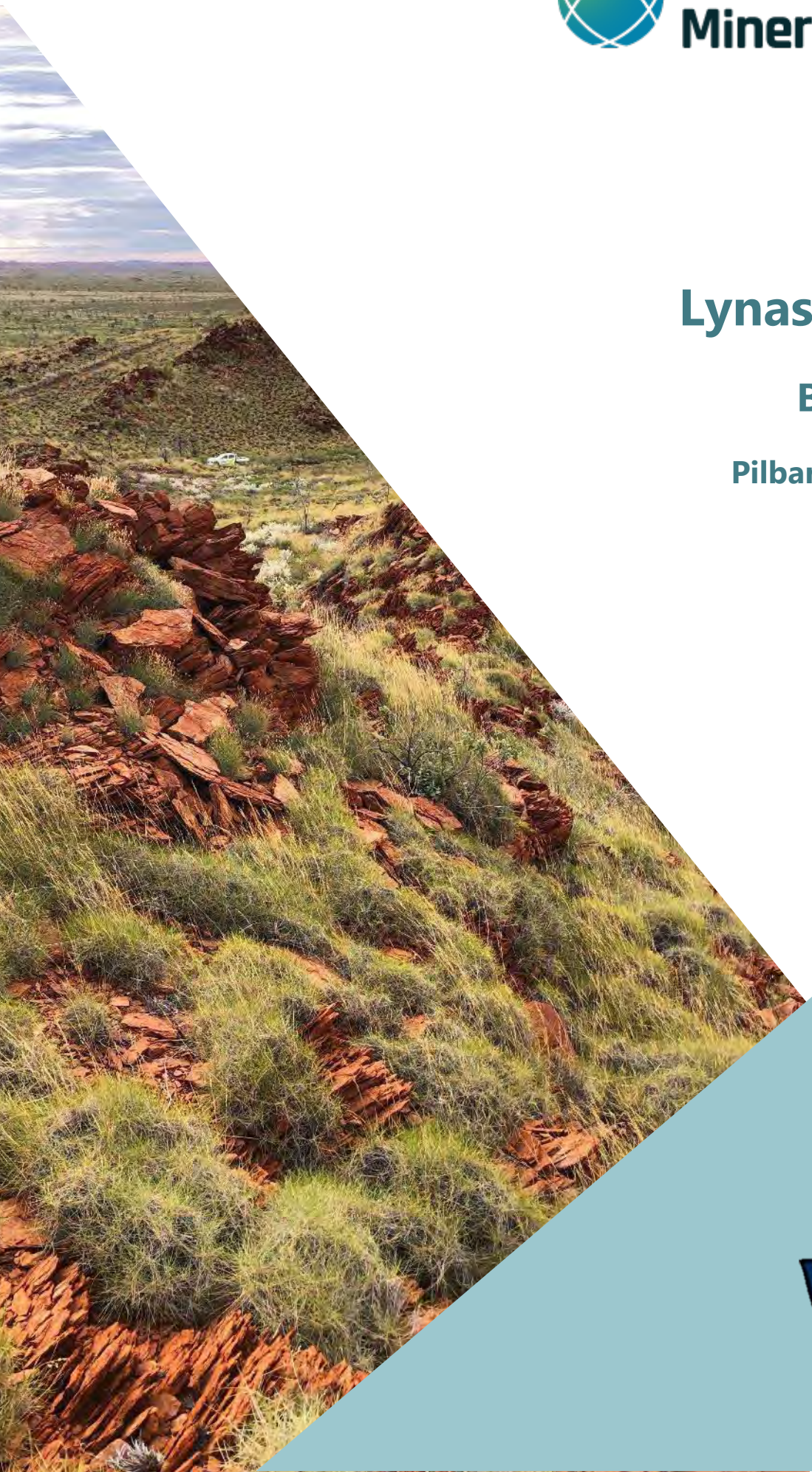

Lynas Find Project

Biological Survey

Pilbara, Western Australia

Prepared on behalf of
Ecotec (WA) Pty Ltd for Pilbara Minerals Ltd by
Animal Plant Mineral Pty Ltd.

October 2022

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EXECUTIVE SUMMARY

Animal Plant Mineral Pty Ltd was commissioned by Ecotec (WA) Pty Ltd to undertake a Detailed Flora and Vegetation and Targeted Terrestrial Vertebrate Fauna survey of the Pilbara Minerals Lynas Find deposit. The Lynas Find deposit is a possible future expansion for the Pilgangoora lithium project. The Study Area is 394 hectares and is located 84 km south-east of Port Hedland in the Pilbara region of Western Australia.

Field survey was conducted in August 2022. In the six months prior to survey, 358.2 mm of rainfall was recorded, a total greater than the long-term average of 278.8 mm for the same period. Furthermore, the rainfall in May was 123.8 mm which is almost 4.5 times higher than the long-term average of 52.3 mm for the same period. No adverse weather conditions occurred that would impact the results of the survey. The timing of the flora and vegetation field survey was within the recommended Supplementary survey period for the region. Survey timing was within that recommended for birds, amphibians and mammals. Conditions are generally unsuitable for reptiles in winter.

Nine vegetation types are described for the Study Area. One vegetation type is synonymous with that described for baseline survey for the Pilgangoora project, the remaining eight are different from previously described. 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 cattle grazing and vegetation clearing for mining activity. Completely Degraded areas comprise 73 ha or 18.5% of the Study Area.

No Threatened flora are known to occur in the Study Area or were recorded during the survey. Two Priority 3 flora were recorded – *Rothia indica* and *Triodia chichesterensis.* An additional seven Priority flora species identified in the desktop study also possibly occur, due to the presence of suitable habitat.

No Declared weeds or Weeds of National Significance were recorded. Three weeds were recorded – *Cenchrus ciliaris*, *Cenchrus setiger* and *Aerva javanica*. All three recorded weeds are assessed as a having a High ecological impact and a Rapid rate of invasiveness under the Pilbara Weed Prioritisation Process.

Six fauna habitats are described for the Study Area:

- FH1 – Boulder rock outcrops (4%)
- FH2 – Platy rock outcrops (1%)
- FH3 – Low hills (54%)
- FH4 – Sandy plains (3%)
- FH5 – Stony gullies (2%)
- FH6 – Stony plains (17%)

The remaining area is Disturbed.

Previous database records and surveys have recorded the Northern quoll and Pilbara leaf-nosed bat within the Study Area. Database records from the local area indicate that an additional nine conservation significant fauna may possibly occur.

Targeted survey for conservation significant fauna identified:

- A population important for the long-term survival of the Northern quoll;

- Habitat critical to the survival of the Northern quoll in three categories:
  - rocky habitat such as ranges (habitat FH1);
  - areas of native vegetation within 1 km of FH1; and
  - dispersal and foraging habitat associated with or connecting the population within FH1 to other nearby populations or foraging habitats, assumed to be defined by geological unit A-KEe-xmws-mus;
- Pilbara leaf-nosed bat is present within the Study Area but the quality of habitat is limited to Moderate value foraging over FH1 and FH5 and Low value elsewhere, with no roosting habitat present;
- Western pebble-mound mouse is present in the Study Area and Targeted Search identified mound locations. Suitable habitat was within the FH3 and FH6 habitats but was confined to the northern central section of the Study Area;
- Foraging habitat suitable for the Grey Falcon occurs within the Study Area. This may be used by populations known to occupy the Turner River area 23 km to the west; and
- Possible habitat for the Night parrot, Greater bilby, Ghost bat, Brush-tailed mulgara, Spectacled hare-wallaby, Long-tailed dunnart and Pin-striped finesnout ctenotus but no evidence of their presence was recorded.

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PROJECT TERMS

Abbreviation	Meaning
The Project	Lynas Find Project

UNITS OF MEASURE

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

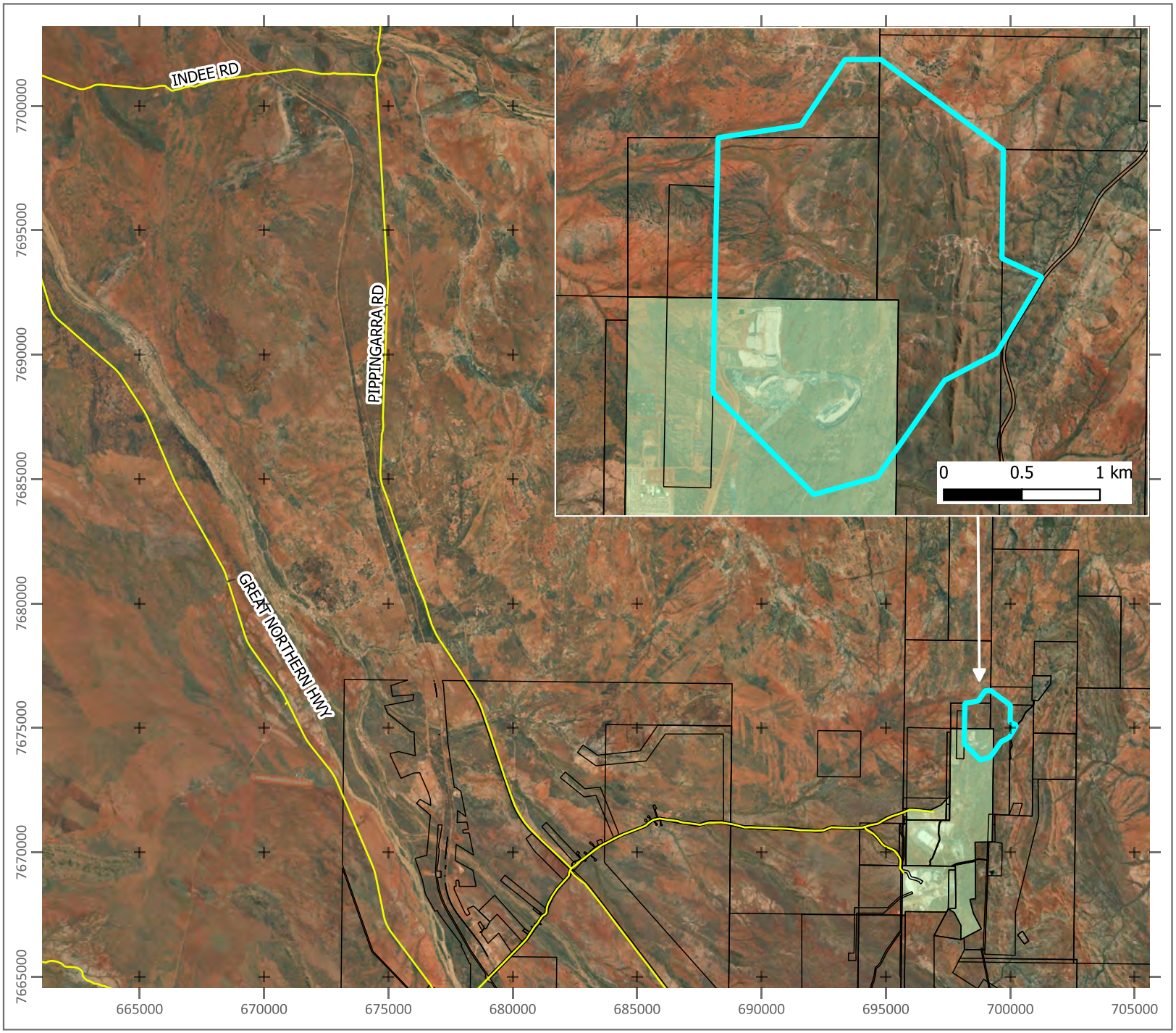
LIST OF ABBREVIATIONS

Abbreviation	Meaning
APM	Animal Plant Mineral Pty Ltd
BC Act	*Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
DBCA	Department of Biological Conservation and Attractions
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environment Regulation
EN	Endangered
Ecotec	Ecotec (WA) Pty Ltd
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Areas
IBRA	Interim Biogeographic Regionalisation for Australia
MI	Migratory
MNES	Matters of National Environmental Significance
OS	Other Specifically Protected
PEC	Priority Ecological Community
P	Priority
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 Ecotec (WA) Pty Ltd (**Ecotec**) to undertake a Detailed Flora and Vegetation and Targeted Terrestrial Vertebrate Fauna survey of the Pilbara Minerals Lynas Find deposit (**the Project**), located 84 km south-east of Port Hedland in the Pilbara region of Western Australia (**WA**) (Figure 1-1). The Study Area is 394 hectares (**ha**) including 44 ha previously cleared as part of ongoing mining operations for the Pilgangoora lithium project. The Lynas Find deposit is a possible future expansion for the Pilgangoora lithium project.



