WP-NW-(E)</b> 698621	<b>(N)</b> 7676607	
<b>Date:</b> 17/07/2023	<b>WP-NE-(E)</b> 698671	<b>(N)</b> 7676608	
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 698671	<b>(N)</b> 7676557	
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 698621	<b>(N)</b> 7676557	

<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	2 – 10 cm and 1 – 20 m, Blocky and large Granite boulders	<b>Surface Rocks Cover (%):</b>	70
<b>Rock Type:</b>	Granite		
<b>Landform</b>	Granite outcrops on undulating hills/risers		
<b>Slope aspect</b>	North		
<b>Vegetation Description</b>	Scattered low <i>Corymbia</i> and <i>Eucalyptus</i> . Mid shrubland of <i>Acacia</i> . Hummock grassland of <i>Triodia</i>		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2.5	0.1	<i>Corymbia hamersleyana</i> , <i>Eucalyptus leucophloia</i>
<b>Midstorey</b>	1.8	10	<i>Acacia adsurgens</i> , <i>A. maitlandii</i>
<b>Understorey</b>	0.3	30	<i>Triodia epactia</i> , <i>T. lanigera</i>
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E24	<b>Date:</b> 17/07/2023	<b>Botanist:</b> EH
<b>Site Type / Size:</b> Releve, 50 x 50 m	<b>WP - (E)</b> 698563	<b>(N)</b> 7676658

<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	2 – 5 cm, Rounded	<b>Surface Rocks Cover (%):</b>	60
<b>Rock Type:</b>	Quartzite		
<b>Landform</b>	Stony rise		
<b>Slope aspect</b>	Crest of rise		
<b>Vegetation Description</b>	Tall sparse shrubland of <i>Acacia inaequilatera</i> . Sparse mid shrubland of <i>Acacia acradenia</i> . Hummock grassland of <i>Triodia</i> .		
<b>Condition</b>	Very good		
<b>Disturbances</b>	Occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3.5	1	<i>Acacia inaequilatera</i>
<b>Midstorey</b>	1.2	1	<i>Acacia acradenia</i>
<b>Understorey</b>	0.15	40	<i>Triodia chichesterensis</i> , <i>T. wiseana</i> , <i>T. lanigera</i>
<b>Conservation Significant Flora:</b> <i>Triodia chichesterensis</i> (P3)			

<b>Site:</b> E25	<b>WP-NW-(E)</b> 698201	<b>(N)</b> 7676448
<b>Date:</b> 18/07/2023	<b>WP-NE-(E)</b> 698250	<b>(N)</b> 7676447
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 698250	<b>(N)</b> 7676398
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 698200	<b>(N)</b> 7676397



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	1 – 15 cm, Angular	<b>Surface Rocks Cover (%):</b>	50
<b>Rock Type:</b>	Quartzite		
<b>Landform</b>	Drainage gully between rocky rises.		
<b>Slope aspect</b>	West		
<b>Vegetation Description</b>	Corymbia and Eucalyptus open woodland. Acacia cowleana open shrubland. Triodia lanigera hummock grassland.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	3.5	4	Corymbia hamersleyana, Eucalyptus leucophloia
<b>Midstorey</b>	1.9	15	Acacia cowleana, A. inaequilatera, A. adsurgens
<b>Understorey</b>	0.4	50	Triodia lanigera,
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E26	<b>WP-NW-(E)</b> 697991	<b>(N)</b> 7676503
<b>Date:</b> 18/07/2023	<b>WP-NE-(E)</b> 698041	<b>(N)</b> 7676504
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 698042	<b>(N)</b> 7676453
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 697991	<b>(N)</b> 7676454



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Clay sand	<b>Soil Colour:</b>	Red brown
<b>Surface Rocks Size/Shape:</b>	1 cm ironstone pebbles and 1 – 10 m wide granite domes	<b>Surface Rocks Cover (%):</b>	30
<b>Rock Type:</b>	Granite, Ironstone		
<b>Landform</b>	Plain with low granite outcropping		
<b>Slope aspect</b>	Gently sloping to South but fairly flat		
<b>Vegetation Description</b>	Tall sparse shrubland of Acacia adsurgens Low shrubland of A. stellaticeps.		
<b>Condition</b>	Good		
<b>Disturbances</b>	Moderate grazing, occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2.5	10	Acacia adsurgens
<b>Midstorey</b>	0.8		Acacia stellaticeps
<b>Understorey</b>	0.5	60	Triodia epactia, T. laigera
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E27	<b>WP-NW-(E)</b> 697736	<b>(N)</b> 7676482
<b>Date:</b> 18/07/2023	<b>WP-NE-(E)</b> 697786	<b>(N)</b> 7676481
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 697786	<b>(N)</b> 7676432
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 697736	<b>(N)</b> 7676432



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Clay sand	<b>Soil Colour:</b>	Red brown
<b>Surface Rocks Size/Shape:</b>	1 cm, Angular	<b>Surface Rocks Cover (%):</b>	2
<b>Rock Type:</b>	Ironstone		
<b>Landform</b>	Plain, granite hills to North		
<b>Slope aspect</b>	Gently sloping to South		
<b>Vegetation Description</b>	Scattered tall <i>Acacia inaequilatera</i> shrubs. Mid open shrubland of <i>Acacia acradenia</i> . Hummock grassland of <i>Triodia lanigera</i> .		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Moderate grazing, occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2.5	0.5	<i>Acacia inaequilatera</i>
<b>Midstorey</b>	1.7	2	<i>Acacia acradenia</i>
<b>Understorey</b>	0.3	65	<i>Triodia lanigera</i> ,
<b>Conservation Significant Flora:</b> None			

<b>Site:</b> E28	<b>WP-NW-(E)</b> 698042	<b>(N)</b> 7675983
<b>Date:</b> 18/07/2023	<b>WP-NE-(E)</b> 698092	<b>(N)</b> 7675983
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 698092	<b>(N)</b> 7675932
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 698042	<b>(N)</b> 7675932



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy with gravel	<b>Soil Colour:</b>	Red brown
<b>Surface Rocks Size/Shape:</b>	Quartz 5 cm, Granite boulders 10 m wide	<b>Surface Rocks Cover (%):</b>	10
<b>Rock Type:</b>	Granite, Quartzite		
<b>Landform</b>	Gully/drainage line between stone rises.		
<b>Slope aspect</b>	Drains to East		
<b>Vegetation Description</b>	Scattered tall <i>Acacia inaequilatera</i> shrubs. Mid open shrubland of <i>Acacia adsurgens</i> . Hummock grassland of <i>Triodia wiseana</i> .		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Occasional Tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	4	2	<i>Corymbia hamersleyana</i>
<b>Midstorey</b>	1.9	30	<i>Acacia adsurgens</i> , <i>Indigofera rugosa</i>
<b>Understorey</b>	0.4	50	<i>Triodia wiseana</i> . <i>T. epactia</i>
<b>Conservation Significant Flora:</b> <i>Triodia chichesterensis</i> (P3)			

<b>Site:</b> E29	<b>WP-NW-(E)</b> 697635	<b>(N)</b> 7675442
<b>Date:</b> 18/07/2023	<b>WP-NE-(E)</b> 697685	<b>(N)</b> 7675443
<b>Botanist:</b> EH	<b>WP-SE-(E)</b> 697686	<b>(N)</b> 7675392
<b>Site Type / Size:</b> Quadrat, 50 x 50 m	<b>WP-SW-(E)</b> 697634	<b>(N)</b> 7675393



<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Brown
<b>Surface Rocks Size/Shape:</b>	2 – 7 cm, Platy	<b>Surface Rocks Cover (%):</b>	60
<b>Rock Type:</b>	Granite		
<b>Landform</b>	Stony rise with a sandy swale behind		
<b>Slope aspect</b>	Crest of rise and swale to north		
<b>Vegetation Description</b>	Low scattered Corymbia. Tall sparse Acacia inaequilatera. Mid hummock grassland.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Moderate grazing, occasional tracks.		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2	0.5	Corymbia hamersleyana
<b>Midstorey</b>	2.2	2	Acacia inaequilatera, A. acradenia, A. adsurgens
<b>Understorey</b>	0.3	40	Triodia wiseana, T. epactia, T. lanigera
<b>Conservation Significant Flora:</b> None			