Legend

- Study Area
- Roads
- Pilbara Minerals Limited: Pilgangoora Operations
- Pilbara Minerals Limited Tenements
- Project Location

Scale: @ A4
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0 2.5 5 km

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

Author: TB Approved: EH Date: 19/07/2022

Project Location

Prepared for:
Pilbara Minerals

Figure: 1-1

1.2 SCOPE OF WORK

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 scope of work was to conduct a detailed flora and vegetation survey, 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:

- Determine vegetation associations on the site;
- Identify species present on site including T and P Flora;
- Locate and identify, as far as possible, weed species, in particular any Declared Weeds;
- Map the vegetation and locations of T and P species; 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 species previously determined as present on-site including T and P Fauna (under the provisions of the *Biodiversity Conservation Act 2016* (**BC Act**) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (**EPBC Act**);
- 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;
- Record incidental fauna observations;

- Conduct spotlight survey, without physical capture/collection of individuals; and
- Record habitats suitable for T and P fauna

2 BACKGROUND AND SUPPORTING INFORMATION

2.1 RELEVANT LEGISLATION

2.1.1 Commonwealth Government EPBC Act

The Commonwealth 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 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 where 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 (APB) under the BAM Act 2007 (WA). 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 impacts;
- 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 2020a)
- 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**) 2010a).
- Survey Guidelines for Australia's T Birds (DEWHA 2010b);
- Survey Guidelines for Australia's T Mammals (Department of Sustainability Environment Water Population and Communities (**DSEWPAC**) 2011a);
- Survey Guidelines for Australia's T Reptiles (DSEWPAC 2011b); 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)
- Instructions for the preparation of data packages for IBSA (EPA 2020b).

2.2 LAND USE

The majority of the Study Area lies within the Wallareenya pastoral lease, and a small portion of the eastern side of the Study Area lies within the Strelley pastoral lease. The current land use is cattle grazing.

Active mining operations and exploration activities occur within the Study Area. Unrehabilitated drill pads and exploration tracks are present and a 45 ha area has been cleared by Pilbara Minerals as part of the Pilgangoora Project.

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 Study Area. Port Hedland Airport has recorded rainfall from 1942 – 2022 (80 years), and temperature from 1948 – 2022 (74 years). The 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 to 27.4°C in July. Monthly mean rainfall ranges from 90.2 mm in February to 0.9 mm in October, with a mean annual rainfall of 317.7 mm (BoM 2022).

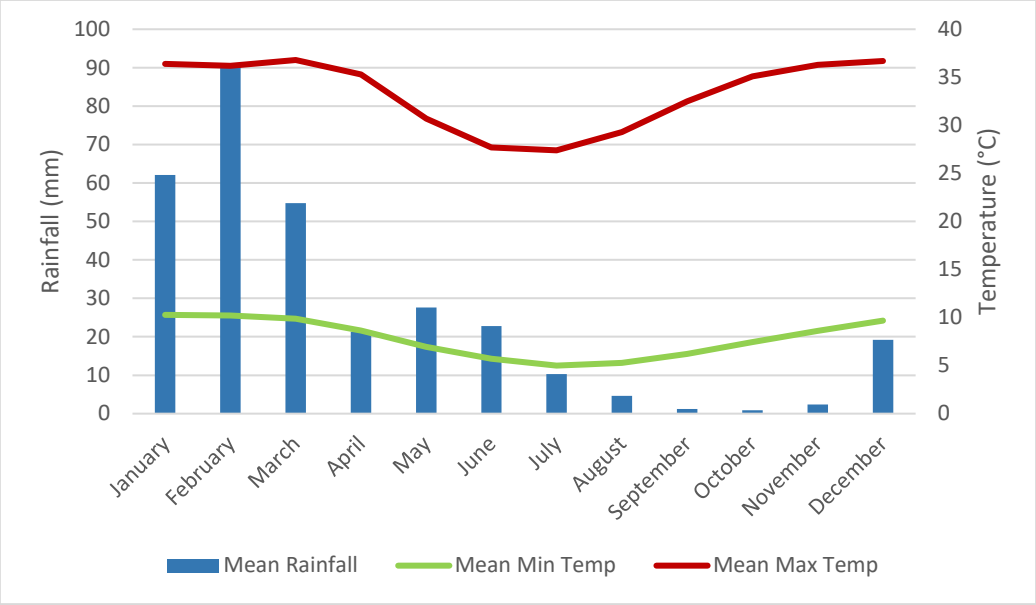


Figure 2-1. Temperature and rainfall averages for Port Hedland Airport weather station (Station No. 004032) (BoM 2022)

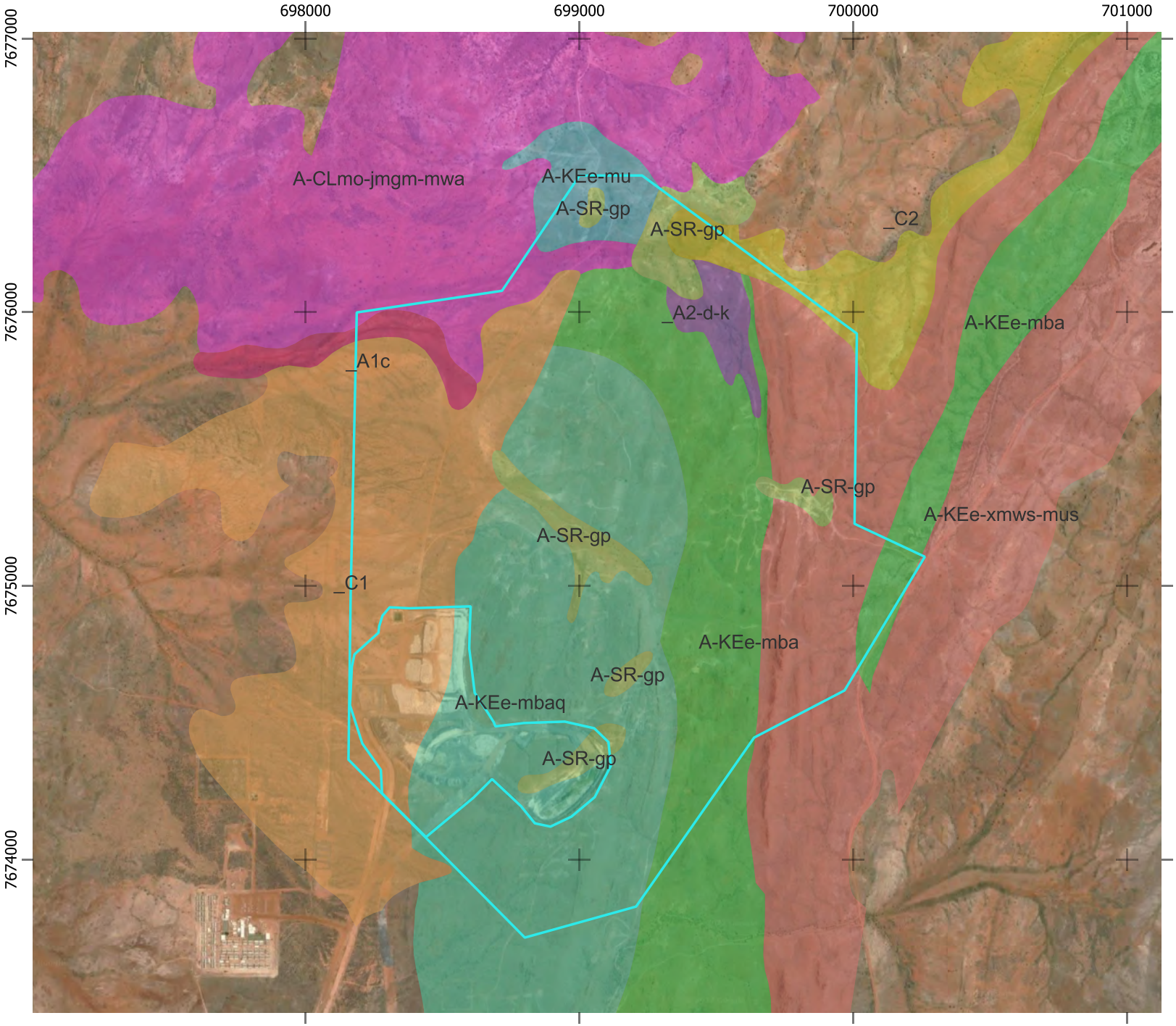
2.4 GEOLOGY

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 Study Area is within the Wodgina (2655) map area and contains the following 10 geological formations:

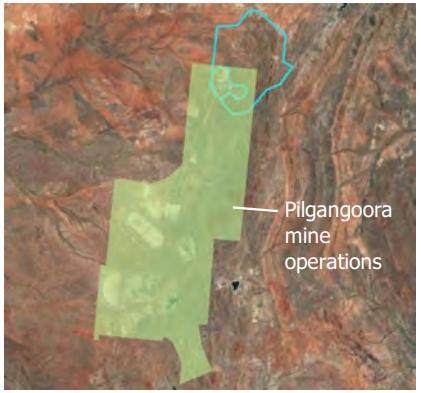
- _A1c – Alluvial unit; Sand, silt, and gravel in active drainage channels; includes clay, silt and sand in poorly defined drainage courses on floodplains; unconsolidated;
- _A2-d-k - Alluvial unit; Partly consolidated alluvial gravel, sand and silt; local carbonate cement; dissected by present-day drainage;
- _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;
- A-CLmo-jmgm-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-KEe-mba; Euro Basalt; Amphibolite and metabasalt; includes local metadolerite and metamorphosed komatiitic basalt; locally schistose;
- A-KEe-mbaq; Euro Basalt; Silicified amphibolite and metabasalt;
- A-KEe-mu; Euro Basalt; Metamorphosed ultramafic rock;
- A-KEe-xmws-mus; Euro Basalt; Mafic and ultramafic schists; and
- A-SR-gp – Split Rock Supersuite; Pegmatite.

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



Legend

- Study Area
- _A1c
- _A2-d-k
- _C1
- _C2
- A-CLmo-jmgm-mwa
- A-KEe-mba
- A-KEe-mbaq
- A-KEe-mu
- A-KEe-xmws-mus
- A-SR-gp



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Projection: Transverse Mercator

Author: EH Approved: ML Date: 25/10/2022

Geology of the Study Area

Prepared for:
Pilbara Minerals

Figure: 2-2

The soils of the Study Area were mapped by Tille (2006). The Study 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.

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 Study Area falls within two soil landscape systems, as listed in Table 2-1 and illustrated in Figure 2-3.

Table 2-1. Land Systems of the Study Area

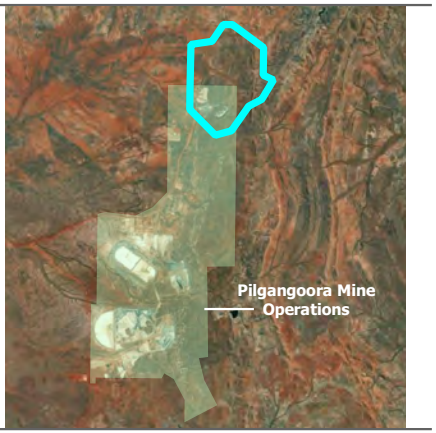
Land System	Geology	Description
Macroy	Level to gently undulating stony and gritty surfaced plains with occasional granite tor fields and domes and closely to moderately spaced dendritic tributary drainage floors, relief up to 25 m	Stony plains and occasional tor fields based on granite supporting hard 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

Legend

- Study Area
- Cleared

Land Systems

- Macroy
- Talga



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

Author: TB Approved: EH Date: 19/07/2022

Land Systems

Prepared for:
Pilbara Minerals

Figure: 2-3

2.7 REGIONAL VEGETATION

The Study Area is located within the Eremaean Botanical Province and contains one pre-European Beard vegetation association of the George Ranges System, and one vegetation association of the Abydos Plain – Chichester System as shown in Figure 2-4. 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 the Study Area have over 99% pre-European Vegetation extent remaining. Conservation significance ranking of vegetation associations occurring within the Study Area are of 'Least Concern'.

Table 2-2 Pre-European Beard Vegetation Associations within the Study Area

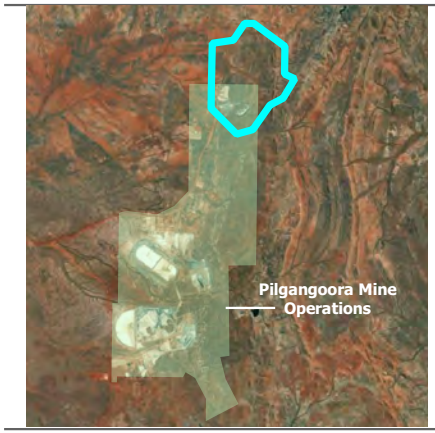
Unit	Vegetation Description	Pre-European Extent (ha)	Current Extent (ha)	Pre-European Extent Remaining (%)	Current Extent within DBCA Managed Lands (%)
82	Hummock grassland with scattered bloodwoods and snappy gum *Triodia* spp., *Corymbia dichromophloia, Eucalyptus leucophloia*	2,565,901	2,553,206	99.51	11.57
93	Hummock grassland with scattered shrubs or mallee *Triodia* spp. *Acacia* spp., *Grevillea* spp. *Eucalyptus* spp	3,044,310	3,040,641	99.88	1.96

Legend

- Study Area
- Cleared

Vegetation Association

- 82
- 93



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

Author: TB Approved: EH Date: 19/07/2022

Pre-European Beard Vegetation Associations

Prepared for:
Pilbara Minerals

Figure: 2-4

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 Western Australia'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 (**CAPAD**) returned no conservation estates located within 50 km of the Study Area. The nearest gazetted terrestrial conservation estate is Mungaroona Range, 85 km to the south-west of the Study Area.