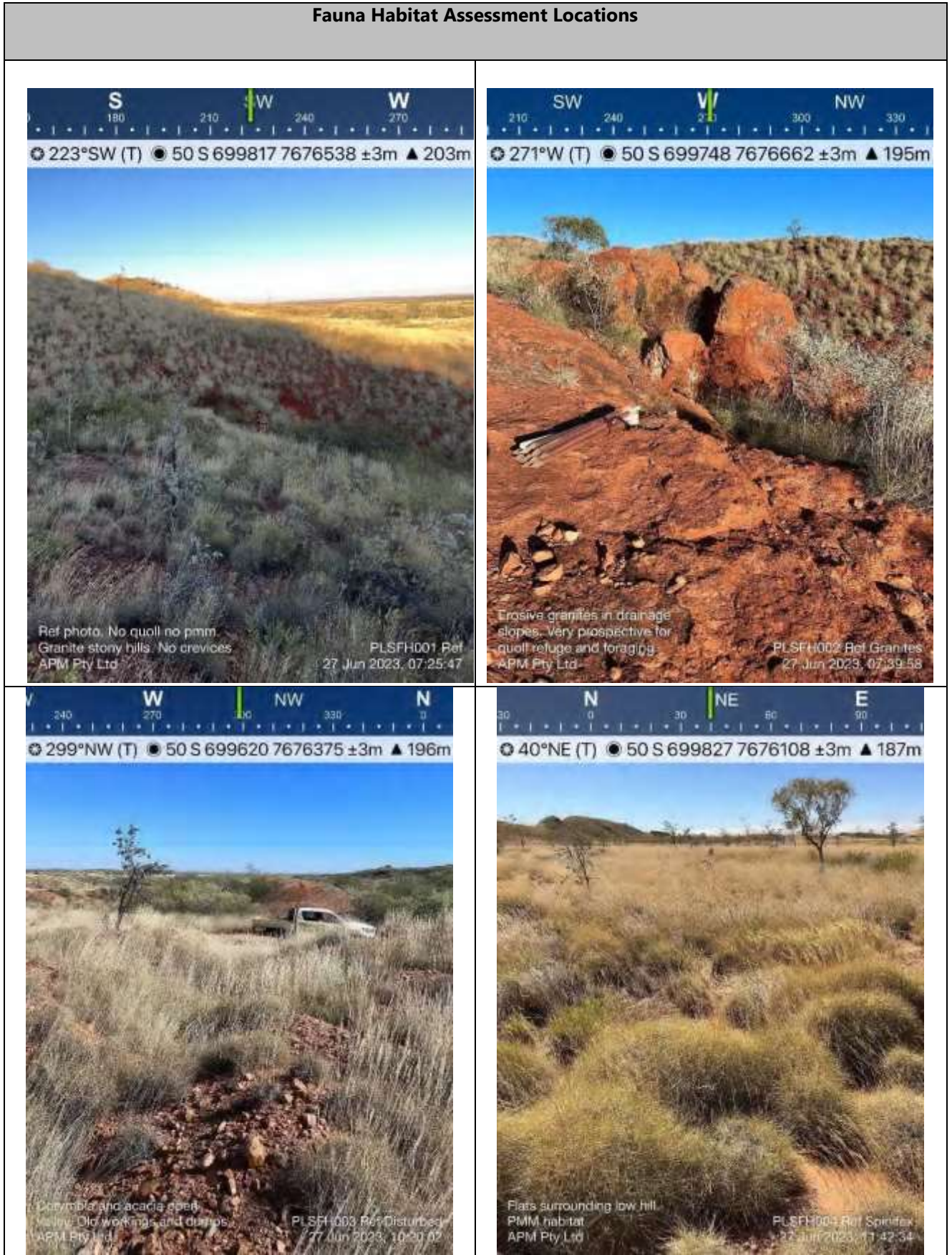


<b>Seasonal Conditions:</b>	Dry season, dry soil.	<b>Age Since Last Fire:</b>	> 5 years
<b>Soil Type:</b>	Sandy loam	<b>Soil Colour:</b>	Red brown
<b>Surface Rocks Size/Shape:</b>	1 – 4 cm, Angular	<b>Surface Rocks Cover (%):</b>	20
<b>Rock Type:</b>	Granite, Quartzite		
<b>Landform</b>	Plain, slight stony rise		
<b>Slope aspect</b>	Flat		
<b>Vegetation Description</b>	Scattered Acacia inaequilatera tall shrubs. Sparse Acacia adsurgens mid shrubs. Triodia lanigera mid hummock grassland.		
<b>Condition</b>	Very Good		
<b>Disturbances</b>	Moderate grazing, occasional tracks		
<b>Strata</b>	<b>Height (m)</b>	<b>Cover (%)</b>	<b>Species</b>
<b>Overstorey</b>	2.5	0.2	Acacia inaequilatera
<b>Midstorey</b>	1.2	3	Acacia adsurgens, A. bivenosa
<b>Understorey</b>	0.3	40	Triodia lanigera
<b>Conservation Significant Flora:</b> None			

## **APPENDIX D: FAUNA HABITAT PHOTOS**

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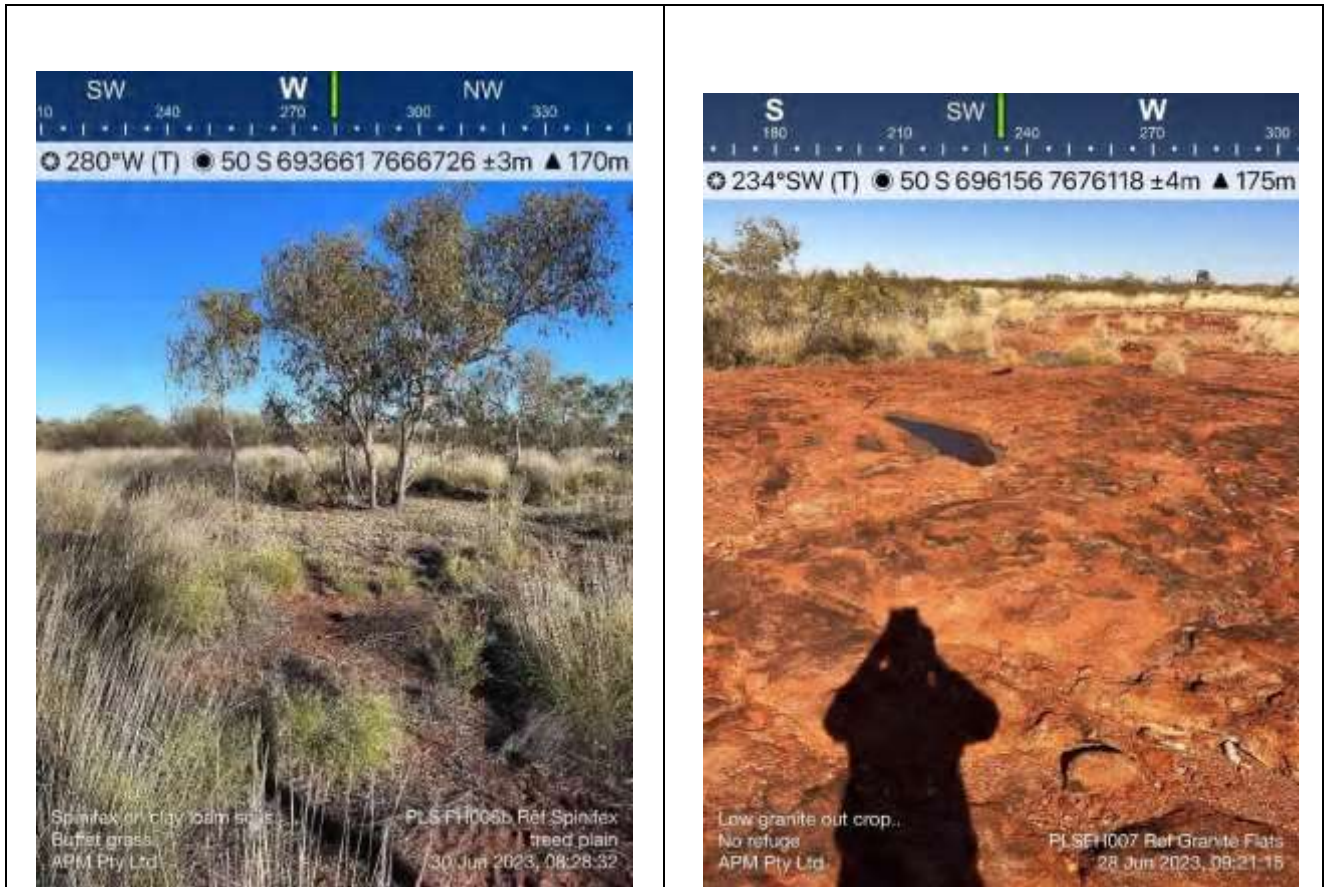
PILBARA MINERALS LIMITED



NVCP Application Area – Biological Survey Appendix  
D – Fauna Observation Photos



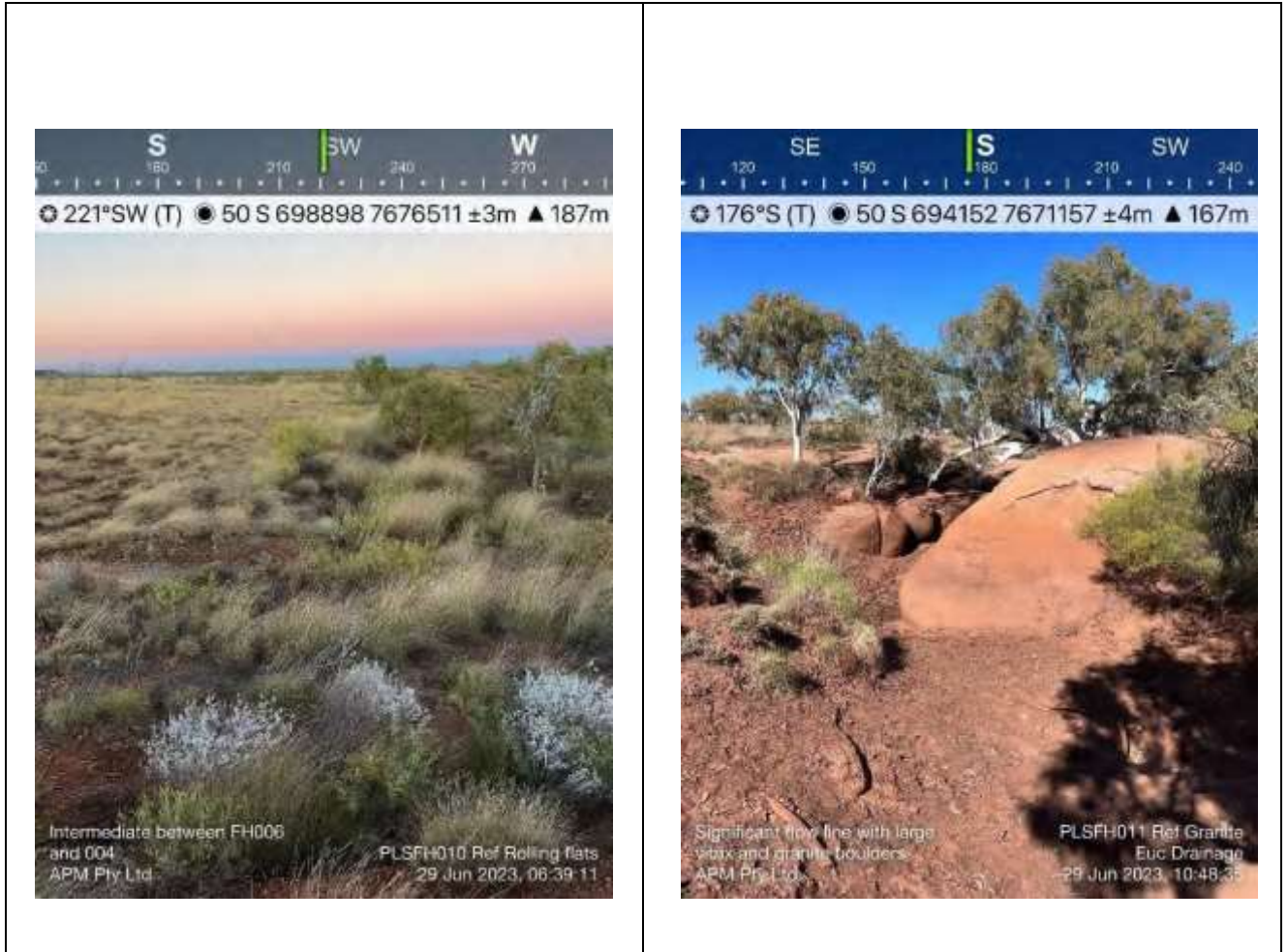
NVCP Application Area – Biological Survey Appendix  
D – Fauna Observation Photos



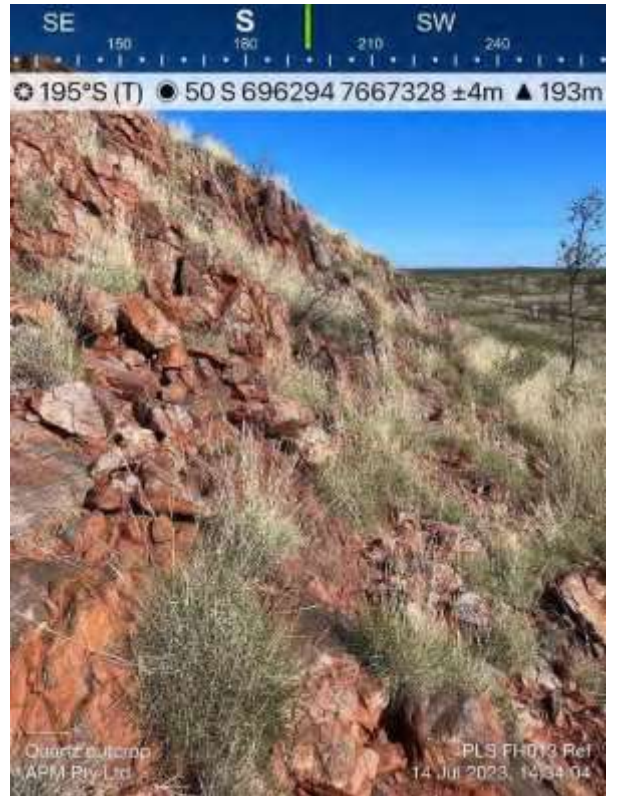
NVCP Application Area – Biological Survey Appendix  
D – Fauna Observation Photos



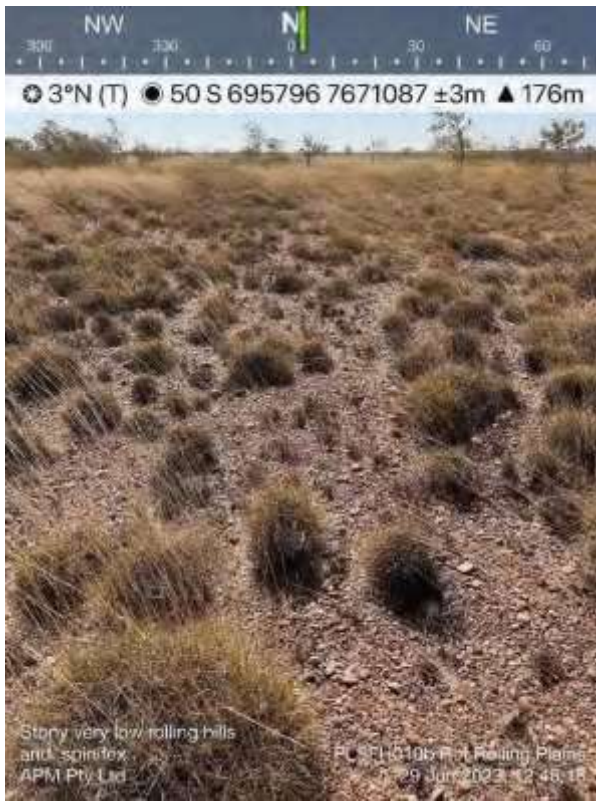
NVCP Application Area – Biological Survey Appendix  
D – Fauna Observation Photos



NVCP Application Area – Biological Survey Appendix  
 D – Fauna Observation Photos



NVCP Application Area – Biological Survey Appendix  
 D – Fauna Observation Photos



Camera Trap Locations



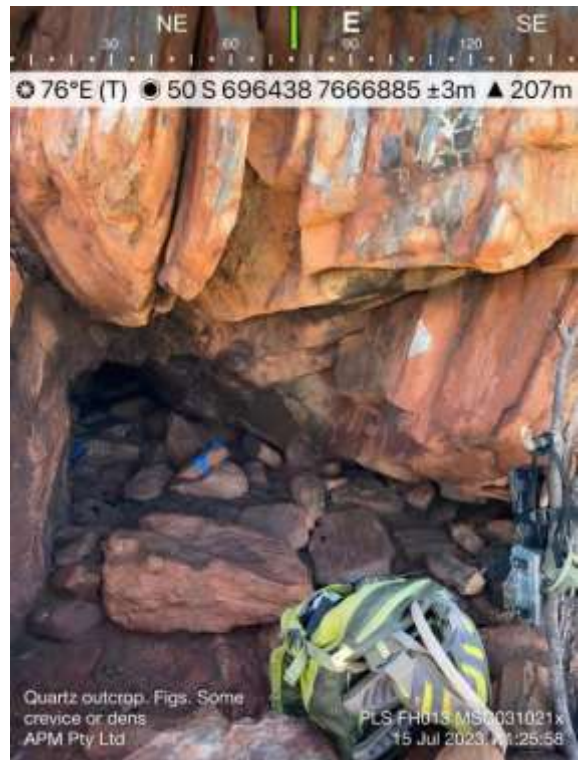
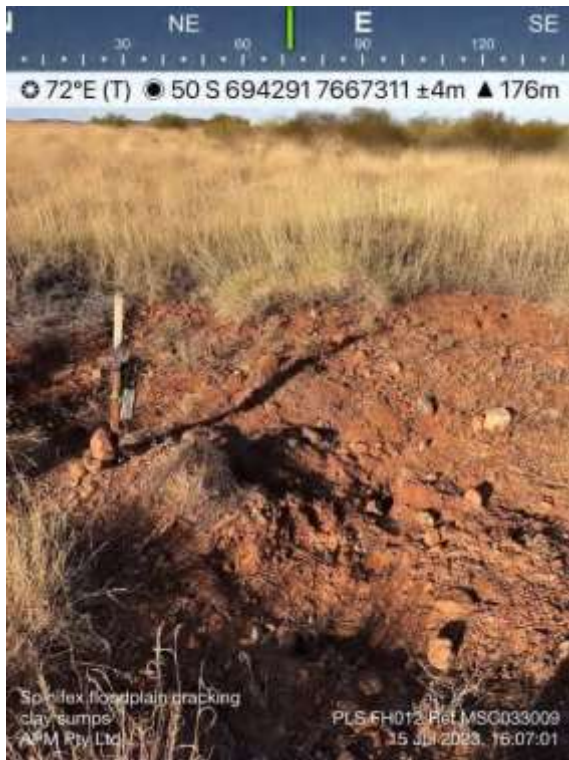
NVCP Application Area – Biological Survey Appendix  
D – Fauna Observation Photos



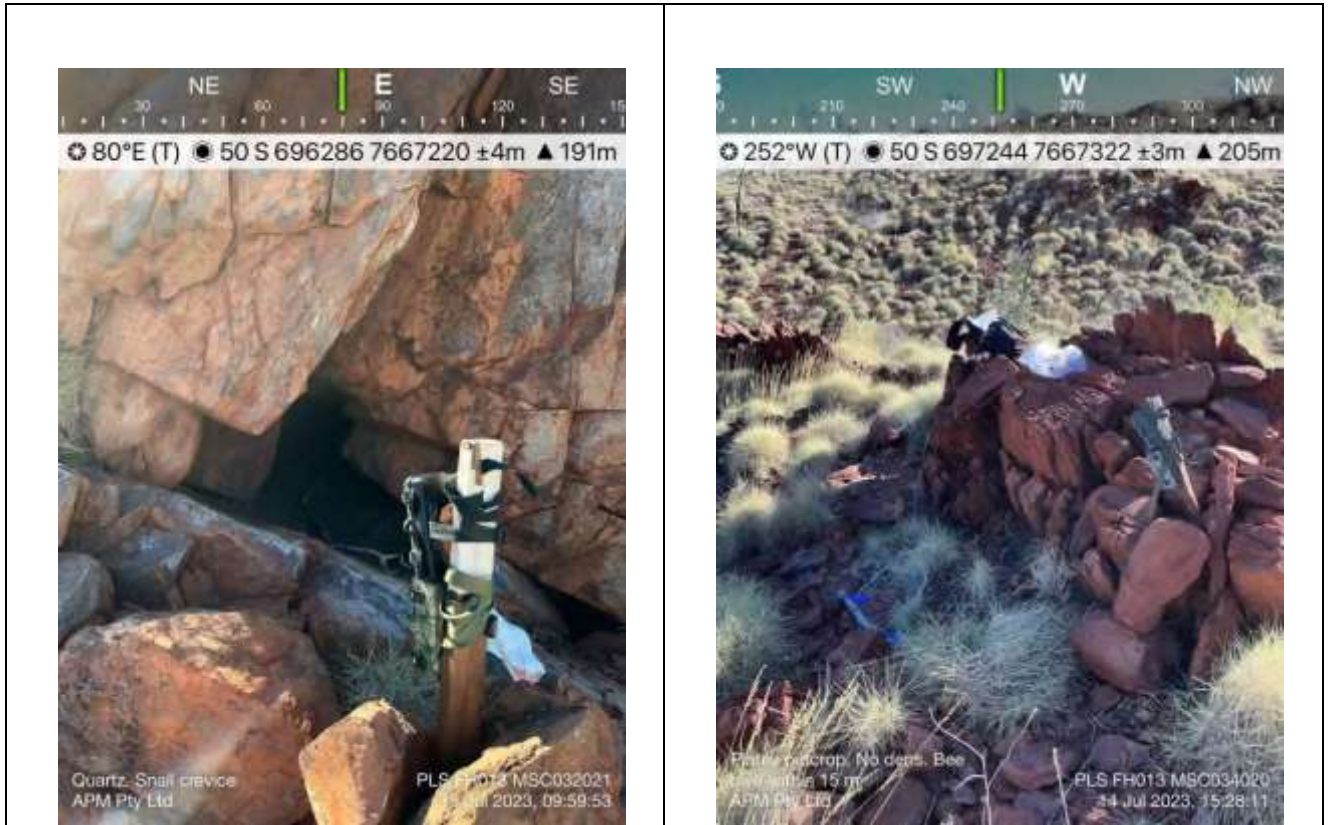
NVCP Application Area – Biological Survey Appendix  
 D – Fauna Observation Photos