2.8.2 Environmentally Sensitive Areas

Environmentally Sensitive Areas (**ESA**) are areas that are defined by the 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 metres (**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 Gnangara 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.

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 Study 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.

Environmentally Sensitive Areas can be viewed on the DWER clearing permit system map viewer. There are no ESA's within the Study Area.

3 METHODOLOGY

3.1 DESKTOP STUDY

The desktop study provides background information on the known attributes of flora, vegetation and fauna of the Study 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 from the area, or documented records are historic. Therefore, for this search, a search area of 30 km from a central coordinate of 699160, 7675100 (GDA 1994, MGA Zone 50) was applied to ensure relevancy for the habitats present within and adjacent to the Study Area.

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 PECs. A 50 km buffer was applied to the fauna, flora and threatened and priority ecological community search from a central coordinate of 699160, 7675100 (GDA 1994, MGA Zone 50).

Introduced flora and fauna records from within 30 km were obtained from the NatureMap database.

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	50 km radius	DBCA	Figure 4-2; Section 4.1.2
	30 km radius	PMST	Appendix B
Threatened Flora	50 km radius	DBCA	Figure 4-1; Section 4.1.1
	30 km radius	PMST	Appendix B
Introduced Flora	30 km radius	NatureMap	Section 4.1.3
Threatened Fauna	50 km radius	DBCA	Figure 5-1; Section 5.1.1
	30 km radius	PMST	Appendix B
Introduced Fauna	30 km radius	NatureMap	Section 5.1.2

3.1.2 Literature Review

Flora, vegetation and terrestrial vertebrate fauna surveys have been conducted in the local area for the Pilgangoora Project, including the south-west portion of the Study Area.

The following local surveys were reviewed, and the results incorporated into the Desktop Study:

- Baseline Vertebrate Fauna Survey, Pilgangoora. Prepared on behalf of Pilbara Minerals Limited by 360 Environmental. Publication date: May 2016.
- Pilgangoora Access Road Borrow Pits - Flora and Vegetation Assessment. Prepared on behalf of Pilbara Minerals Limited by MMWC Environmental Pty Ltd. Publication date: July 2016.
- Pilgangoora Project Area – Flora, Vegetation and Fauna Assessment. Prepared on behalf of Pilbara Minerals Limited by MMWC Environmental Pty Ltd. Publication date: July 2016
- Pilgangoora Project – Stage 2 Expansion Desktop Environmental Assessment. Prepared on behalf of Pilbara Minerals Limited by Ecologia Environmental. Publication date: 26 October 2018.
- Pilbara leaf-nosed bat Survey, Pilgangoora Prepared for Pilbara Minerals by 360 Environmental November 2015
- Pilbara leaf-nosed bat Roost Survey, Pilgangoora Prepared for Pilbara Minerals by 360 Environmental February 2016
- Northern quoll survey on mining tenement M45/1266. Prepared for Pilbara Minerals by Terrestrial Ecosystems, January 2020.

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 Study 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 Study Area
Likely	Suitable habitat is present in the Study Area and the species has previously been recorded within 15 km
Possible	Suitable habitat is present within the Study Area and the species has previously been recorded between 15 – 30 km of the Study Area
Unlikely	No suitable habitat is present in the Study Area

3.2 FIELD SURVEY

3.2.1 Survey Timing and Personnel

The terrestrial vertebrate field survey was carried out by Dr Mitchell Ladyman. The flora and vegetation field survey was undertaken by Dr Neil Pettit assisted by Mr Danah Blache.

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
8th – 13th August 2022	Dr Mitchell Ladyman	20+ years	Terrestrial vertebrate fauna survey
	Dr Neil Pettit	25+ years	Flora and vegetation survey
	Danah Blache	under instruction	

3.2.2 Survey Conditions

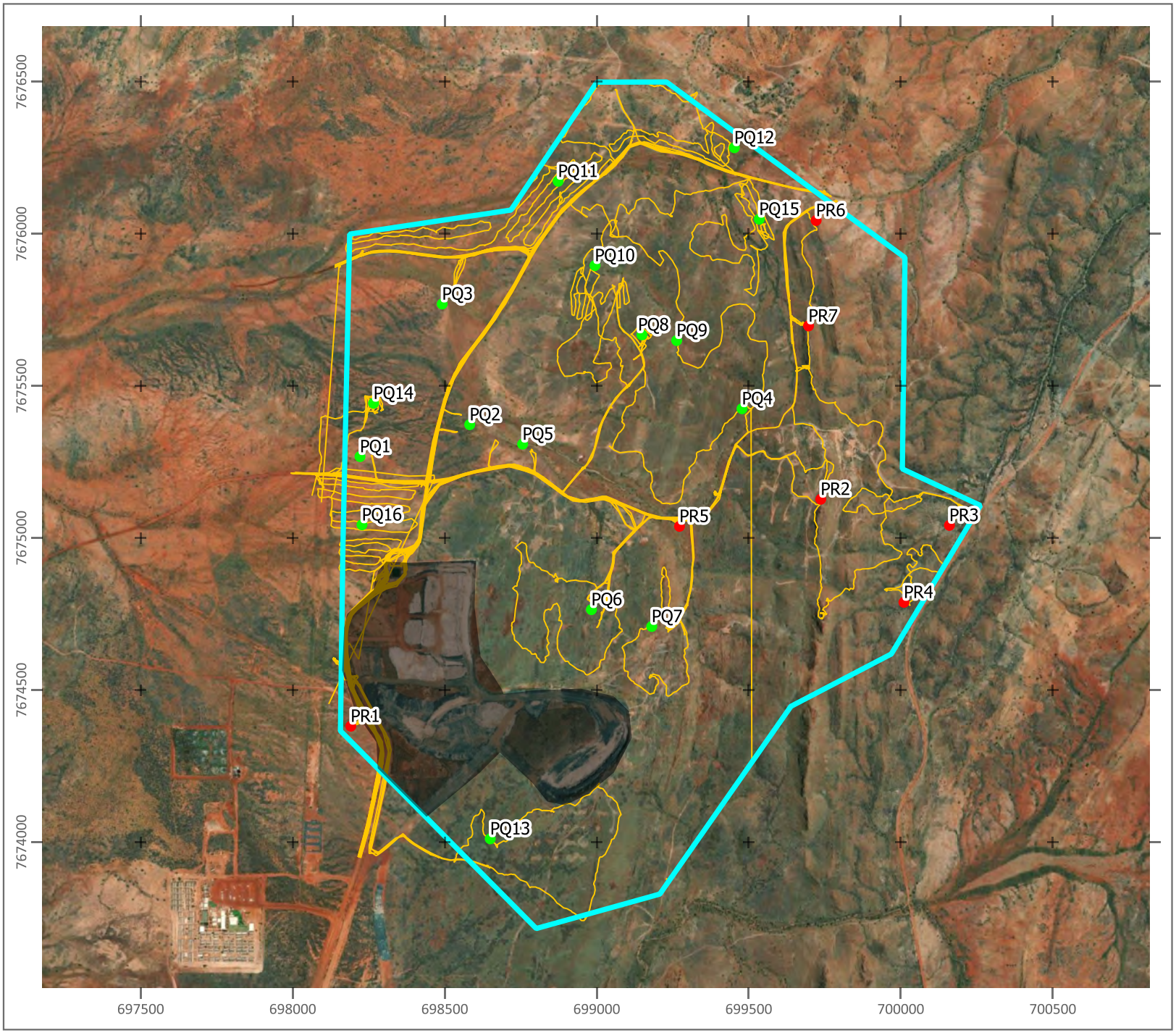
In the six months prior to survey, 358.2 mm of rainfall was recorded, a total greater than the long-term average of 278.8 mm for the same period (BoM 2022). Furthermore, the rainfall in May was 123.8 mm which is almost 4.5 times higher than the long-term average of 52.3 mm for the same period.

During the survey period, temperatures reached a maximum of between 22.8 and 30 °C and a minimum of between 10.7 and 18°C overnight, which is typical of the time of year (BoM 2022). No rainfall was recorded during the survey period and no adverse weather conditions occurred that would impact the results of the survey.

The Study 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 was within the recommended Supplementary survey period for the region.

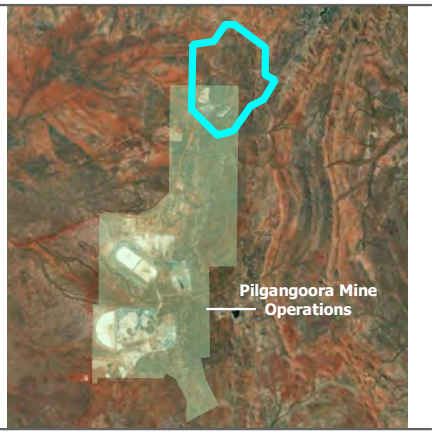
3.2.3 Flora and Vegetation

A detailed survey (EPA 2016) was conducted for flora and vegetation. Vegetation was sampled using 16 quadrats of 50 x 50 m and seven relevés of approximately the same size (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^2) and marked at the north-west corner using a handheld GPS unit. Relevés are 'unmarked quadrats', where a centre point is marked and an area equivalent to that of a quadrat is visually approximated around this point for the purpose of estimating species composition and cover.



Legend

- Study Area
- Cleared
- Quadrat
- Relevé
- Flora Targeted Search



Scale: @ A4
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0 250 500 m

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

Author: TB Approved: EH Date: 25/08/2022

Flora Survey Sites

Prepared for:
Pilbara Minerals

Figure: 3-1

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, photographs of the quadrat, site code.
Physical features	Landform, slope, aspect, soil attributes, ground surface cover, litter, rock type and physical attributes.
Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System tool (Garmin) to accuracy approximately ± 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, cover and abundance.

A flora inventory was compiled from taxa listed in Detailed survey sites and from opportunistic floristic collections throughout the Study 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 2020, T and P Flora List 5 December 2020, and the EPBC Act List of T Flora (DCCEEW 2022). The BAM Act Declared Plants database was consulted to determine if any are Declared Plants (DAFWA 2015), and the Weeds of National Significance list to determine any WONS (DoE 2015).

The vegetation associations were described based on their structure and species composition, as defined by quadrat and releve data, and field observations. Vegetation was mapped in the field using handheld GPS units and aerial photographs, then digitised as map figures using GIS software. Vegetation is described at the association level (Executive Steering Committee for Australian Vegetation Information (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

Vegetation Condition	Eremaean and Northern Botanical Provinces adapted from Trudgen (1988)
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

For consistency with the existing Pilgangoora operations, data analysis was applied using the method presented by MMWC Environmental (2016). A species by site matrix was prepared that included the data from the current field survey and that presented by MMWC Environmental (2016). The Primer 7 (Clarke and Gorley, 2015), software was used to perform floristic composition vegetation classification. Data was square root transformed 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 Chao 2 model to estimate the species richness of the Study Area.

3.2.4 Fauna

Fauna habitat assessments were performed at 39 locations. Descriptive data was recorded including soil type, landform, presence of microhabitats, disturbances and images were recorded. Site photos are included in Appendix D.

Targeted search was conducted for signs of conservation significant fauna using traverses at 50-100 m intervals. Signs include scats, prints, slough skin, scratchings made during foraging and other diggings,

burrows and mounds. Traverses were conducted from sunrise to sunset (0700 to 1700 hrs) and included dawn and dusk.

Sixteen motion-triggered cameras were deployed throughout the Study Area between the 9th and 25th of August. Camera function was checked at deployment and collection so operational days could be confirmed. The total number of recording nights was 226. Table 3-6 lists the camera locations and operational days by target habitat.