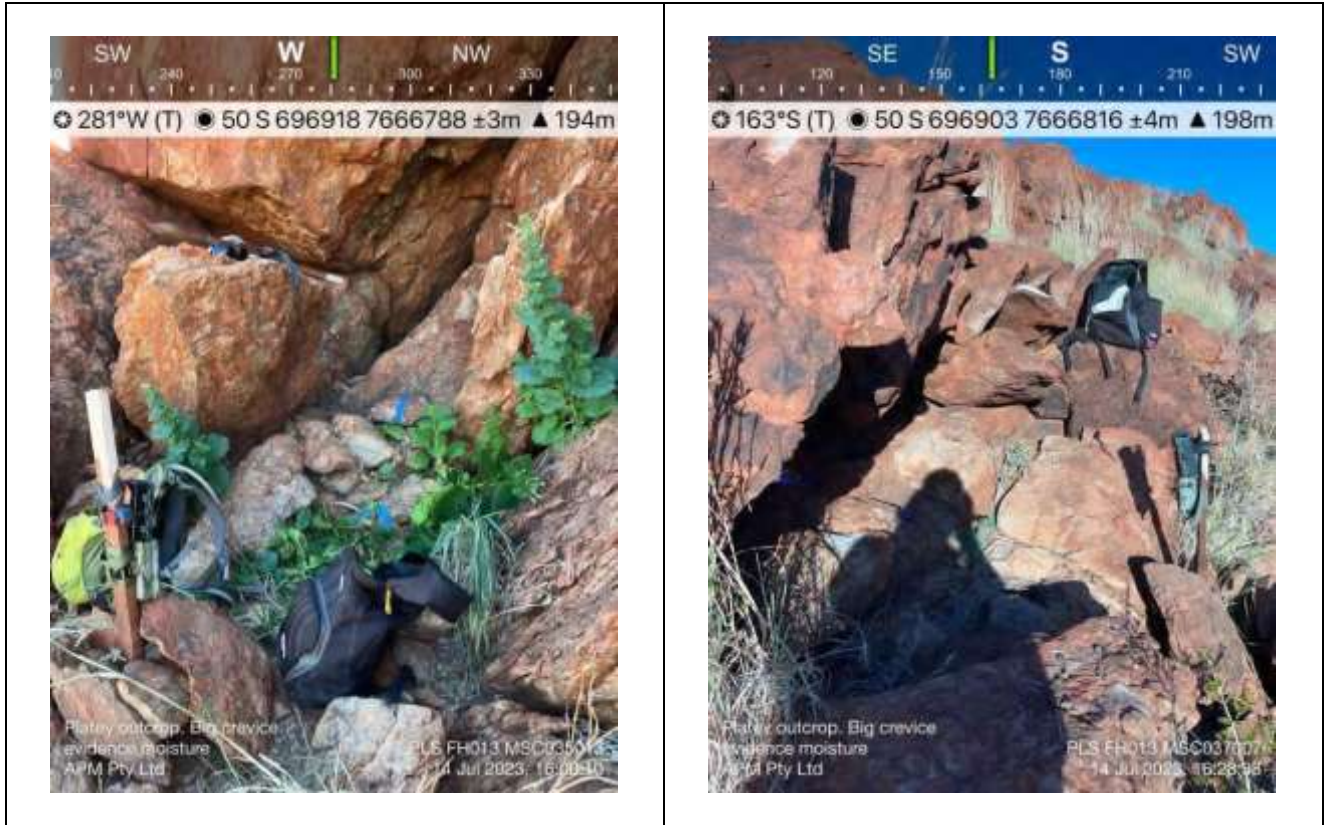
NVCP Application Area – Biological Survey Appendix  
 D – Fauna Observation Photos



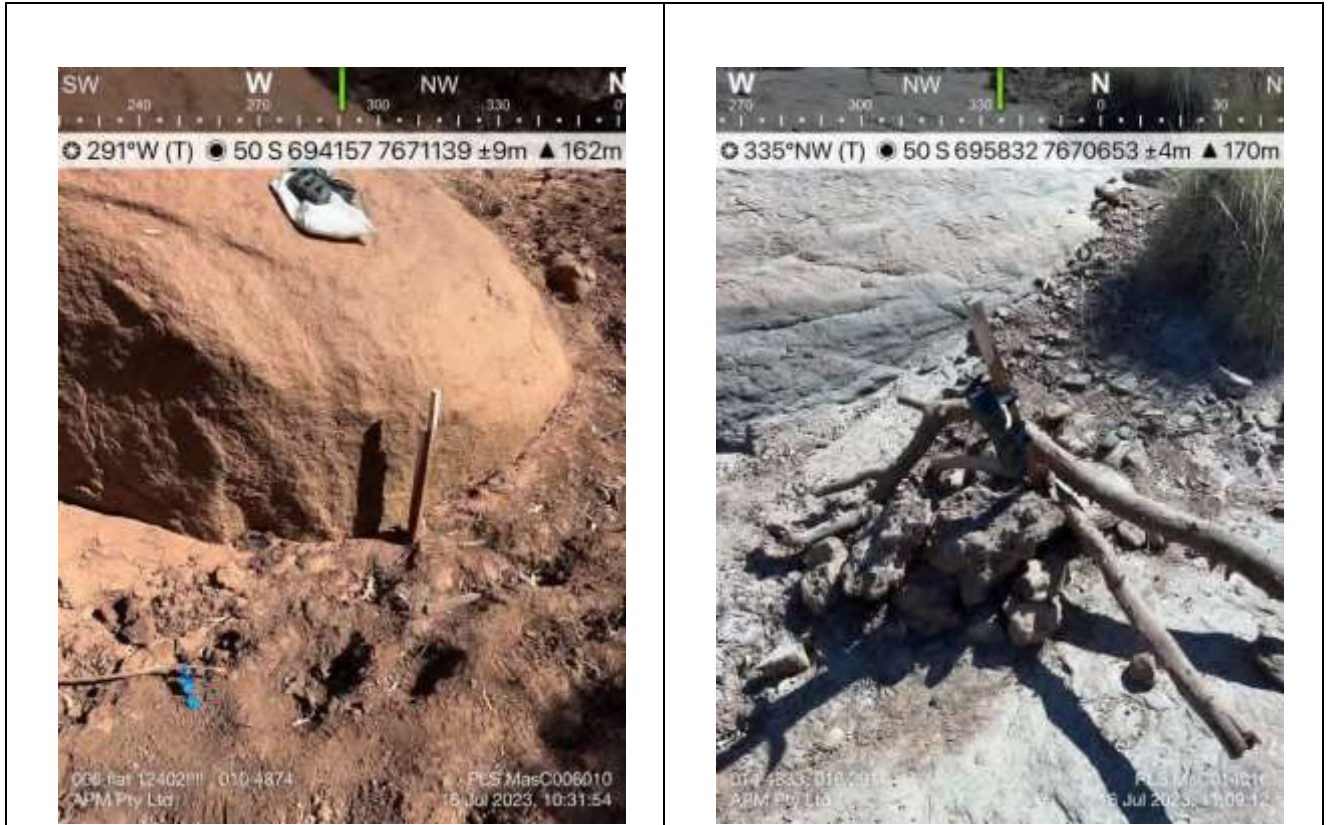
NVCP Application Area – Biological Survey Appendix  
D – Fauna Observation Photos



NVCP Application Area – Biological Survey Appendix  
D – Fauna Observation Photos



NVCP Application Area – Biological Survey Appendix  
D – Fauna Observation Photos



Acoustic Bat Detector Locations

NVCP Application Area – Biological Survey Appendix  
D – Fauna Observation Photos



NVCP Application Area – Biological Survey Appendix  
D – Fauna Observation Photos

## **APPENDIX E: SPECIALISED ZOOLOGICAL TECHNICAL REPORT**

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PILBARA MINERALS LIMITED

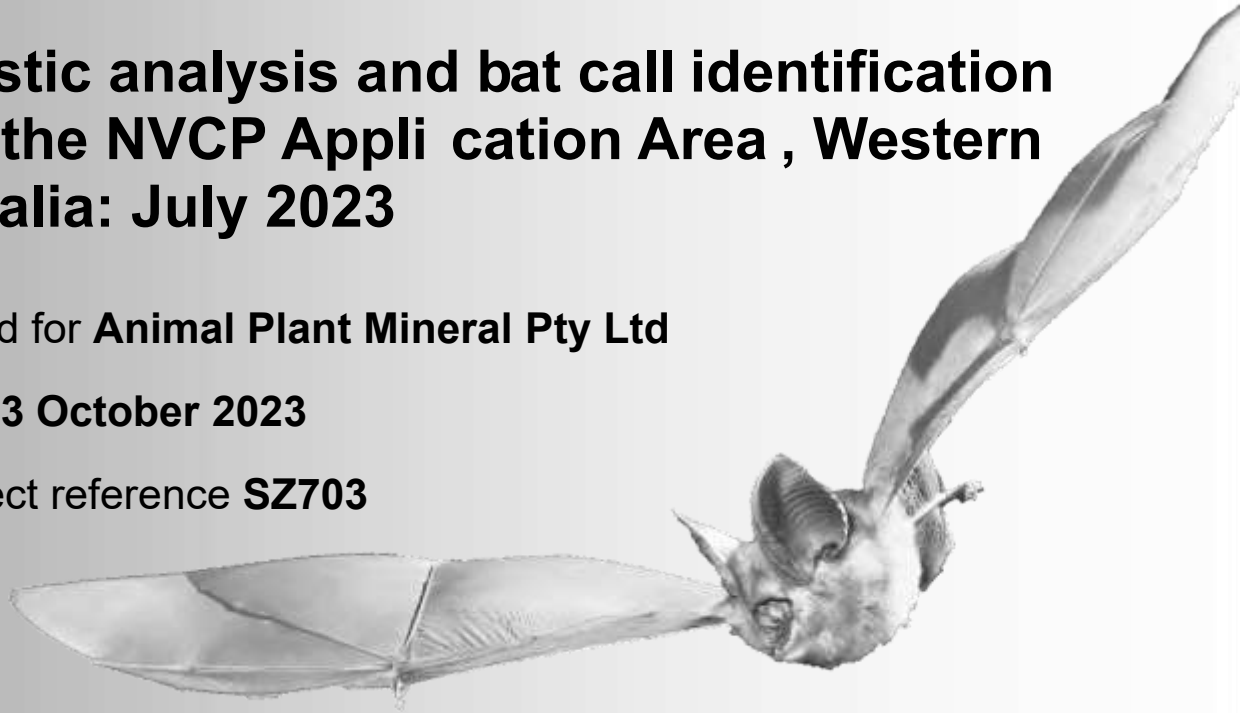


# Acoustic analysis and bat call identification from the NVCP Application Area , Western Australia: July 2023

Prepared for **Animal Plant Mineral Pty Ltd**

Version **3 October 2023**

SZ project reference **SZ703**



Prepared by **Dr Kyle Armstrong and Yuki Konishi**

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This report should be included as an appendix in any larger submission to Government, and cited as:

Specialised Zoological (2023). Acoustic analysis and bat call identification from the NVCP Application Area, Western Australia : July 2023. Unpublished report by Specialised Zoological for Animal Plant Mineral Pty Ltd, 3 October 2023, project reference SZ703.

## Summary

The outcome is provided of the analysis of acoustic (bat detector) recordings made in July 2023 in the NVCP Application Area, located in the Pilbara region of Western Australia.

The scope of the analysis was limited to the detection of the Threatened-listed Ghost Bat *Macroderma gigas* (Megadermatidae) and Pilbara Leaf-nosed Bat *Rhinonycteris aurantia* (Rhinonycteridae).

The recording dataset comprised a total of 49 recording nights from five bat detector units placed at five recording sites (**Table 1; Figure 1**). Note that two bat detector units provided by Specialised Zoological had a technical issue that truncated the recordings, and all recordings in the first half of July were problematic.

Acoustic processing of the bat detector recordings was conducted separately for each of the two target bat species using methods optimised for the detection of their unique echolocation call types.

A total of 21 echolocation call sequences of the Pilbara Leaf-nosed Bat were detected at three separate recording sites (**Table 2; Figures 1 and 2**).

The detection of echolocation call sequences well after sunset and well before sunrise, and away from areas of rocky outcrop containing deep caves, is indicative of individuals of this species out foraging away from a diurnal roost.

No calls of the Ghost Bat were observed in the recordings.

Further information is available should verification be required.

## Methods

The data provided were recorded in full spectrum WAV format with Titley Scientific Anabat Swift bat detectors (sampling rate 500 kHz, set to record between sunset and sunrise).

A multi-step acoustic analysis procedure developed to process large full spectrum echolocation recording datasets from insectivorous bats (Armstrong et al. 2021a,b) was applied to the recordings made on the survey. Firstly, the WAV files were scanned in the software SCAN'R version 1.8.3 (Binary Acoustic Technology) for bat echolocation calls using a parameter set optimised for the detection of each of the two target species. This process provides measurements (SCAN'R parameters) from each putative pulse of the target species. The outputs were then used to determine if putative bat pulses measured in SCAN'R could be attributed to the two target species. This was done in two ways.

First, all WAV files containing putative calls of the Pilbara Leaf-nosed Bat were inspected in Adobe Audition version 23.1 software, and listings of files containing false positive identifications were discarded. Custom R language scripts assisted with summarisation of the remaining data, and the calculation of times of first detection after sunset and last detection before sunrise.

Second, a custom [R] language ‘shiny’ app was used to aid recognition of the calls of the Ghost Bat. The app assisted with three tasks:

1. Performed a Discriminant Function Analysis on training data from representative calls from cave-roosting bats in the Pilbara;
2. From the measurements of each putative Ghost Bat echolocation pulse from SCAN'R, calculated values for the first two Discriminant Functions that could separate the signal types derived from the analysis of training data, and plotted these resulting coordinates over confidence regions for the defined signal types; and
3. Facilitated an inspection in a spectrogram of chosen examples of interest (within the confidence region for Ghost Bat calls) for each recording night by opening the original WAV files in Adobe Audition version 23.1.

Species were identified based on information in Armstrong and Coles (2007) and the author's own unpublished material.

## Limitations

The identifications presented in this report have been made within the following context:

1. The identifications made herein were based on the ultrasonic acoustic data recorded and provided by a ‘third party’ (the client named on the front of this report).
2. The scope of this report extended to providing information on the identification of two target bat species in bulk ultrasonic recordings. Further comment on these species and the possible impacts of a planned project on bat species were not part of the scope.
3. In the case of the present report, the recording equipment was set up and supplied by Specialised Zoological. The equipment was operated by the third party on the survey.
4. Specialised Zoological has not made a visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.
5. Specialised Zoological has had no input into the overall design and timing of this bat survey, recording site placement, nor the degree of recording site replication.
6. While Specialised Zoological has made identifications to the best of our ability given the available materials, and reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort or non-invasive methods such as video recordings. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.
7. There are a variety of factors that affect the ‘detectability’ of each bat species, given the frequency, power and shape characteristics of their calls. Further information on the analysis and the various factors that can impinge on the reliability of identifications can be provided upon request.
8. The most reliable way of detecting the Ghost Bat with bat detectors is to place the equipment with the microphone facing into a potential cave roosting site. The echolocation calls of this species are of low amplitude, and therefore most detectable

when a Ghost Bat flies close to the bat detector as it exits the underground structure. If there is uncertainty about whether Ghost Bats are present in a cave, then video recordings can be a useful addition to the survey. The detection of Ghost Bats with bat detectors away from cave entrances is less reliable, unless an approach based on an acoustic lure is used (e.g. see the new method described in a paper accepted recently by Ruykys et al. 2023 in press).

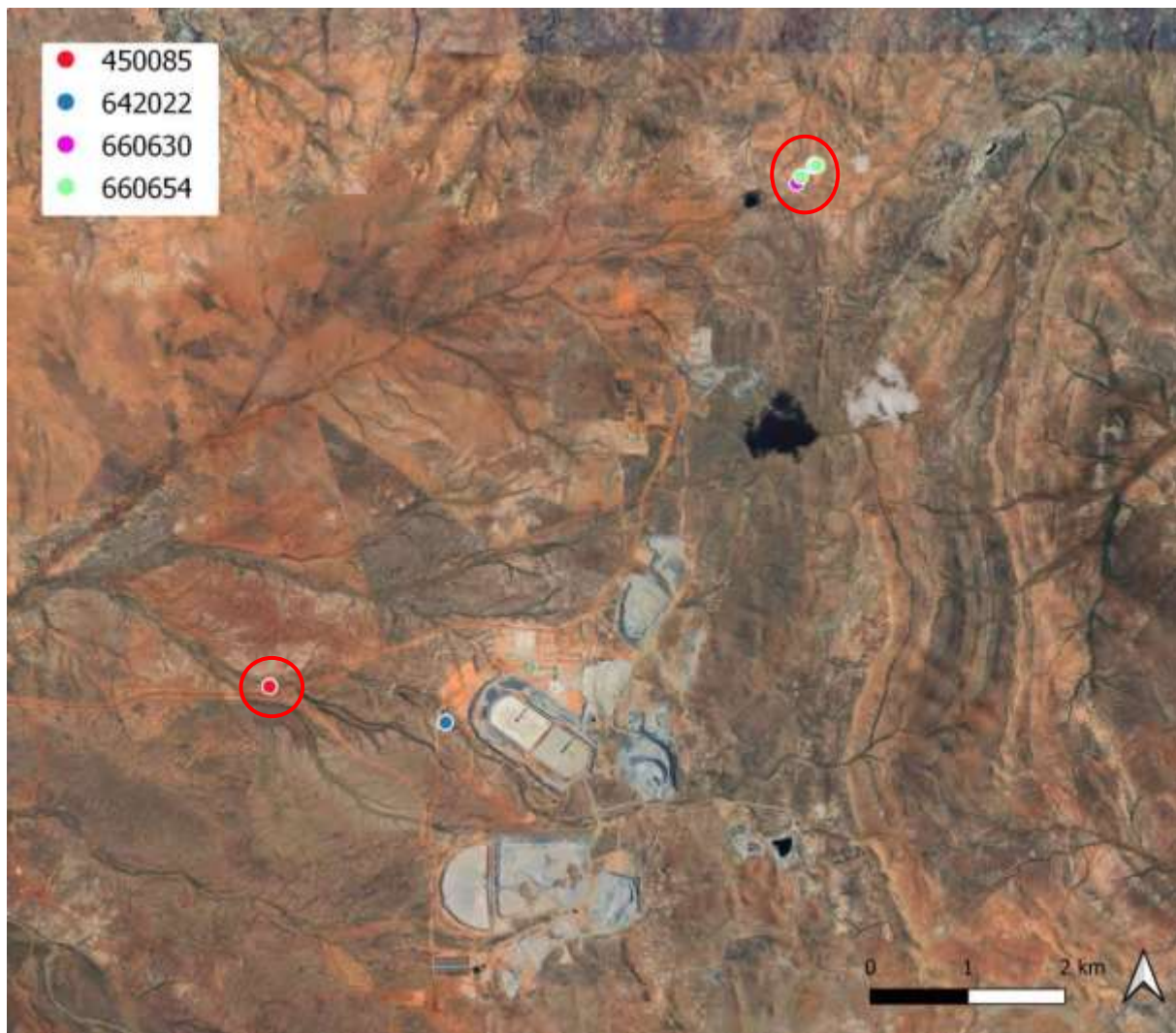
9. This version of the document supersedes any previous version. Previous drafts are not authorised by us for submission to the regulator or the public domain.

## References

- Armstrong, K.N. and Coles, R.B. (2007). Echolocation call frequency differences between geographic isolates of *Rhinonictis aurantia* (Chiroptera: Hipposideridae): implications of nasal chamber size. *Journal of Mammalogy* 88: 94–104. <http://dx.doi.org/10.1644/06-MAMM-A-115R1.1>
- Armstrong K.N., Broken-Brow J., Hoyer G., Ford G., Thomas M. and Corben C. (2021a). Effective detection and identification of sheath-tailed bats of Australian forests and woodlands. *Australian Journal of Zoology* 68: 346–363. <https://doi.org/10.1071/ZO20044>
- Armstrong K.N., Clarke S., Linke A., Scanlon A., Roetman P., Hitch, A.T. and Donnellan S.C. (2021b). Citizen science implements the first intensive acoustics-based survey of insectivorous bat species across the Murray-Darling Basin of South Australia. *Australian Journal of Zoology* 68: 364–381. <https://doi.org/10.1071/ZO20051>
- Ruykys, L., Hanrahan, N. and Stokeld, D. (2023 in press). Novel acoustic lure methodology facilitates detection of the cryptic ghost bat at a landscape scale. *Wildlife Research*.  
URL: <https://www.publish.csiro.au/WR/justaccepted/WR22189>

**Table 1.** Summary of bat detector recordings analysed. [Ra: number of echolocation sequences of the Pilbara Leaf-nosed Bat *Rhinonictis aurantia*; Note that there were issues with the units (beyond the responsibility of Animal Plant Mineral Pty Ltd) that lead to loss of date and time information; the units recorded data between 14 July and 2 August 2023; date ranges in 2003 are incorrect and the result of an issue with units obtaining a GPS fix—these were adjusted to calculate time since first detection after sunset, last detection before sunrise]

Swift Serial No.	Latitude	Longitude	No. recording nights	Nights of	Ra calls
450007	<i>Not available</i>	<i>Not available</i>	5	'2003-11-28 – 2003-12-03'	0
450085	-21.051113	118.867217	3	'2003-11-30 – 2003-12-03'	4
642022	-21.054677	118.884608	17	2023-07-15 – 2023-08-01	0
660630	-21.001420	118.919222	7	2023-07-14 – 2023-07-20	2
660654	-20.999712	118.920870	17	2023-07-14 – 2023-07-30	15
<b>Totals</b>			<b>49</b>	<b>2023-07-14 – 2023-08-01</b>	<b>21</b>