Table 3-6. Motion-triggered camera setup and duration

Targeted Fauna Habitat	Location (GDA 1994 MGA zone 50)	Camera	Operational trap nights
Rocky Outcrops	699742, 7675156	MSC01	17
	698871, 7674864	MSC02	0
	699682, 7675703	MSC08	17
	699696, 7675565	MSC09	17
	699688, 7675219	MSC13	16
	698961, 7675548	MSC15	16
Total Rocky Outcrops			**83**
Gullies	699275, 7675041	MSC03	16
	699388, 7675148	MSC04	16
	698062, 7675866	MSC06	14
	699240, 7674713	MSC07	15
	699954, 7674833	MSC10	3
	700056, 7675138	MSC11	15
	698959, 7675235	MSC14	15
Total Gullies			**94**
Plains	698062, 7675866	MSC05	17
	698274, 7674867	MSR12	16
	698362, 7674913	MSR16	16
Total Plains			**49**
Total			226

Four Anabat Swift acoustic bat recording devices were deployed for between 8 and 17 nights between the 8th and 24th of August 2022 for a total of 51 trap nights. Table 3-7 lists the acoustic bat recording devices deployed in each habitat type, 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 Ghost bat *Macroderma gigas* and Pilbara leaf-nosed bat *Rhinonicteris aurantia*. Attention was also given to determining if the Northern leaf-nosed bat *Hipposideros stenotis,* is present. This species is generally not known to occur in the Pilbara but database records from 2012 indicate it may be present in the local area.

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

Habitat	Location (GDA 1994 MGA zone 50)	Acoustic Bat Recorder	Trap nights
Stony Gully	699389, 7675152	AS45007	16 nights
Stony Gully	700055, 7675137	AS642029	8 nights
Sandy Plains	698157, 7675894	AS642022	10 nights
Stony Plains	698266, 7674859	AS450085	17 nights
Total			**51 trap nights**

Four Phillips DVT-7110 Digital Voice-Tracer Sound Recording devices were deployed for recording bird calls in .wav format, with the Night parrot as the target. Devices were deployed for four nights from the 8th to the 12th of August 2022, for a total of 16 trap nights. Locations were selected that provided the highest potential habitat quality. Habitat quality for Night parrot was assessed with reference to habitats described and depicted by the Night Parrot Recovery Team (2022).

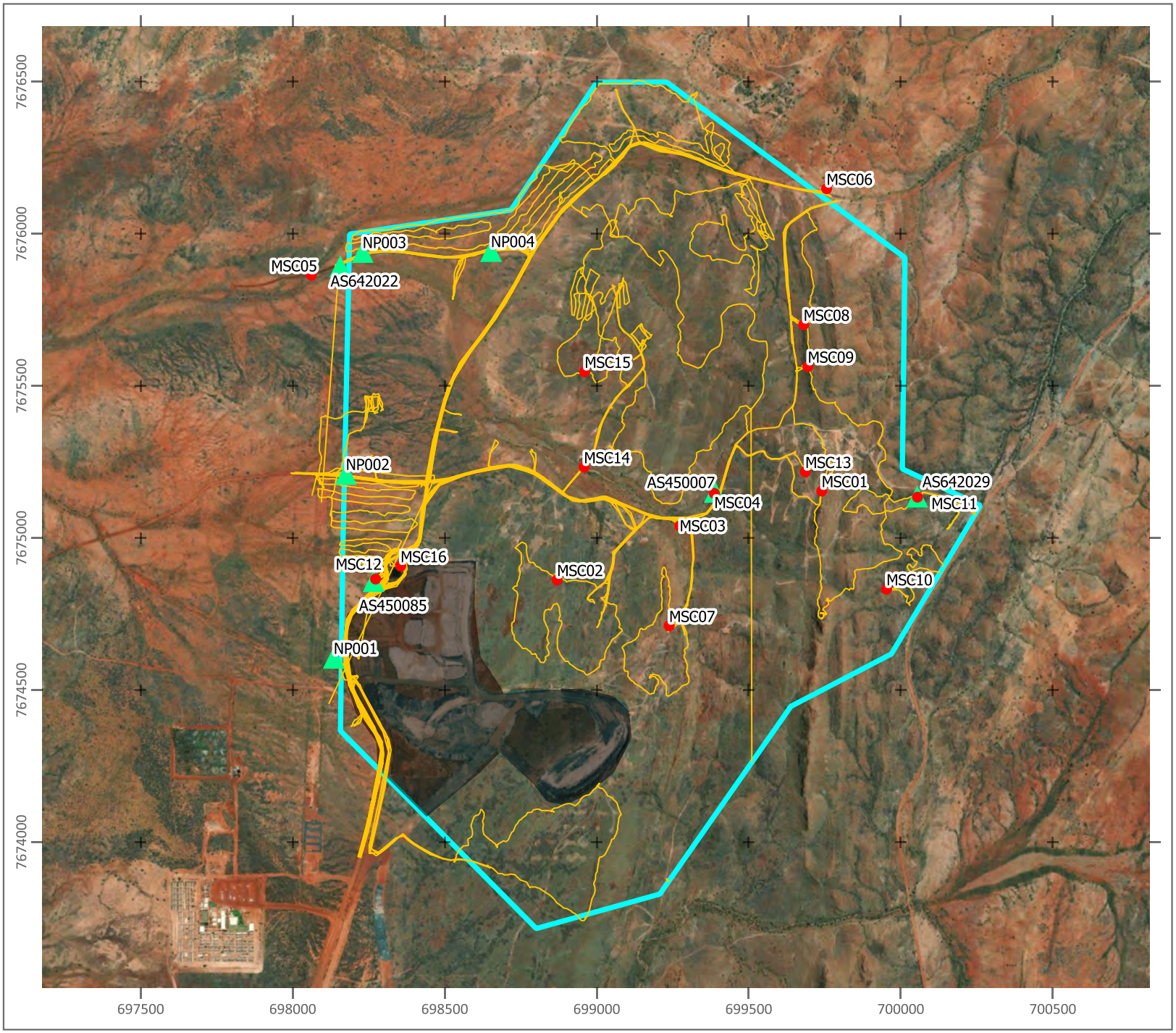
Table 3-8 lists the recording devices deployed in each habitat type, and the number of trap nights.

Table 3-8. Acoustic bird recording devices

Habitat	Location (GDA 1994 MGA zone 50)	Acoustic Bird Recorder	Trap nights
Stony Plains	698135, 7674606	NP01	4 nights
Stony Plains	698175, 7675211	NP02	4 nights
Stony Plains	698230, 7675941	NP03	4 nights
Stony Plains	698653, 7675944	NP04	4 nights
Total			**16 trap nights**

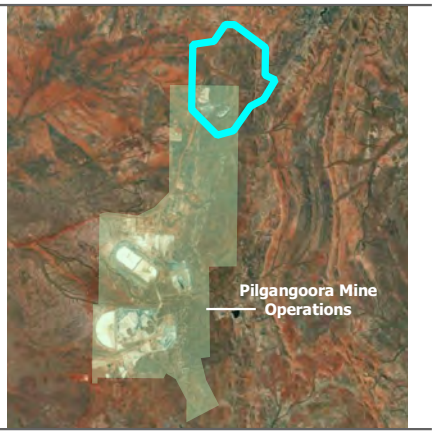
Acoustic recordings were assessed with reference to the calls available on the Night Parrot Recovery Team (2022) website. Sound files recorded between 04:30 to 06:00 and 17:00 to 19:00 were assessed, as these times would coincide with birds leaving or returning to roosting habitat. In addition to listening to call playbacks, calls were viewed using a spectrograph using the Audacity® software package. A profile of Night parrot calls was created by playing the calls available on the Night Parrot Recovery Team (2022) website, for comparison with recorded bird calls. The assessments were also made with reference to descriptions of known vocalisations of the Night parrot as published by Leseberg *et al.* (2019).

Nomenclature within this report is applied according to the WA Checklist of Terrestrial Vertebrates (Western Australian Museum, 2022). Figure 3-2 shows the location of motion-triggered cameras, bat acoustic recording devices and targeted searches. Detailed fauna habitat assessments were made at the locations where cameras and acoustic recording devise were deployed, and during traverses.



Legend

- Study Area
- Cleared
- Fauna Targeted Search
- Acoustic Bat Detector
- Motion-triggered Camera



Scale: @ A4
1: 18000

0 250 500 m

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

Author: TB Approved: EH Date: 25/08/2022

Fauna Survey Sites

Prepared for:
Pilbara Minerals

Figure: 3-2

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 Study 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 and basic assessment, suitable for the size and intensity of the proposed Project and the availability of previous local survey.
Timing, weather, season, cycle	Not a constraint The Study Area is within the Eremaean Botanical district. Survey was conducted in the recommended Supplementary season. Rainfall in the six months prior was higher than average and therefore, weather and seasonal conditions were not a constraint. No inclement weather occurred during the survey period that would impact the detection of target fauna. Survey timing was within that recommended for birds, amphibians and mammals. Conditions are generally unsuitable for reptiles in winter.
Sources of information	Not a constraint Previous biological reports and database records are available for the locality and region.
Completeness: Flora and vegetation	Not a constraint The scope was completed. Five plants (4.3% of the collection) were not able to be determined to the species level due to sterile specimens. Modelling indicates the survey captured 84% of the floristic richness in the area.
Completeness: Fauna	Not a constraint The scope was completed. The survey resulted in no ambiguous identifications of bat calls, bird calls or photos.

4 FLORA AND VEGETATION RESULTS

4.1 DESKTOP STUDY

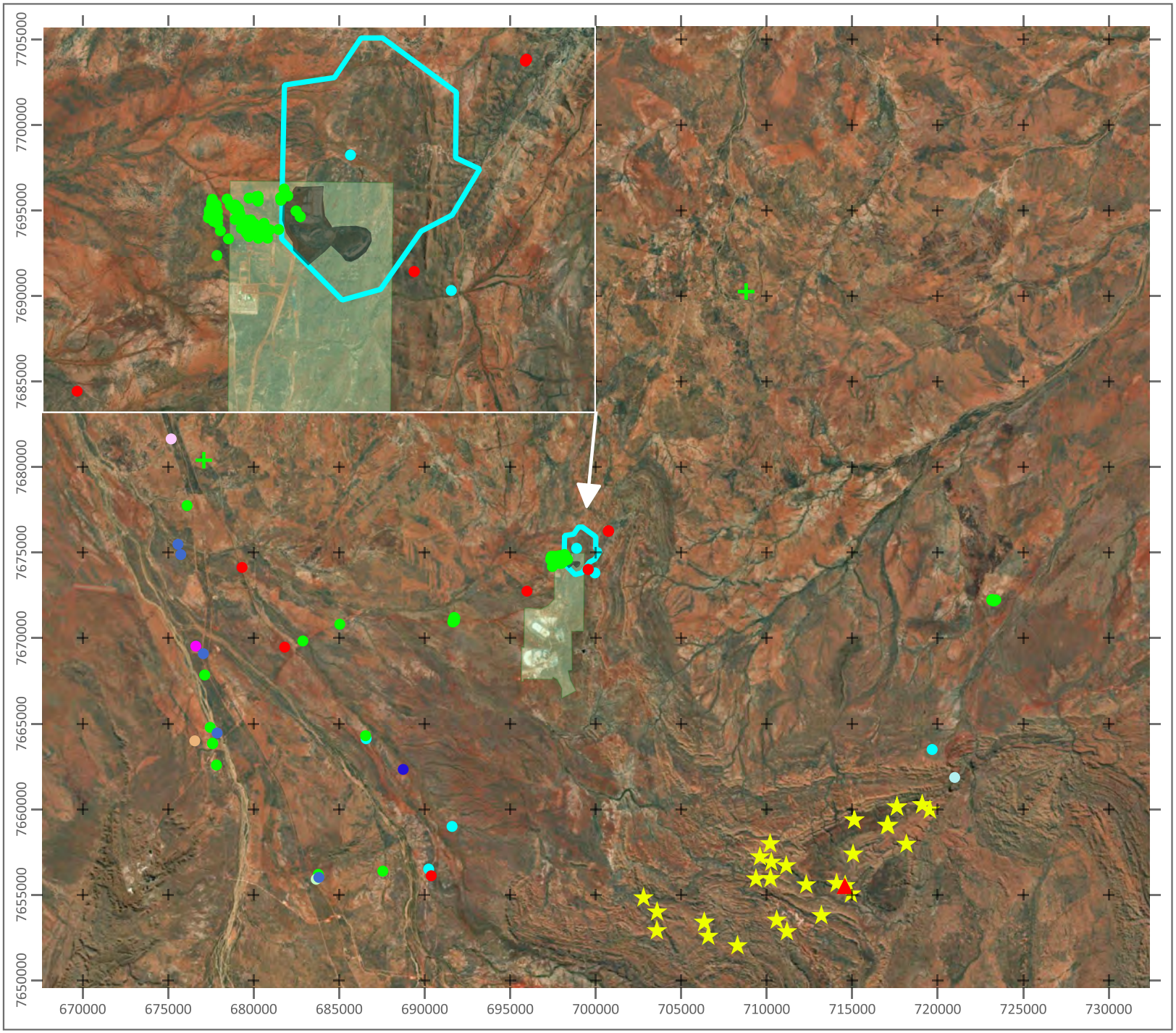
4.1.1 Significant Flora

No T Flora listed under the BC Act or EPBC Act have been previously recorded within the Study Area. Two P Flora species have been previously recorded in the Study Area, *Euphorbia clementii*, and a population of *Euploca mutica* (formerly *Heliotropium muticum*), both of which are listed as P3 in WA.