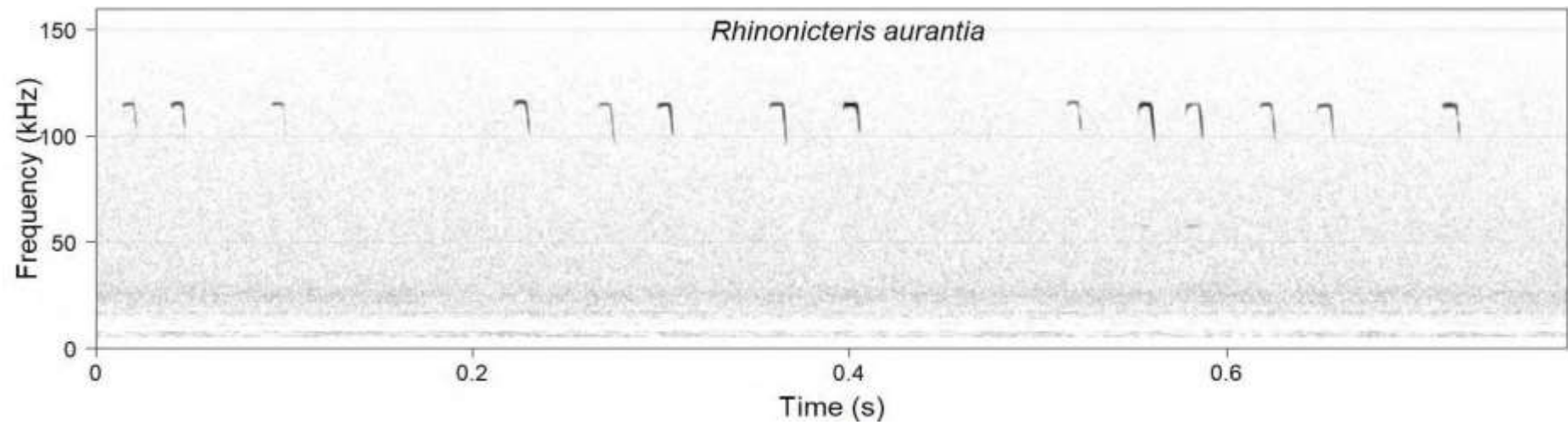


**Figure 1.** The location of the bat detector recording sites within the project area (tracked by unit serial number; unit 450007 recorded no GPS coordinates). The Pilbara Leaf-nosed Bat was detected at the sites circled in red.

*Acoustic analysis from the NVCP Application Area, Western Australia: July 2023***Table 2.** Summary of detections of the Pilbara Leaf-nosed Bat from Lynas Find (alternating blue highlight distinguishes different sites).

Serial	Night of	Passes	Sunset	Dusk	Dawn	Sunrise	Time first detection	Time last detection	Time since sunset	Time until dawn
450085	14/07/2023	2	14/07/2023 17:39	14/07/2023 18:03	15/07/2023 6:18	15/07/2023 6:42	22:59:42	0:27:25	5H 19M 57S	6H 15M 0S
450085	15/07/2023	2	15/07/2023 17:40	15/07/2023 18:03	16/07/2023 6:18	16/07/2023 6:42	22:57:54	1:43:31	5H 17M 46S	4H 58M 44S
660630	17/07/2023	2	17/07/2023 17:40	17/07/2023 18:04	18/07/2023 6:18	18/07/2023 6:41	22:34:08	1:14:19	4H 53M 15S	5H 27M 32S
660654	14/07/2023	4	14/07/2023 17:39	14/07/2023 18:03	15/07/2023 6:18	15/07/2023 6:42	21:08:43	23:28:39	3H 28M 58S	7H 13M 46S
660654	16/07/2023	1	16/07/2023 17:40	16/07/2023 18:04	17/07/2023 6:18	17/07/2023 6:42	22:22:32	22:22:32	4H 42M 2S	8H 19M 324S
660654	17/07/2023	1	17/07/2023 17:40	17/07/2023 18:04	18/07/2023 6:18	18/07/2023 6:41	21:23:34	21:23:34	3H 42M 41S	9H 18M 17S
660654	18/07/2023	3	18/07/2023 17:41	18/07/2023 18:05	19/07/2023 6:17	19/07/2023 6:41	21:31:09	23:09:21	3H 49M 53S	7H 32M 17S
660654	22/07/2023	3	22/07/2023 17:42	22/07/2023 18:06	23/07/2023 6:16	23/07/2023 6:40	4:39:16	4:40:50	10H 56M 26S	1H 59M 43S
660654	24/07/2023	1	24/07/2023 17:43	24/07/2023 18:07	25/07/2023 6:16	25/07/2023 6:39	23:08:36	23:08:36	5H 24M 59S	7H 31M 19S
660654	25/07/2023	1	25/07/2023 17:44	25/07/2023 18:07	26/07/2023 6:16	26/07/2023 6:39	23:28:16	23:28:16	5H 44M 16S	7H 11M 18S
660654	28/07/2023	1	28/07/2023 17:45	28/07/2023 18:08	29/07/2023 6:15	29/07/2023 6:38	21:51:48	21:51:48	4H 6M 38S	8H 46M 37S

SZ703:



**Figure 2.** Example echolocation call sequence of the Pilbara Leaf-nosed Bat.

## **APPENDIX F: SPECIES BY SITE MATRIX - FLORA**

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NVCP Application Area – Biological Survey  
Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	N01	N02	N03	N04	N05	N06	N07	N08	N09	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24	N25	N26	
<b>Amaranthaceae</b>																											
<i>*Aerva javanica</i>							0.1								0.1												
<i>Alternanthera nodiflora</i>			0.1																								
<i>Ptilotus astrolasius</i>	0.1			0.1	0.1	0.1	0.1		0.1		0.1				0.1	0.2	0.1	0.1	0.1								0.1
<i>Ptilotus axillaris</i>							0.1																				
<i>Ptilotus calostachyus</i>	0.1	0.1		0.1	0.1		0.1		0.1							0.1	0.1	0.1	0.1								
<i>Ptilotus clementii</i>															0.1												
<i>Ptilotus exaltatus</i>																											
<i>Ptilotus gomphrenoides</i>																											
<b>Asteraceae</b>																											
<i>Pluchea tetranthera</i>				0.5			0.1		0.1														0.1				
<i>Pterocaulon sphacelatum</i>							0.1		0.1		0.1																
<i>Streptoglossa bubakii</i>																											
<b>Boraginaceae</b>																											
<i>Euploca chrysocarpa</i>																											
<i>Trichodesma zeylanicum</i>									0.1																		
<b>Caryophyllaceae</b>																											
<i>Polycarpaea corymbosa</i>																											
<b>Cleomaceae</b>																											
<i>Arivela uncifera</i>	0.1	0.1				0.1	0.1								0.1												
<b>Convolvulaceae</b>																											
<i>Bonamia erecta</i>	0.1					0.1	0.1	0.1		0.1					0.1	0.5	0.1	0.1	0.1		0.1						0.1
<i>Bonamia media</i>																						0.1				0.1	
<i>Bonamia pilbarensis</i>		0.1				0.1	0.1			0.1		0.1	0.1														
<i>Evolvulus alsinoides</i>												0.1							0.1								
<i>Operculina aequisepala</i>									0.1						0.1												
<i>Polymeria ambigua</i>			0.1			0.1		0.1		0.1																	
<b>Cucurbitaceae</b>																											
<i>Cucumis argenteus</i>						0.1																					
<b>Cyperaceae</b>																											
<i>Bulbostylis ?turbinata</i>																											
<i>Bulbostylis barbata</i>																			0.1								
<i>Fimbristylis dichotoma</i>																											
<i>Fimbristylis microcarya</i>																										0.1	
<i>Fimbristylis nuda</i>																											
<b>Euphorbiaceae</b>																											
<i>Euphorbia careyi</i>								0.1			0.1	0.1															

NVCP Application Area – Biological Survey  
Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	N01	N02	N03	N04	N05	N06	N07	N08	N09	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24	N25	N26
Euphorbia coghlanii											0.1															
Euphorbia mitchelliana			0.1								0.1		0.1	0.1								0.1				
Euphorbia tannensis																										
Euphorbia vaccaria																										
Fabaceae																										
Acacia acradenia	0.5	0.5	0.1	2	2	2	2		1			6				2	5	2	1			0.5	5	0.1	2	
Acacia adsurgens	5		0.5		2.5	2	0.5	0.1	2	10			1	2			1	1	1	5	5					0.5
Acacia ancistrocarpa																			0.1							
Acacia bivenosa			1							2			2	0.5		2							0.1			0.5
Acacia colei								2					0.5		1											0.1
Acacia cowleana			2					1					2		2			2	5	25	2		0.5			1
Acacia inaequilatera	0.1	0.1	0.1	0.5	1	0.5	0.5	0.5	0.1	0.1		0.1	0.5			0.1	0.1		0.5	0.1		0.5	0.5	0.1	0.1	0.1
Acacia maitlandii																										
Acacia orthocarpa		0.1																				0.5				
Acacia pyrifolia											1		2		0.1											0.5
Acacia spondylophylla																										
Acacia stellaticeps									0.1			2	0.1			0.1						0.1				
Acacia synchronicia																										
Acacia trachycarpa								0.1			1															

NVCP Application Area – Biological Survey  
Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species						N01	N02	N03	N04	N05	N06	N07	N08	N09	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24	N25	N26
<i>Alysicarpus muelleri</i>														0.1															0.1		
<i>Cajanus cinereus</i>			2	1					0.5			2.5	0.5		2											0.1					
<i>Crotalaria cunninghamii</i>												0.5				0.1															
<i>Cullen pallidum</i>																															
<i>Indigofera colutea</i>													0.1		0.1																
<i>Indigofera hirsuta</i>			0.1	0.5						0.1													0.1								
<i>Indigofera monophylla</i>	0.1	0.1	2	0.1		0.1	0.1			0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.1				0.1	0.1			0.1	0.1		0.1	0.1		
<i>Indigofera rugosa</i>				0.1								0.1																		5	
<i>Leptosema anomalum</i>																					2										
<i>Neptunia dimorphantha</i>																															
<i>Neptunia monosperma</i>															0.1																
<i>Petalostylis labicheoides</i>			5										2	2		0.5										0.5					
<i>Rhynchosia minima</i>				0.1					0.1	0.1		0.1		0.1	0.1	0.1			0.1						0.1						
<i>Senna artemisioides</i>																							0.1						0.1	0.1	
<i>Senna artemisioides subsp oligophylla</i>										0.5																					
<i>Senna glutinosa</i>																0.1						0.1			0.1				0.1		
<i>Senna glutinosa subsp chatelainiana</i>																									0.1						
<i>Senna notabilis</i>			0.5						0.1			0.1			0.1							0.1						0.1	0.1		



NVCP Application Area – Biological Survey  
 Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	N01	N02	N03	N04	N05	N06	N07	N08	N09	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24	N25	N26

<b>Phrymaceae</b>																											
<i>Mimulus gracilis</i>																											
<b>Phyllanthaceae</b>																											
<i>Phyllanthus maderaspatensis</i>																											

NVCP Application Area – Biological Survey  
Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	N27	N28	N29	N30	N31	E01	E02	E03	E04	E05	E06	E07	E08	E09	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
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<i>Triodia epactia</i>	20		15		40	25	30	30		2	5	15	10		10		1		2		30					50
<i>Triodia micra</i>		10		20			10		50	30							45	40	10	40	25			15		
<i>Triodia wiseana</i>		20	10	10		10				10	40				2	50						2	35			10
<b>Portulacaceae</b>																										

NVCP Application Area – Biological Survey  
Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species						N01	N02	N03	N04	N05	N06	N07	N08	N09	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24	N25	N26		
<b>Amaranthaceae</b>																																	
<i>*Aerva javanica</i>																																	
<i>Alternanthera nodiflora</i>																																	
<i>Ptilotus astrolasius</i>	0.1	0.1		0.1													0.1	0								0			0		0.01		
<i>Ptilotus axillaris</i>																																	
<i>Ptilotus calostachyus</i>	0.1			0.1		0		0.01						0			0									0.01				0.01			
<i>Ptilotus clementii</i>																						0											
<i>Ptilotus exaltatus</i>																																	
<i>Ptilotus gomphrenoides</i>											0																						
<b>Asteraceae</b>																																	
<i>Pluchea tetranthera</i>						0		0.01																		0.01							
<i>Pterocaulon sphacelatum</i>																										0.01							
<i>Streptoglossa bubakii</i>																		0															
<b>Boraginaceae</b>																																	
<i>Euploca chrysocarpa</i>																	0.01																
<i>Trichodesma zeylanicum</i>																																	
<b>Caryophyllaceae</b>																																	
<i>Polycarpaea corymbosa</i>						0																											
<b>Cleomaceae</b>																																	
<i>Arivela uncifera</i>																																	
<b>Convolvulaceae</b>																																	
<i>Bonamia erecta</i>										0.1										0						0							
<i>Bonamia media</i>																																	
<i>Bonamia pilbarensis</i>	0.1								0.1																								
<i>Evolvulus alsinoides</i>				0.1						0.01																	0		0.1				
<i>Operculina aequisejala</i>																																	
<i>Polymeria ambigua</i>																																	
<b>Cucurbitaceae</b>																																	
<i>Cucumis argenteus</i>				0.1						0																							
<b>Cyperaceae</b>																																	
<i>Bulbostylis ?turbinata</i>																											0						
<i>Bulbostylis barbata</i>				0.1	0.1																												
<i>Fimbristylis dichotoma</i>																																	
<i>Fimbristylis microcarya</i>		0.1														0.01																	
<i>Fimbristylis nuda</i>																															0		
<b>Euphorbiaceae</b>																																	
<i>Euphorbia careyi</i>						0.1																											



NVCP Application Area – Biological Survey  
Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	N27	N28	N29	N30	N31	E01	E02	E03	E04	E05	E06	E07	E08	E09	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
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<i>Senna ferraria</i>																										
<i>Swainsona formosa</i>																										
<i>Tephrosia arenicola</i>				0.1	0.1																					

NVCP Application Area – Biological Survey  
 Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	N27	N28	N29	N30	N31	E01	E02	E03	E04	E05	E06	E07	E08	E09	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
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<b>Phrymaceae</b>																										
<i>Mimulus gracilis</i>																										
<b>Phyllanthaceae</b>																										
<i>Phyllanthus maderaspatensis</i>																										

0.01

NVCP Application Area – Biological Survey  
Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	N27	N28	N29	N30	N31	E01	E02	E03	E04	E05	E06	E07	E08	E09	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
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<i>Triodia epactia</i>			5	5	5		30			5					40		10		55						
<i>Triodia lanigera</i>	35	30	20	40	15		0.5	5		10	1													10	30
<i>Triodia wiseana</i>	10	12	25		40	45	20	50		50	40	40	50	70		50	50	40	40	0.5	30	30			
<b>Portulacaceae</b>																									
<i>Portulaca oleracea</i>									0.01	0															
<b>Proteaceae</b>																									
<i>Grevillea pyramidalis</i>																	0								
<i>Grevillea wickhamii</i>					0.1			0.5				0.01			1	0.1			0.1	0.1	0.2				
<i>Hakea lorea</i>																	0.1								
<b>Rubiaceae</b>																									
<i>Dolichocarpa crouchiana</i>																									
<b>Santalaceae</b>																									
<i>Santalum lanceolatum</i>																									
<b>Solanaceae</b>																									
<i>Solanum cleistogamum</i>							0																		
<i>Solanum diversiflorum</i>									0.1	0															
<i>Solanum phlomoides</i>										0															
<b>Violaceae</b>																									
<i>Afrohybanthus aurantiacus</i>																							0		
<b>Zygophyllaceae</b>																									
<i>Tribulus hirsutus</i>																									
<i>Tribulus suberosus</i>							0.1	0.1	0.5																0.01
* <i>Tribulus terrestris</i>																									
* denotes introduced flora.																									
highlight denotes flora not previously rec																									

NVCP Application Area – Biological Survey  
 Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	E21	E22	E23	E24	E25	E26	E27	E28	E29	Op Col				
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Amaranthaceae														
Pillara Minerals Limited														
<del>Amaranthaceae</del>														
Ptilotusastrolasius	0							0.1						



NVCP Application Area – Biological Survey  
Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	E21	E22	E23	E24	E25	E26	E27	E28	E29	Op Col				
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<i>Senna ferraria</i>														
<i>Pharbitis nil</i>														
<i>Swainsona formosa</i>								0.1						
<i>Tephrosia arenicola</i>								0.1						

NVCP Application Area – Biological Survey  
Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	E21	E22	E23	E24	E25	E26	E27	E28	E29	Op Col				
Phrymaceae														
<del>Mitella</del>														
Phyllanthaceae														
<del>Phytolacca</del>														
Plantaginaceae														
Stemodiagrossa														
Poaceae														
<del>Alopecurus</del>					0.01									
<del>Alopecurus</del>														
<del>Alopecurus</del>														
<del>Cyperus</del>														
<del>Cyperus</del>														
Chrysopogonfallax														
<del>Cynopogon</del>														
<del>Cymbopogon</del>														
<del>Taraxacum</del>														
Enneapogoncaerulescens														
<del>Trigonotis</del>														
Eragrostiseriopoda														
Eragrostistenellula														
Eragrostisxerophila														
<del>Festuca</del>														
<del>Festuca</del>		0.01			0.02									
<del>Festuca</del>														
<del>Festuca</del>									X					
Heteropogoncontortus														
Iseilemamembranaceum					0.01									
<del>Ischaemum</del> sp														
<del>Ischaemum</del>							0.1							
<del>Ischaemum</del>														
<del>Stenopogon</del>														
<del>Stenopogon</del>														
Sporoboluscaroli														
<del>Taraxacum</del>														
Triodiaangusta														
<del>Triodia</del>														
Triodiachichesterensis (P3)				35			10							

NVCP Application Area – Biological Survey  
Appendix F – Flora Species by Site Matrix and Species Accumulation Curve

Species	E21	E22	E23	E24	E25	E26	E27	E28	E29	Op Col					
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Total		5			30		20	10							
Bara Minerals Limited	30	20	2	50	30	65		10	40						
Triodiawiseana			5				20	20							
Portulacaceae															

## APPENDIX G: FAUNA LIKELIHOOD OF OCCURRENCE ASSESSMENT - FAUNA

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
-- Birds --					
Actitis hypoleucos	Common Sandpiper	MI	MI	<p>Edge of sheltered waters salt or fresh (e.g. estuaries, mangrove creeks, rocky coasts, near-coastal saltlakes (including saltwork ponds), river pools, lagoons, claypans, drying swamps, flood waters, dams and sewage ponds. Preferring situations where low perches are available (Johnstone and Storr, 1998).</p> <p>Shallow, pebbly, muddy or sandy edges of rivers and streams coastal to far inland; dams, lakes, sewage ponds; margins of tidal rivers, waterways in mangroves or saltmarshes; mudflats: rocky or sand beaches; causeways, riverside lawns, drains, street gutters. (Pizzey and Knight, 2012).</p>	<p>Unlikely. Perching opportunities available in the creeks however water pooling is limited and ephemeral.</p> <p>Two records 20 km to the west from a semipermanent pool in a tributary of the Turner River.</p>

BIOLOGICAL SURVEY – PILGANGOORA  
PROJECT

Apus pacificus	Fork-tailed Swift	MI	MI	<p>Broadly distributed aerial species that is not specifically limited to any particular habitat type.</p> <p>Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. (Pizzey and Knight, 2012).</p> <p>Occurs over dry or open habitats comprising of riparian woodland, low scrub, heathland, or saltmarsh, also grasslands and sandplains with spinifex. (Morcombe, 2011).</p>	<p>Possible.</p> <p>Listed by the PMST as Likely to occur. Seven records are reported from 1998 – 2014 over a wide variety of habitats.</p> <p>This species is distributed across Australia. It is an aerial species that rarely comes to land. Individuals would not be specifically dependant on any habitats present in the Survey Area.</p>
Calidris acuminata	Sharp-tailed Sandpiper	MI	MI	<p>Scarce to moderately common (much more plentiful near coasts than in interior). (Johnstone and Storr, 1998).</p>	<p>Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools.</p>

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
				<p>Tidal mudflats, saltmarshes, mangroves; shallow fresh, brackish or saline inland wetlands; floodwaters, irrigated pastures and crops; sewage ponds, saltfields. Widespread summer migrant to coastal and inland Australia. (Pizzey and Knight, 2012).</p>	<p>Seasonally inundated areas limited to the gilgai claypans.</p> <p>No records in the local area. PMST considers the species May occur.</p>

BIOLOGICAL SURVEY – PILGANGOORA  
PROJECT

Calidris ferruginea	Curlew Sandpiper	CR	CR, MI	<p>Mainly shallows of estuaries and near-coastal saltlakes (including saltwork ponds) and drying near-coastal freshwater lakes and swamps. Also beaches and near-coastal sewage ponds. (Johnstone and Storr, 1998)</p> <p>Tidal mudflats; saltmarsh, saltfields; fresh, brackish or saline wetlands; sewage ponds. (Pizzey and Knight, 2012)</p>	<p>Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans.</p> <p>No records in the local area. PMST considers the species May occur.</p>
Calidris melanotos	Pectoral Sandpiper		MI	<p>Mainly fresh waters (swamps, lagoons, river pools, irrigation channels and sewage ponds); also, samphire flats around estuaries and saltlakes. (Johnstone and Storr, 1998)</p> <p>Shallow fresh waters, often with low grass or other herbage; swamp margins, flooded pastures, sewage ponds, occasionally tidal areas, saltmarshes. (Pizzey and Knight, 2012)</p>	<p>Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans.</p> <p>No records in the local area. PMST considers the species May occur.</p>
Charadrius veredus	Oriental Plover	MI	MI	<p>Open plains; bare, rolling country, often far from water; ploughed land; muddy or sandy wastes near inland swamps or tidal mudflats; bare claypans; margins of coastal marshes; grassy fields and lawns. (Pizzey and Knight, 2012).</p>	<p>Possible. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans.</p> <p>One local historic record from an area that is now cleared.</p>