One T flora species has been recorded within 25 km, *Quoya zonalis* (formerly *Pityrodia* sp. Marble Bar, listed as Endangered under the EPBC Act and T under the BC Act). One P1, ten P3, and one P4 species have records within 30 km of the Study Area.

No additional T species were returned from the PMST or literature review.

T and P flora returned from the DBCA database with records within 30 km of the Study Area are shown in Figure 4-2.



Legend

- Study Area
- Cleared
- Pilgangoora Mine Operations

Threatened

- Quoya zonalis

Prority 1

- Themeda sp. Panorama

Priority 3

- Eragrostis crateriformis
- Euphorbia clementii
- Euploca mutica
- Gomphrena leptophylla
- Goodenia nuda
- Gymnanthera cunninghamii
- Nicotiana umbratica
- Terminalia supranitifolia
- Triodia basitricha
- Triodia chichesterensis

Priority 4

- Bulbostylis burbidgeae

Scale: @ A4
1: 32,000

0 5 10 km

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

Author: TB Approved: EH Date: 18/08/2022

Threatened and Priority Flora Records

Prepared for:
Pilbara Minerals

Figure: 4-1

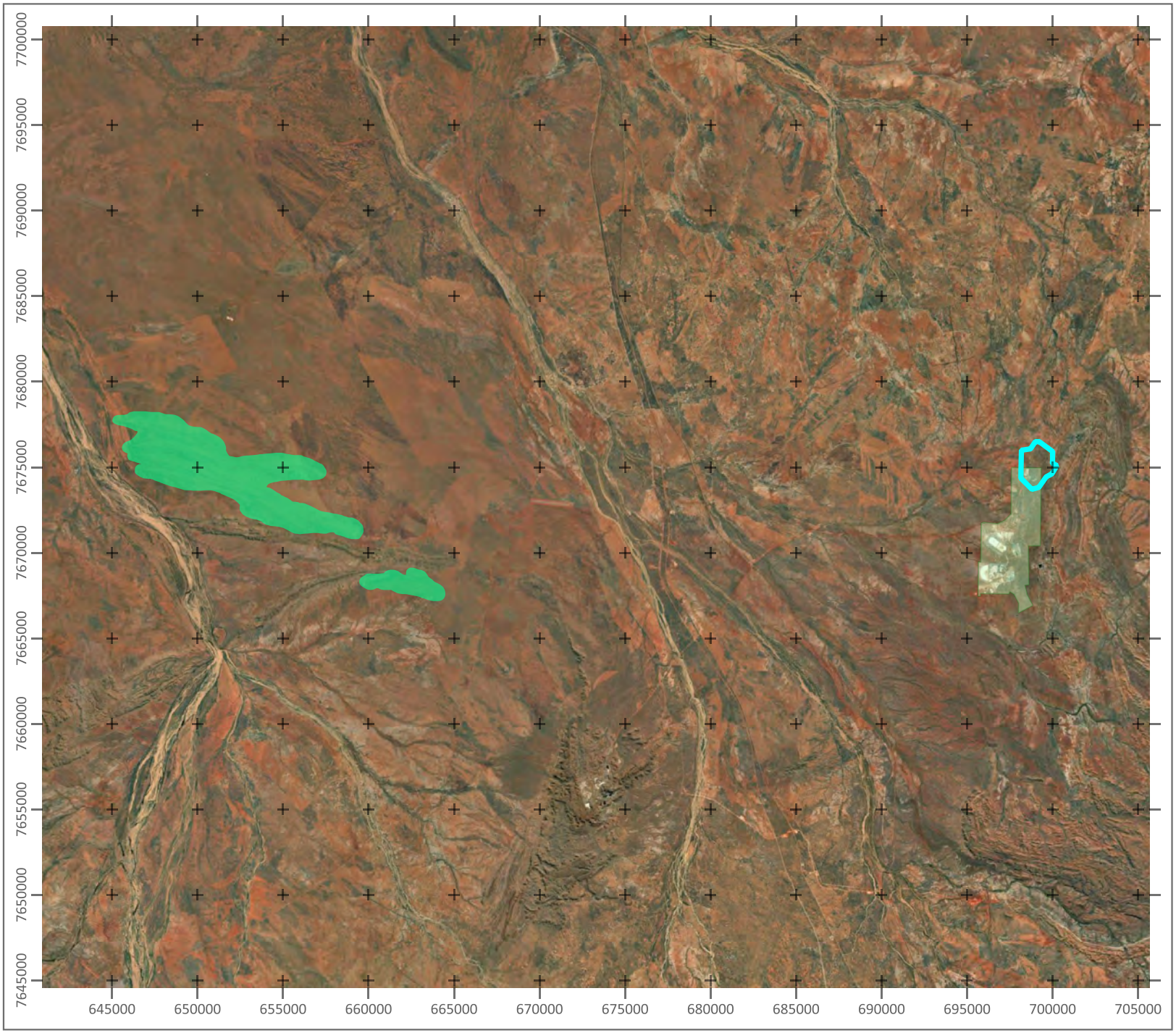
An assessment of the likelihood of occurrence of these 13 species within the Study Area was performed using the criteria listed in Table 3-2. The results of the assessment are listed in Table 4-1.

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

Species	Cons. Code		Preferred Habitat	Likelihood of Occurrence
	BC Act	EPBC Act		
Bulbostylis burbidgeae	P4		Granitic soils. Granite outcrops and cliff bases.	Possible. Suitable habitat in 10a, 11a, 11b
Eragrostis crateriformis	P3		Clayey loam or clay. Creek banks, depressions.	Unlikely to occur
Euphorbia clementii	P3		Gravelly hillsides, stony grounds.	Recorded
Euploca mutica	P3		Hummock grassland and sandplains.	Recorded nearby
Gomphrena leptophylla	P3		Open flats, sandy creek beds, edges salt pans and marshes, stony hillsides.	Possible. Suitable habitat in 7a, 9a, 9b
Goodenia nuda	P4		Has been previously found in drainage lines of red-brown loamy sand or sandy loam and in disturbed roadside areas	Unlikely to occur
Gymnanthera cunninghamii	P3		Sandy soils.	Possible. Suitable habitat in 7a
Nicotania umbratica	P3		Typically grows in shelter of large boulders on rocky outcrops and in shallow soils	Possible. Suitable habitat in 10a
Quoya zonalis	T	EN	Steep, rocky, sandstone conglomerate and granite slopes in skeletal, brown, sandy loam soils of the Capricorn Land System	Possible. Suitable habitat in 10a
Terminalia supranitifolia	P3		Sand. Among basalt rocks.	Unlikely to occur
Themeda sp. Panorama (J. Nelson *et al.* NS 102)	P1		Has been found growing along watercourses and creeklines and on rocky substrate	Possible. Suitable habitat in 6a, 8a and 8b.
Triodia basitricha	P3		Occurs on rocky and gravelly slopes of mountains or low hills.	Possible. Suitable habitat in 11a and 11b.
Triodia chichesterensis	P3		Occurs on sand or loam over rocky or gravelly substrates, often with quartzite.	Recorded

4.1.2 Significant Vegetation

There are no TECs listed under the BC Act or EPBC Act known to occur within the Study Area. One Priority 3 Ecological Community is located within 50 km of the Study Area; the Gregory Land System (Figure 4-2).



Legend

- Study Area
- Pilgangoora Mine Operations

Priority Ecological Communities

- Gregory Land System

Scale: @ A4
1: 320,000

0 5 10 km

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

Author: TB Approved: EH Date: 19/07/2022

Threatened and Priority Ecological Communities

Prepared for:
Pilbara Minerals

Figure: 4-2

4.1.3 Introduced Flora Species

NatureMap returned eight introduced flora, including three species that are classed as Declared pests in WA, and two WoNS. Eight introduced flora species have been recorded locally by MMWC Environmental (2016), including one Declared pest.

Table 4-2 lists the introduced flora species recorded within 30 km of the Study Area. Where a local record and a database record is available, the local record is adopted as the source.

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

Species	Common Name	BAM Act Listing	WONS	Source
Aerva javanica	Kapok Bush	Permitted – S11	No	MMWC
Arivela viscosa (formerly *Cleome viscosa)*	Tickweed	Permitted – S11	No	Database
Boerhavia coccinea	Tar Vine	Permitted – S11	No	Database
Calotropis procera	Rubber Bush	Declared Pest – S22(2) (Exempt)	No	Database
Cenchrus ciliaris	Buffel Grass	Permitted – S11	No	MMWC
Cenchrus setiger	Birdwood Grass	Permitted – S11	No	MMWC
Chloris barbata	Purpletop Chloris	Permitted – S11	No	MMWC
Cynodon dactylon	Couch Grass	Permitted – S11	No	MMWC
Flaveria trinervia	Speedy Weed	Permitted – S11	No	MMWC
Opuntia elata	Prickly Pear	Declared Pest – S11(2) (C3 Restricted)	Yes	Database
Opuntia stricta	Common Prickly Pear	Declared Pest – S11(2) (C3 Restricted)	Yes	MMWC
Passiflora foetida var. *hispida*	Stinking Passion Flower	Permitted – S11	No	MMWC
Tamarix aphylla	Athel Pine	Declared Pest – S22(2) (Exempt)	Yes	MMWC

4.2 FIELD SURVEY

4.2.1 Flora

A total of 113 species of flora were recorded within the Study Area, comprising 110 native species and three introduced species. Five collections could not be identified beyond genus level due to the lack of flowering parts or fruiting bodies, or because they were only found in juvenile form.

The Fabaceae (pea family, 28 native) Poaceae (grass family, 21 native, 2 introduced), Malvaceae (13 native species) and Amaranthaceae (8 native species, one introduced) were the most species-rich families recorded. Twenty-six families were recorded across the Study Area.

The complete list of plant species recorded within the Study Area is presented in Appendix F. The mean species richness was 20 species per quadrat, slightly less than the MMWC Environmental (2016) survey which included 49 detailed sites with an average species richness of 25.

A species accumulation curve was performed with a modelled Chao 2 species richness of 128, indicating that the floristic survey was approximately 83% complete.

The survey recorded 30 species not previously recorded for the Pilgangoora project area. These species are identified in Appendix F and bring the total richness for the Pilgangoora project area to 231 including subspecies, and varieties. The newly recorded species includes two Priority flora that are detailed in Section 4.2.4.

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

The three introduced flora species recorded are detailed in Section 4.2.6.