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		

BIOLOGICAL SURVEY – PILGANGOORA  
PROJECT

Erythrotriorchis radiatus	Red Goshawk	VU	VU	Well-wooded country. (Johnstone and Storr, 1998)  Open forests, woodlands, especially near rivers, wetlands; rainforest fringes. (Pizzezy and Knight, 2012)	Unlikely. No records are known from the Pilbara and not within the range of the species known distribution (BirdLife International 2022, TSSC 2015).
Falco hypoleucos	Grey Falcon	VU	VU	Mainly lightly wooded and coastal riverine flats. (Johnstone and Storr, 1998)  Lightly treed and inland plains; gibber deserts, sandridges, pastoral lands, timbered watercourses; seldom in driest deserts (Pizzezy and Knight, 2012).	Likely. The Survey Area is potentially suitable foraging habitat.  Listed by EPBC as Known to Occur in the feature area and five records since 2012 occur near the Turner River and larger tributaries. The closest record is 10 km south west of the Survey Area.  All habitats in the Survey Area are suitable foraging habitat for this species.
Falco peregrinus	Peregrine Falcon	OS	-	Mainly about cliffs along coasts, rivers and ranges, and about wooded watercourses and lakes (Johnstone and Storr, 1998).  Cliffs, gorges, timbered watercourses, environs of rivers, wetlands, plains, open woodlands, pylons, spires, buildings. (Pizzezy and Knight, 2012)	Likely. All habitats are suitable.  One record from 2002 is nearby the Survey Area. This location is now the site of the Pilgangoora mine.

BIOLOGICAL SURVEY – PILGANGOORA  
PROJECT

Glareola maldivarum	Oriental pratincole	MI	MI	Feeding in air and roosting on bare ground beside water, e.g. tidal flats and floodwaters (Johnstone and Storr, 1998).  Plains; shallow wet and dry edges of open bare wetlands; tidal mudflats, beaches (Pizzey and Knight, 2012).	Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans.  No records in the local area. PMST considers the species May occur.
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Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
Hirundo rustica	Barn swallow	MI	MI	Mainly towns and wetlands (sewage and saltworks ponds, river pools, swamps, tidal creeks and reservoirs). (Johnstone and Storr, 2004)  Open country; agricultural land, especially near water; railyards, towns, overhead wires. (Pizzey and Knight, 2012)	Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans.  No records in the local area. PMST considers the species May occur.

BIOLOGICAL SURVEY – PILGANGOORA  
PROJECT

Motacilla cinerea	Grey Wagtail	MI	MI	<p>Mainly banks and rocks in fast-running fresh water habitats; rivers, creeks, streams and around waterfalls, both in forest and open country; but occurs almost anywhere during migration. Flits from rock to rock, and often enters water after insects (or performs flycatcher sallies after them). (Johnstone and Storr, 2004)</p> <p>In Australia, near running water in disused quarries; sandy, rocky streams in escarpments and rainforests; sewage ponds, ploughed fields, airfields. (Pizzey and Knight, 2012)</p>	<p>Unlikely. The drainage lines in the Survey Area are highly ephemeral and would only flow for brief period of time. Drainage lines are in plains habitat where fast running channel flow is limited. There are no previous records in the local area and the species is uncommonly recorded in Australia.</p> <p>No records in the local area. PMST considers the species May occur.</p>
Motacilla flava	Yellow Wagtail	MI	MI	<p>Damp short-grass flats: rice stubbles and edge of swamps, sewage ponds, bore overflows, grazed or mowed grass and irrigated areas. (Johnstone and Storr, 2004)</p>	<p>Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans.</p> <p>No records in the local area. PMST considers the species Likely to occur.</p>

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		

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Numenius madagascariensis	Eastern Curlew	CR	CR, MI	<p>Mainly tidal mudflats; also reef flats, sandy beaches and rarely near-coastal lakes (including saltwork ponds). (Johnstone and Storr, 1998)</p> <p>Estuaries, tidal mudflats, sandspits, saltmarshes, mangroves; occasionally fresh or brackish lakes; bare grasslands near water. (Pizzey and Knight, 2012)</p>	<p>Unlikely, prefers saline habitats. Seasonally inundated areas limited to the gilgai claypans..</p> <p>Listed in the PMST as suitable habitat may occur. No local database records.</p>
Pezoporus occidentalis	Night Parrot	CR	EN	<p>Treeless or sparsely wooded spinifex <i>Triodia</i> spp. near water (including artesian bores) (Johnstone and Storr, 1998).</p> <p>Seeding spinifex on stony rises, breakaway country, sandy lowlands; shrubby glasswort, chenopods; succulents on flats around salt lakes; flooded claypans saltbush, bluebush, bassia associations (Pizzey and Knight, 2012).</p>	<p>Possible. No local records. Habitat modelling includes the Survey Area at the extremity of the species potential extent. Foraging resources are limited.</p>
Rostratula australis	Australian Painted- Snipe	EN	EN	<p>Common in south and north-east Kimberley swampy plains before their degradation by cattle, but only five records since 1909. Rare summer visitor to North-west, single birds recorded at man-made ponds in the Hamersley and Ophthalmia Ranges in December and January and a male collected at Carnarvon in November. In arid interior a female about to lay collected at Brockman Creek in August 1896 (Johnstone and Storr, 1998).</p> <p>Well-vegetated shallows and margins of wetlands, dams, sewage ponds; wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub, open timber. (Pizzey and Knight, 2012)</p>	<p>Unlikely. No habitat occurs in the Survey Area. Seasonally inundated areas limited to the gilgai claypans where no dense vegetation is available. Vegetation fringing creeks is too open to provide suitable cover.</p> <p>No records in the local area. PMST considers the species May occur.</p>

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-- Mammals --

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
Dasyercus blythi	Brush-tailed Mulgara	P4	-	Inhabits spinifex grasslands and burrows on the flats between low sand dunes (Van Dyck and Strahan, 2008).	Likely. Stony Plains habitat is suitable.  Multiple database records from 2012 are less than 15 km to the southwest.
Dasyurus hallucatus	Northern Quoll	EN	EN	The Northern Quoll will usually den in hollow tree trunks (Hill and Ward, 2010) or in small caves and crevices in rocky outcrops.	Present. Denning and foraging habitat is available in Rocky Outcrop habitat, however this is limited to a small areas. Foraging and Denning habitat is available in the Major Drainage Line habitat, however no evidence of Northern Quoll was recorded there.  Confirmed to occur in the Rocky Outcrop Habitats. Know to occur in the local area, with records restricted to Rocky Outcrop habitat.

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Lagorchestes conspicillatus leichardti	Spectacled HareWallaby	P4	-	Open Acacia forests, open woodlands and tall shrubland tussock or hummock grasslands (Van Dyck and Strahan, 2008).	overPresent. Multiple historic records nearby. Suitable shelter habitat in the Shallow Drainage Depression and Creeks Habitat.  A scat suspected to belong to this species was recorded during survey.
Macroderma gigas	Ghost Bat	VU	VU	Their distribution is influenced by the availability of suitable caves and mines for roost sites (Churchill 2008). In the Pilbara, ghost bats prefer to forage on productive plain areas with thin mature woodland over patchy or clumped tussock or hummock grass (Triodia spp.) on sand or stony ground (Bat Call WA 2021a).	Likely. Foraging habitat available across the Survey Area. No roosting habitat available. The Survey Area is within foraging range of database record locations.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
Macrotis lagotis	Bilby	VU	VU	Occupy a variety of inland habitats including grass and stony downs country on cracking clays, desert sandplains and dune fields of laterite with hummock grassland and massive red earths with Acacia shrubland (Van Dyck and Strahan, 2008).	Possible. Suitable habitat includes the Stony Plains habitat.  Historic record nearby, recent records 16 km to the west.

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Pseudomys chapmani	Western Pebblemound Mouse	P4	-	Found on stony hillsides with hummock grassland (Menkhorst and Knight, 2009)	Present. Mounds located in the Stony Plains and Low Hills habitats.
Rhinonictoris aurantia	Pilbara Leaf-Nosed Bat	VU	VU	Dependant on deep and complex cave systems. Roosting and foraging habitats defined by TSSC (2016) and Bat Call WA (2021b)	Present. No roosting habitat available. Foraging habitat is present.
Sminthopsis longicaudata	Long-tailed Dunnart	P4		A specialist rock dwelling species (Freeland et al. 1988). It prefers exposed rock and stony soils with hummock grasses and shrubs, on flat-topped hills, lateritic plateaus, sandstone ranges and breakaways.	Unlikely. No suitable habitat.
-- Reptiles --					
Anilius ganei	Gane's blind snake (Pilbara)	P1		Known from widely separated areas between Newman and Pannawonica. Possibly associated with moist gorges and gullies (Wilson and Swan 2008).	Unlikely. Suitable habitat unlikely to be present as drainage lines are small and highly ephemeral. Limited termite mounds present for foraging resource.
Liasis olivaceus subsp. baronni	Pilbara Olive Python	VU	VU	Recorded in areas with gorges and escarpments in close proximity to water holes (Doughty et al. 2011). During the cooler months they will typically hide in caves, crevices and	Unlikely. No suitable habitat.  There are no gorges or significant water filled gullies in the Survey Area. No permanent or semi-
Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence

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	BC Act	EPBC Act		
			fissures away from water sources. However, in the warmer months they become active and tend to stay near rocky outcrops and water.	permanent pools in the creeks. Caves, crevices or fissures are limited to a small area that has no proximity to permanent pools.
Liopholis kintorei	Great Desert Skink	VU	<p>A nocturnal burrowing and social lizard, living in family groups and creating extensive burrows that are typically 1 m deep and up to 10 m in diameter with multiple entrances (McAplin 2001).</p> <p>Typically occupy hummock grass sandplains and some adjacent dunefield swales, though they can occur in a variety of habitats (McAplin 2001). Vegetation usually consists of hummock grassland (<i>Triodia basedowii</i>, <i>T. pungens</i> and <i>T. schinzii</i>), with some scattered shrubs and occasional trees (e.g. <i>Acacia</i> spp., <i>Eucalyptus</i> spp., <i>Hakea</i> spp., <i>Grevillea</i> spp. and <i>Allocasuarina decaisneana</i>) (McAlpin 2001). Tend to utilise areas of habitat that have been burnt within the previous 2-15 years (McAplin 2001; Morre et al. 2015).</p>	<p>Unlikely.</p> <p>No records in the local area. PMST considers the species May occur in the buffer area only. The area where suitable habitat may occur is 10 km to the east of the Survey Area and separated by a rocky range.</p>

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