4.2.2 Vegetation Types

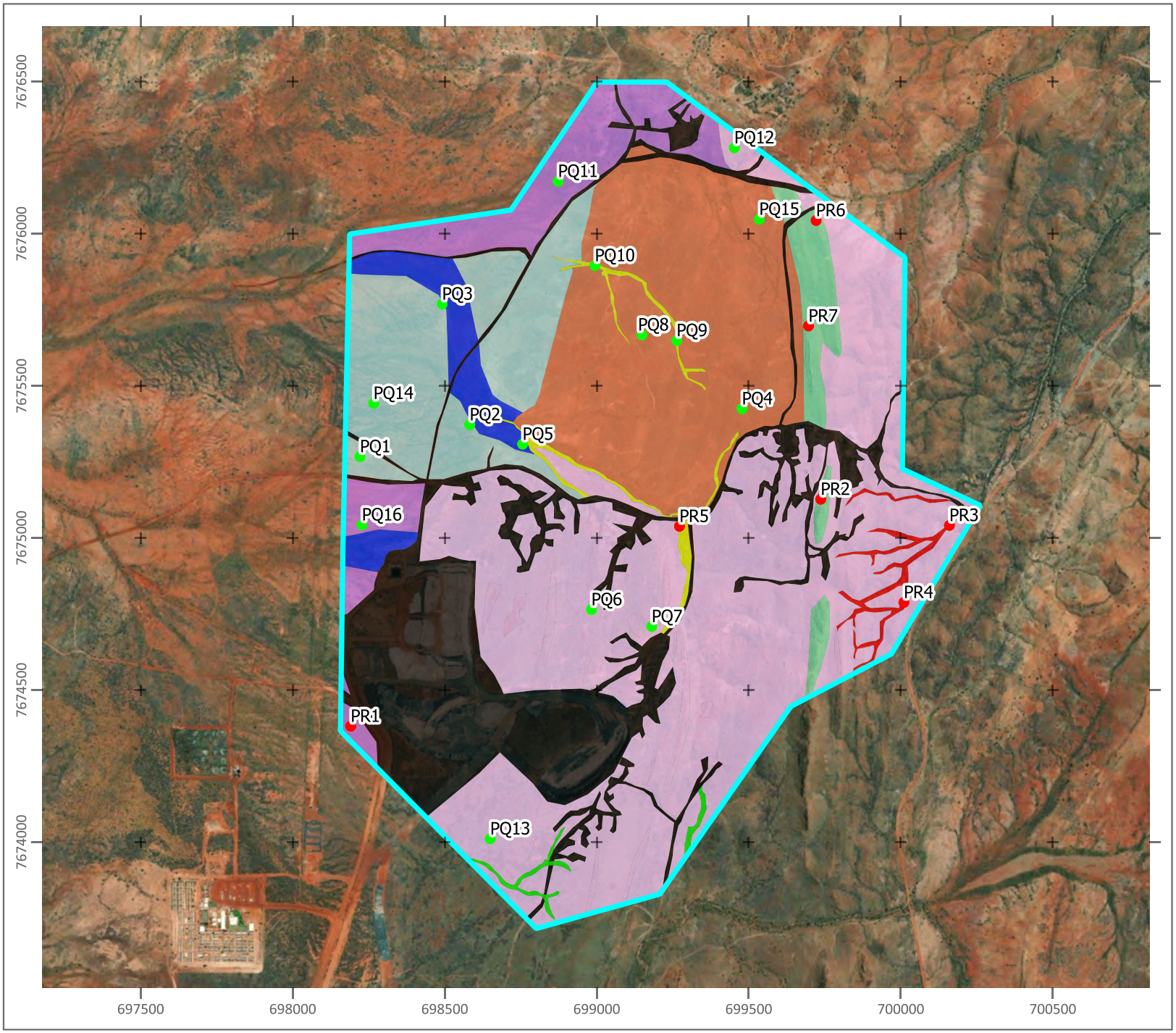
Nine vegetation types are described for the Study Area, as summarised in Table 4-3 and detailed in the subsections below. As the Lynas Find deposit is considered as an extension to the existing Pilbara Minerals Pilgangoora Project, the vegetation coding system previously used at the site has been retained and extended. MMWC Environmental (2016) described vegetation type using the numerals 1 to 6 and the letters a to c to group sites by landform and floristics respectively. Vegetation type 6a reported here is synonymous with vegetation type 6a as reported in MMWC Environmental (2016), with the remaining units labelled from 7 onwards being different from those recorded previously.

Distribution of vegetation types at a scale of 1: 18,000 is shown in Figure 4-3. The dendrogram resulting from the cluster analysis is shown in Appendix C, followed by the site data sheets and photos.

Table 4-3. Vegetation Types

Code	Landform	Vegetation Description	Extent in Study Area	
			(ha)	%
6a	Gully	Scattered low trees of *Corymbia hamersleyana* over high open shrubland of *Acacia acradenia* and *Grevillea wickhamii* subsp. *hispidula* over scattered shrubs of *Acacia bivenosa* and *Cajanus cinereus* over open hummock grassland of *Triodia epactia* and *Triodia wiseana* over very open tussock grassland of *Eriachne mucronata* and *Cymbopogon ambiguous*	1.26	0.3
7a	Valley Flat	Low *Corymbia hamersleyana* and *Acacia inaequilatera* isolated trees over *Acacia colei, Acacia ancistrocarpa,* and *Acacia bivenosa* sparse mid shrubland and *Triodia epactia,*	11.13	2.8

Code	Landform	Vegetation Description	Extent in Study Area	
			(ha)	%
		Triodia angusta and **Cenchrus setiger* mid open hummock grassland.		
8a	first order creeklines and drainage gullies	Low *Corymbia hamersleyana* isolated trees over *Acacia colei, Grevillea wickhamii,* and *Acacia inaequilatera* open mid shrubland and *Triodia epactia, Triodia wiseana and Triodia chichesterensis* (P3) mid open hummock grassland	3.40	0.9
8b	Creekline	Low *Corymbia hamersleyana* isolated trees over *Acacia colei, Grevillea wickhamii,* and *Acacia inaequilatera* sparse mid shrubland and *Triodia wiseana Triodia angusta* and *Cajanus cinereus* mid open hummock grassland/forbland	2.96	0.8
9a	Stony Plains	Low *Corymbia hamersleyana* isolated trees over *Acacia colei, Acacia ancistrocarpa,* and *Grevillea wickhamii* sparse mid shrubland and *Triodia wiseana Triodia epactia* and *Triodia chichesterensis* (P3) mid hummock grassland	25.79	6.5
9b	Stony Plains	*Acacia ancistrocarpa, Acacia bivenosa* and *Acacia inaequilatera* mid open shrubland and *Triodia wiseana, Alysicarpus muelleri* and *Aristida holathera* mid hummock grassland/forbland/tussock grassland	40.10	10.2
10a	Ridge	Tall, isolated shrubs of *Acacia inaequilatera, Atalaya hemiglauca* and *Acacia colei* over a low sparse shrubland of *Hibiscus sturtii, Acacia acradenia, *Aerva javanica*, and *Triodia wiseana, Triodia brizoides* and *Triodia chichesterensis* (P3) mid open hummock grassland.	10.15	2.6
11a	Hill	Tall, isolated shrubs of *Acacia inaequilatera, Acacia colei* and *Acacia acradenia* over *Triodia brizoides, Triodia wiseana,* and *Triodia epactia* mid hummock grassland.	74.78	19.0
11b	Hill	Low isolated trees of *Corymbia hamersleyana* over tall, isolated shrubs of *Acacia colei, Acacia inaequilatera,* and *Senna glutinosa* subsp. *glutinosa* over *Triodia wiseana, Triodia chichesterensis* (P3), and *Triodia brizoides* mid hummock grassland.	151.24	38.4
D	-	Disturbed areas cleared of vegetation. Including rehabilitated areas where revegetation has not yet re-established.	72.96	18.5

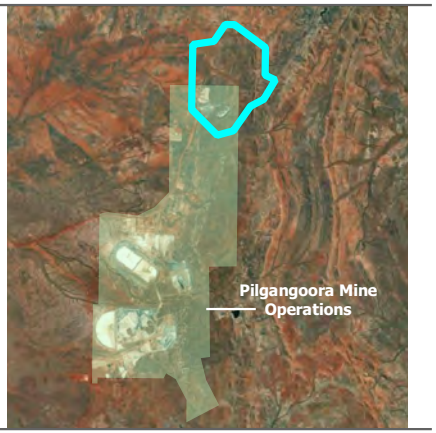


Legend

- Study Area
- Quadrat
- Relevé

Vegetation Unit

6a	9b
7a	10a
8a	11a
8b	11b
9a	D



Scale: @ A4
1: 18000

0 250 500 m

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

Author: TB Approved: EH Date: 06/10/2022

Vegetation Associations

Prepared for:
Pilbara Minerals

Figure: 4-3

Landform: Gully

Vegetation Type: 6a

Scattered low trees of *Corymbia hamersleyana* over high open shrubland of *Acacia acradenia* and *Grevillea wickhamii* subsp. *hispidula* over scattered shrubs of *Acacia bivenosa* and *Cajanus cinereus* over open hummock grassland of *Triodia epactia* and *Triodia wiseana* over very open tussock grassland of *Eriachne mucronata* and *Cymbopogon ambiguous*

The ground layer is the dominant vegetation stratum and is characterised by *Triodia epactia* and *Triodia wiseana* hummock grasses. Tussock grasses such as *Eriachne mucronata* and *Cymbopogon ambiguous* occasionally occur.

This community occurs in the small gully flowing from east to west in the lower rocky hills, with brown sand with granite stones.

Condition: Impacts from cattle grazing are moderate. No weeds were recorded in 2022, the environmental weed *Aerva javanica* (kapok) was recorded in low numbers in 2016. The condition of this vegetation is Very Good.

Detailed sites: This vegetation type was described by MMWC Environmental as vegetation type 6a and was described from 7 detailed sites. No Detailed sites were allocated for the current study. Visual inspection in the field confirmed the vegetation was as described by MMWC Environmental (2016).

Introduced/exotic taxa: None recorded

Conservation significant species: None recorded

Landform – Valley Flat

Vegetation Type: 7a Low *Corymbia hamersleyana* and *Acacia inaequilatera* isolated trees over *Acacia colei, Acacia ancistrocarpa,* and *Acacia bivenosa* sparse mid shrubland and *Triodia epactia, Triodia angusta* and **Cenchrus setiger* mid open hummock grassland.

The ground layer is the dominant vegetation stratum and is characterised by *Triodia epactia* and *Triodia angusta* hummock grasses. Tussock grasses such as **Cenchrus setiger*, **Cenchrus ciliaris*, *Cymbopogon obtectus*, and *Aristida holathera* also occur within this vegetation community. *Cenchrus* spp. are heavily grazed. A diversity of forbs is present in the groundcover, with the most encountered species being *Rhynchosia minima*, *Goodenia lamprosperma*, *Stemodia grossa*, *Cajanus cinereus* and *Euphorbia mitchelliana*.

This community occurs on a broad valley flat, with red sandy loam soils and granite and quartz surface pebbles and gravels. The valley flat is downstream of the gullies in the upper reaches of the Study Area, that fan out when arriving at the plain.

Condition: Impacts from cattle grazing are moderate, and agricultural weeds **Cenchrus setiger* and **C. ciliaris* are present, but in low densities and heavily grazed. The condition of this vegetation is Very Good.

Detailed sites: PQ2, PQ3, PQ5

Total richness: 38 species. Average richness: 21 species

Introduced/exotic taxa: Small isolated occurrences of the exotic grasses *Cenchrus setiger* and *Cenchrus ciliaris* (Buffel Grass) were recorded within this vegetation type.

Conservation significant species: None recorded

Landform – First order creeklines and drainage gullies

Vegetation Type: 8a Low *Corymbia hamersleyana* isolated trees over *Acacia colei, Grevillea wickhamii,* and *Acacia inaequilatera* open mid shrubland and *Triodia epactia, Triodia wiseana and Triodia chichesterensis* (P3) mid open hummock grassland.

The ground layer is characterised by *Triodia epactia* and *Triodia wiseana* hummock grasses with the P3 *Triodia chichesterensis* sometimes present at up to 5% cover. Tussock grasses such as *Themeda triandra, Paraneurachne muelleri, Eriachne mucronata, Chrysopogon fallax*, *Cymbopogon obtectus* and *Eriachne benthamii* are also present within this vegetation community and are moderately grazed.

The shrub layer is the dominant stratum, including a diversity of low shrubs. The most commonly encountered shrub species are *Acacia colei, Grevillea wickhamii, Acacia inaequilatera, Dampiera candicans, *Aerva javanica, Melhania oblongifolia, Tephrosia clementii, Corchorus incanus, Isotropis atropurpurea, Petalostylis labicheoides* and *Scaevola amblyanthera* var. *centralis*.

This community occurs in small first order creek lines, with red sandy loam to sandy gravel soils. This community is upstream of the 7a valley flat vegetation type and ceases where the channels diminish at the eastern edge of the rocky hill country.

Condition: Impacts from cattle grazing are moderate, and the environmental weed **Aerva javanica* is present, but in low density. The condition of this vegetation is Very Good.

Detailed sites: PQ9, PQ10, PR5

Total richness: 40 species. Average richness: 18 species

Introduced/exotic taxa: A small, isolated occurrence of the exotic **Aerva javanica* (Kapok) was recorded within PR5.

Conservation significant species: *Triodia chichesterensis* (P3) was recorded at 5% cover in PQ10 and 0.5% cover in PQ9.

Landform – Creekline

Vegetation Type: 8b Low *Corymbia hamersleyana* isolated trees over *Acacia colei, Grevillea wickhamii,* and *Acacia inaequilatera* sparse mid shrubland and *Triodia wiseana Triodia angusta* and *Cajanus cinereus* mid open hummock grassland/forbland.

The ground layer is the dominant vegetation stratum and is characterised by *Triodia wiseana* and *Triodia angusta* hummock grasses. Tussock grasses such as *Eriachne mucronata, Cymbopogon obtectus* occasionally occur.

A diversity of low shrubs is present, with the most encountered species being *Acacia stellaticeps, Nellica maderaspatensis, Dampiera candicans, Goodenia stobbsiana, Isotropis atropurpurea, Scaevola amblyanthera* var. *centralis* and *Stemodia grossa.*

This community occurs in small creek lines flowing east of the rocky range, with red to orange loamy sands with granite stones.

Condition: Impacts from cattle grazing are low. No weeds were recorded. The condition of this vegetation is Very Good.

Detailed sites: PR3, PR4

Total richness: 31 species. Average richness: 22.5 species

Introduced/exotic taxa: None recorded

Conservation significant species: None recorded

Landform – Stony plains

Vegetation Type: 9a Low *Corymbia hamersleyana* isolated trees over *Acacia colei, Acacia ancistrocarpa,* and *Grevillea wickhamii* sparse mid shrubland and *Triodia wiseana Triodia epactia* and *Triodia chichesterensis* (P3) mid hummock grassland.

The ground layer is the dominant vegetation stratum and is characterised by *Triodia wiseana* and *Triodia epactia* hummock grasses with the P3 *Triodia chichesterensis* sometimes present at up to 5% cover. Tussock grasses such as *Chrysopogon fallax, Eragrostis eriopoda, Paraneurachne muelleri* occasionally occur and are heavily grazed where they do occur.

A diversity of low shrubs is present in the ground layer, with the most encountered species being *Corchorus incanus, Ptilotus austrolasius, Tephrosia arenicola, Arivela uncifera* subsp. *uncifera, Indigofera monophylla, Ptilotus calostachyus and Afrohybanthis aurantiacus.*

This community occurs on stony plains east of the rocky range, with red sandy loam with granite and quartz pebbles at the surface.

Condition: Impacts from cattle grazing are moderate. The exotic grass *Cenchrus ciliaris* (Buffel Grass) was recorded within this vegetation type, heavily grazed. The condition of this vegetation is Good.

Detailed sites: PR1, PQ1, PQ11, PQ16

Total richness: 41 species. Average richness: 19 species

Introduced/exotic taxa: *Cenchrus ciliaris*

Conservation significant species: *Triodia chichesterensis* (P3) was recorded at 5% cover in PQ1 and 0.1% cover in PR1.

Landform – Stony plains

Vegetation Type: 9b *Acacia ancistrocarpa, Acacia bivenosa* and *Acacia inaequilatera* mid open shrubland and *Triodia wiseana, Alysicarpus muelleri* and *Aristida holathera* mid hummock grassland/forbland/tussock grassland.

The shrub layer is the dominant vegetation stratum and is characterised by the taller shrubs *Acacia ancistrocarpa, Acacia bivenosa, Acacia inaequilatera, Grevillea wickhamii*

A diversity of low shrubs is also present in the ground layer, with the most encountered species being *Bonamia erecta, Bonamia linearis, Nellica maderaspatensis, Pterocaulon spaeranthoidess, Rhynchosia minima, Scaevola amblyanthera* var. *centralis, Senna notabilis, Streptaglossa decurrens* and *Tephrosia arenicola.*

This community occurs on stony plains east of the rocky range, with red sandy loam with granite and quartz pebbles at the surface.

Condition: Impacts from cattle grazing are moderate, with tussock grasses sparse to absent. The condition of this vegetation is Good.

Detailed sites: PQ14

Total richness: 20 species

Introduced/exotic taxa: None recorded

Conservation significant species: None recorded

Landform – Ridge

Vegetation Type: 10a Tall isolated shrubs of *Acacia inaequilatera, Atalaya hemiglauca* and *Acacia colei* over a low sparse shrubland of *Hibiscus sturtii, Acacia acradenia, *Aerva javanica*, and *Triodia wiseana, Triodia brizoides* and *Triodia chichesterensis* (P3) mid open hummock grassland.

The ground layer is the dominant vegetation stratum and is characterised by the *Triodia wiseana* and *Triodia brizoides* hummock grasses with the P3 *Triodia chichesterensis* occasionally present at up to 2% cover.

A diversity of low shrubs, forbs and tussock grasses is also present in the ground layer, with the most encountered species being *Cymbopogon ambiguous, Melhania oblongifolia, Cassytha filliformis, Euphorbia mitchelliana, Tribukus platypterus, Afrohybanthus aurantiacus, Amaranthus mitchellii, Indigofera monophylla, Rhynchosia minima* and *Solanum horridum.*

One fig tree (*Ficus aculeata* var. *indecora*) was recorded in this vegetation type as an opportunistic collection.

This community occurs on the crest of the rocky range, with skeletal red sandy soils among boulders and large angular rocks.

Condition: The environmental weed **Aerva javanica* is common. The condition is Very Good.

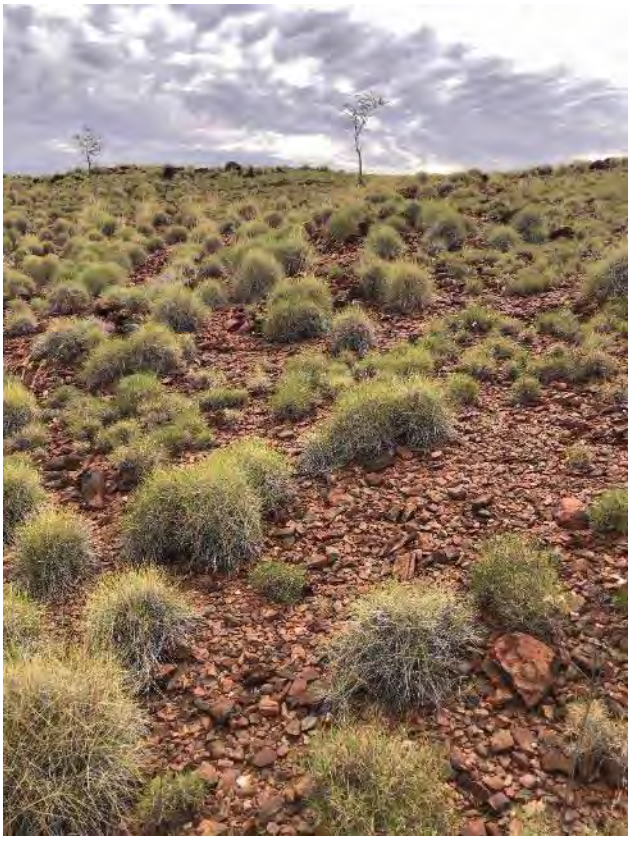
Detailed sites: PR2, PR6, PR7

Total richness: 35 species, average species richness is 18

Introduced/exotic taxa: **Aerva javanica*

Conservation significant species: *Triodia chichesterensis* (P3) at 2% cover in PR2, and *Rothia indica* (P3) at PR 2 at 0.1% cover.

Landform – Hill



Vegetation Type: 11a Tall isolated shrubs of *Acacia inaequilatera, Acacia colei* and *Acacia acradenia* over *Triodia brizoides, Triodia wiseana,* and *Triodia epactia* mid hummock grassland.

The ground layer is the dominant vegetation stratum and is characterised by the *Triodia brizoides* and *Triodia wiseana* and hummock grasses with *Triodia epactia* present in lower numbers.

A diversity of low shrubs, forbs and tussock grasses is also present in the ground layer, with the most encountered species being *Dampiera candicans, Corchorus incanus, Indigofera hirsuta, Boerhaevia gardneri, Trigastrotheca molluginea, Aristida holathera, Bonamia erecta, Corchorus lanifolius* and *Cymbopogon ambiguous.*

This community occurs on the rocky uplands of the central section of the range, in a shallow red loamy soil with a cover of angular rocks of granite and quartz at the surface. It is bounded to the east by the plains, to the west by the ridge.

Condition: No weeds were recorded in this vegetation type and the evidence of grazing was low. Occasional tracks occur. The condition is Very Good.

Detailed sites: PQ4, PQ8, PQ15

Total richness: 28 species, average species richness is 14

Introduced/exotic taxa: None recorded

Conservation significant species: Database record for the P3 *Euphorbia clementii* occurs within this vegetation type. None recorded in the 2022 survey.

Landform – Hill

Vegetation Type: 11b Low isolated trees of *Corymbia hamersleyana* over tall, isolated shrubs of *Acacia colei, Acacia inaequilatera,* and *Senna glutinosa* subsp. *glutinosa* over *Triodia wiseana, Triodia chichesterensis* (P3), and *Triodia brizoides* mid hummock grassland.

The ground layer is the dominant vegetation stratum and is characterised by *Triodia wiseana* hummock grasses the with *Triodia chichesterensis* (P3) as a sub-dominant at up to 15% cover in some places and *Triodia brizoides* present in lower numbers.

A diversity of low shrubs, forbs and tussock grasses is also present in the ground layer, with the most encountered species being *Stemodia grossa, Cymbopogon ambiguous, Eriachne mucronata Corchorus incanus, Ptilotus austrolasius, Scaevola amblyanthera* var. *centralis, Afrohybanthus aurantiacus, Boerhaevia gardneri, Enneopogon lindleyanus, Euphorbia careyi, Euphorbia tannensis* and *Gomphrena cunninghamii.*

This community occurs on the rocky hills, in a shallow red or yellow loamy sandy soil with a cover of angular rocks of granite and schist at the surface.

Condition: The environmental weed **Aerva javanica* was recorded infrequently in this vegetation type and the evidence of grazing was low. Occasional tracks occur. The condition is Very Good.

Detailed sites: PQ46 PQ7, PQ12, PQ13

Total richness: 48 species, average species richness is 21

Introduced/exotic taxa: **Aerva javanica*

Conservation significant species: *Triodia chichesterensis* (P3) at 15% cover in PQ12 and PQ13, and *Rothia indica* (P3) at PQ13 at 0.1% cover.

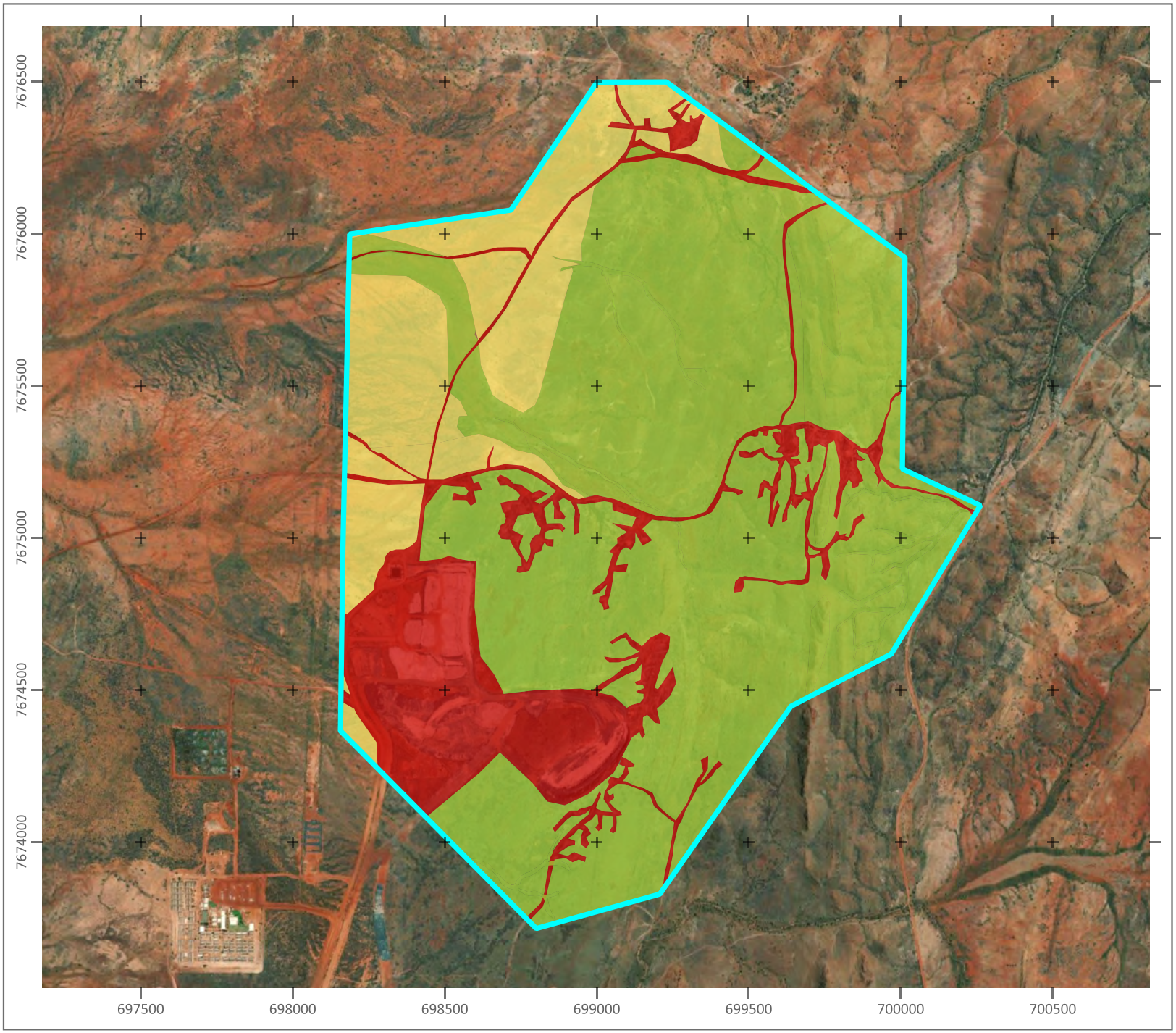
4.2.3 Vegetation Condition

Vegetation condition across the Study Area was within the categories Very Good, Good and Completely Degraded, with most of the Study Area in Very Good condition (Table 4-4; Figure 4-4). The primary sources of disturbance on site are associated with historical and current mining related disturbances (numerous vehicle tracks, drill pads, active mining area on the eastern boundary). In addition, several weed species occur throughout the site, primarily through the creek lines in the plains area and in the rocky ridge landform. A moderate grazing impact from cattle is present in the plains and a low grazing impact in the hills.

Table 4-4. Vegetation condition within the Study Area

Vegetation Condition	Area (ha)	Area (%)
Very Good	254.48	64.6
Good	66.75	16.9
Completely Degraded	72.96	18.5

The Study Area has Moderate (burnt 4-8 years previously) to Very Old fire age, with a large portion of the site being burned in 2017/18, and a small portion on the eastern edge being burned in 2013/14 (DBCA 2022).

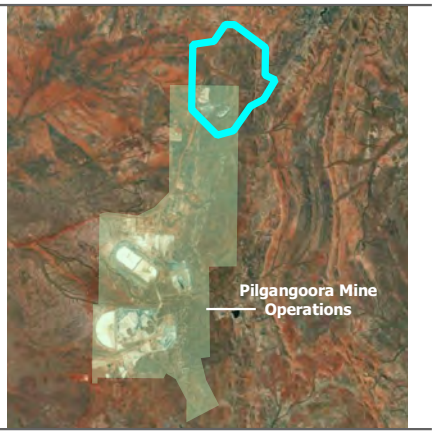


Legend

- Study Area

Vegetation Condition

- Very Good
- Good
- Completely Degraded



Scale: @ A4
1: 18000

0 250 500 m

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

Author: TB Approved: EH Date: 07/10/2022

Vegetation Condition

Prepared for:
Pilbara Minerals

Figure: 4-4

4.2.4 Significant Flora

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

Two P3 species were recorded.

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*). It is distinguished from the closely related and often co-occurring *Triodia lanigera* by its shorter and less hairy leaves and less branched inflorescence.

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 (Figure 4-5). 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 Lynas Find deposit 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.

In the Study Area the species was recorded on rocky soils with quartzite. Collection records indicate that florets are observed between February–April and in August. At the time of survey in August, flowering material was available, and the species was able to be determined using the taxonomic key published by Anderson *et al*. (2017).

Triodia chichesterensis was recorded in four vegetation types - 8a, 9a, 10a and 11b at up to 15% cover, but more commonly at or below 5% cover.

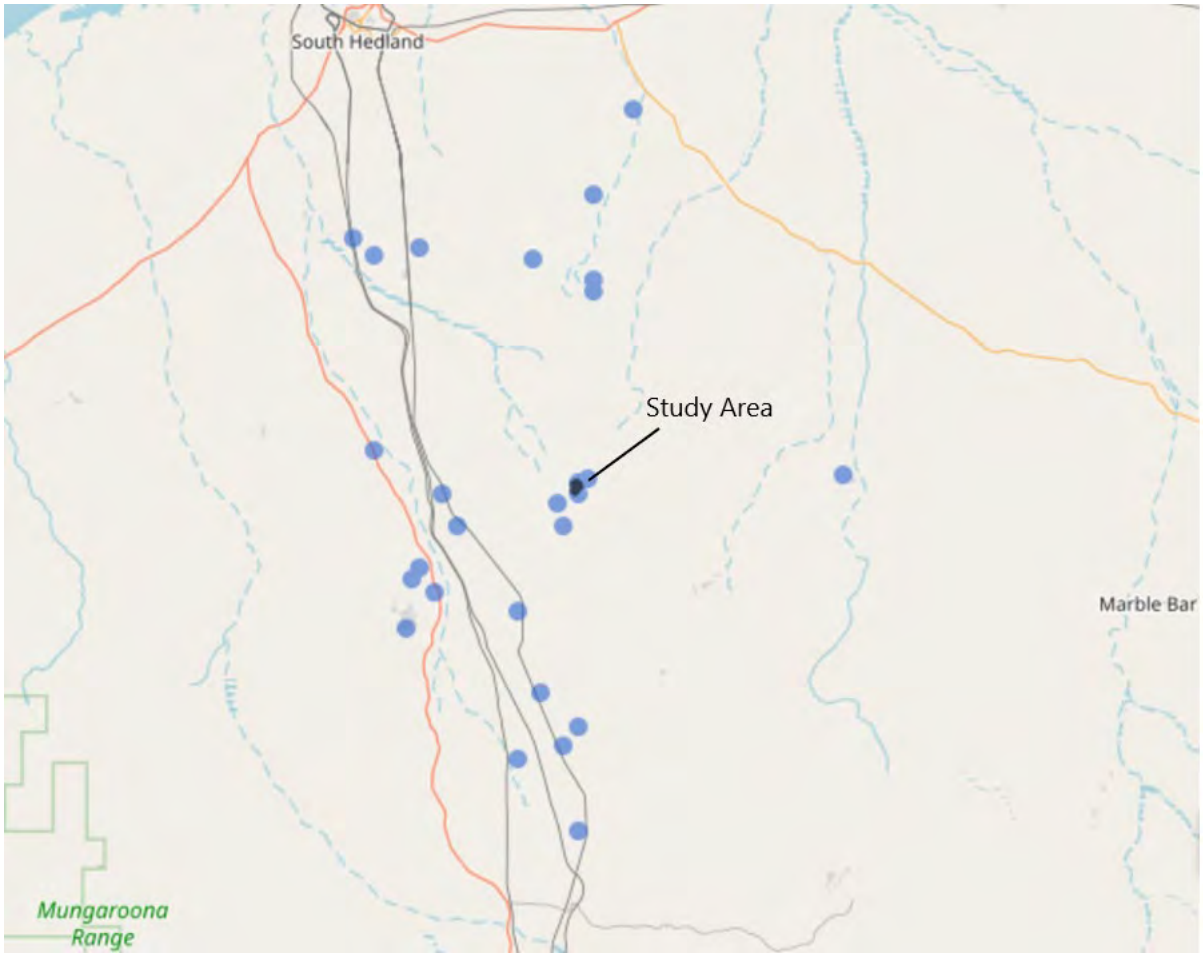


Figure 4-5. Regional records for *Triodia chichesterensis*
Source: Atlas of Living Australia

Rothia indica subsp. *australis* is a prostrate annual herb, to 0.3 m high, densely covered in spreading hairs. Flowering occurs from April to August. It is known from sandy soils in sandhills and sandy flats.

It is known to occur across the northern third of Australia (Figure 4-6), however records are sparsely distributed. A comparatively large number of records have been made in the Chichester subregion of the Pilbara, likely as a consequence of a large survey effort in the subregion. The Study Area is within the known range of the species, however there are no previous records for the species within the locality.

In the Study Area it was recorded in vegetation types 10a and 11b as scattered and infrequent individuals.

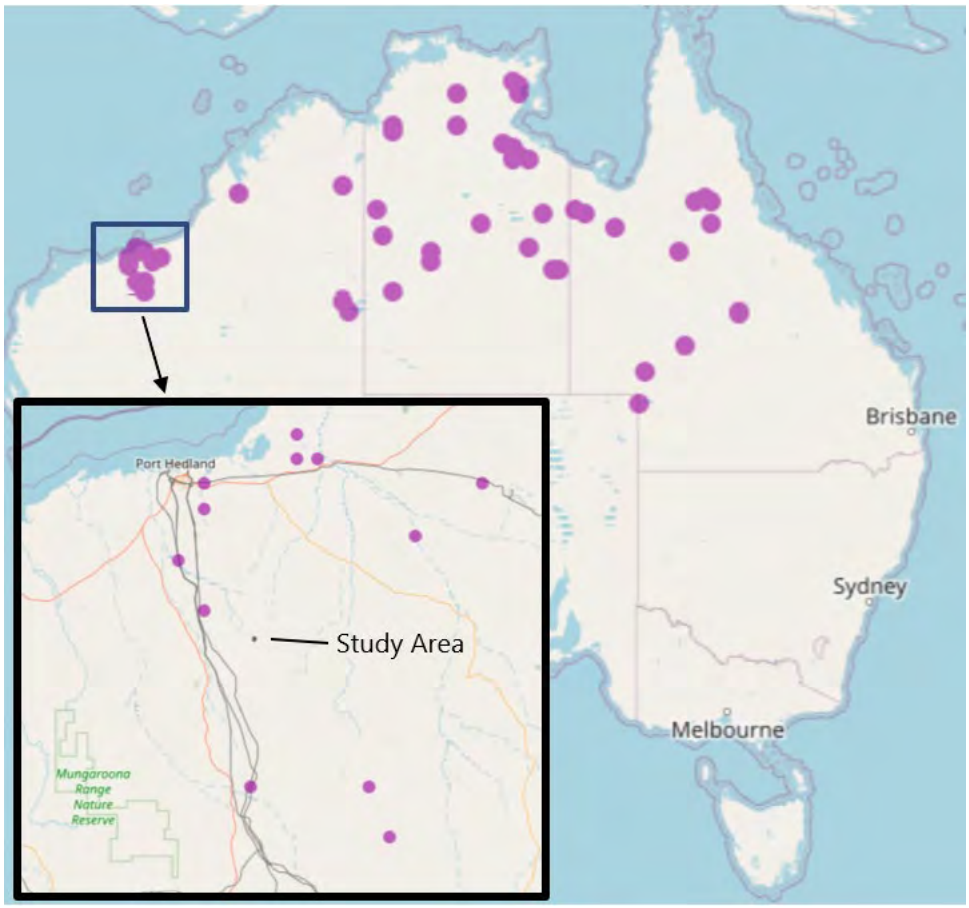


Figure 4-6. Australian and regional records of *Rothia indica* subsp. *australis*
Source: Atlas of Living Australia

An additional P1 species was recorded in the local area during the MMWC Environmental (2016) survey but was not recorded in the current survey. At the time of the MMWC Environmental (2016) survey the species was known as *Heliotropium muticum* and was considered to be a Priority 1 species. Taxonomic revision for the species has led to the revision of the name to *Euploca mutica* (Frohlich *et al*. 2020) and targeted searches resulting in increased known population size has led to a revision of the status to Priority 3.

Euploca mutica is a small, perennial herb/shrub that grows to approximately 0.3 m. In the previous local survey, it was recorded in the sand plain habitat in vegetation association 1a.

Atlas of Living Australia collection records for the species identify that flowering specimens are often collected in August, and that habitat includes sandy or calcareous plains, often on granite geology, with a sandy or loamy surface often with ironstone and quartz. In the Study Area the suitable habitat was assessed as being vegetation type 9a. Targeted searches were conducted throughout vegetation type 9a using traverses at intervals of approximately 25 m. No *Euploca mutica* were recorded. As seasonal conditions were suitable and the survey was conducted within the known flowering period, the species absence is determined with a high level of certainty.

An additional P3 species *Euphorbia clementii* was returned from the database searches as occurring within the Study Area but was not recorded during the survey. *Euphorbia clementii is* an erect herb,

growing up to 0.6 m high. It is known from gravelly hillsides and stony grounds. Suitable habitat in the Study Area is the 11a vegetation type.

4.2.5 Significant Vegetation

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

No species known to be associated with groundwater dependant ecosystems were recorded in the Study Area.

4.2.6 Introduced Flora

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

Table 4-5. Introduced Flora Recorded in the Study Area

Species	Common name	Description (Florabase 2022).
BAM Act S11 - Permitted		
Aerva javanica	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.
Cenchrus ciliaris	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.
Cenchrus setiger	Birdwood grass	Erect, tussocky, stoloniferous perennial, herb or grass-like. Grows to 0.5 m high. Flowers cream to purple from April to May. Grows on brown sands, red loam, or pindan soils on sand dunes, plains, rangelands, stony hillsides, or floodplains.

The agricultural weeds *Cenchrus ciliaris* and *C. setiger* were recorded in the plains on the western side of the Study Area where cattle grazing occurs at a high intensity, and tracks are frequent. Where found, these weeds were heavily grazed.

The environmental weed *Aerva javanica* was most common on the high ridge line and infrequent in the rocky hills.

5 TERRESTRIAL VERTEBRATE FAUNA RESULTS

5.1 DESKTOP STUDY

5.1.1 Significant Fauna

The DBCA database returned 14 species of significant fauna that have previously been recorded within 30 km of the Study Area. Of these, three are listed as migratory bird species (**MI**) and one as Other Specifically Protected (**OS**). Record locations of T and P fauna in relation the Study Area are shown in Figure 5-1.

One endangered (**EN**), one vulnerable (**VU**) and two P fauna species have previously been recorded within the Study Area.

The PMST returned 12 additional species, six T and six 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.

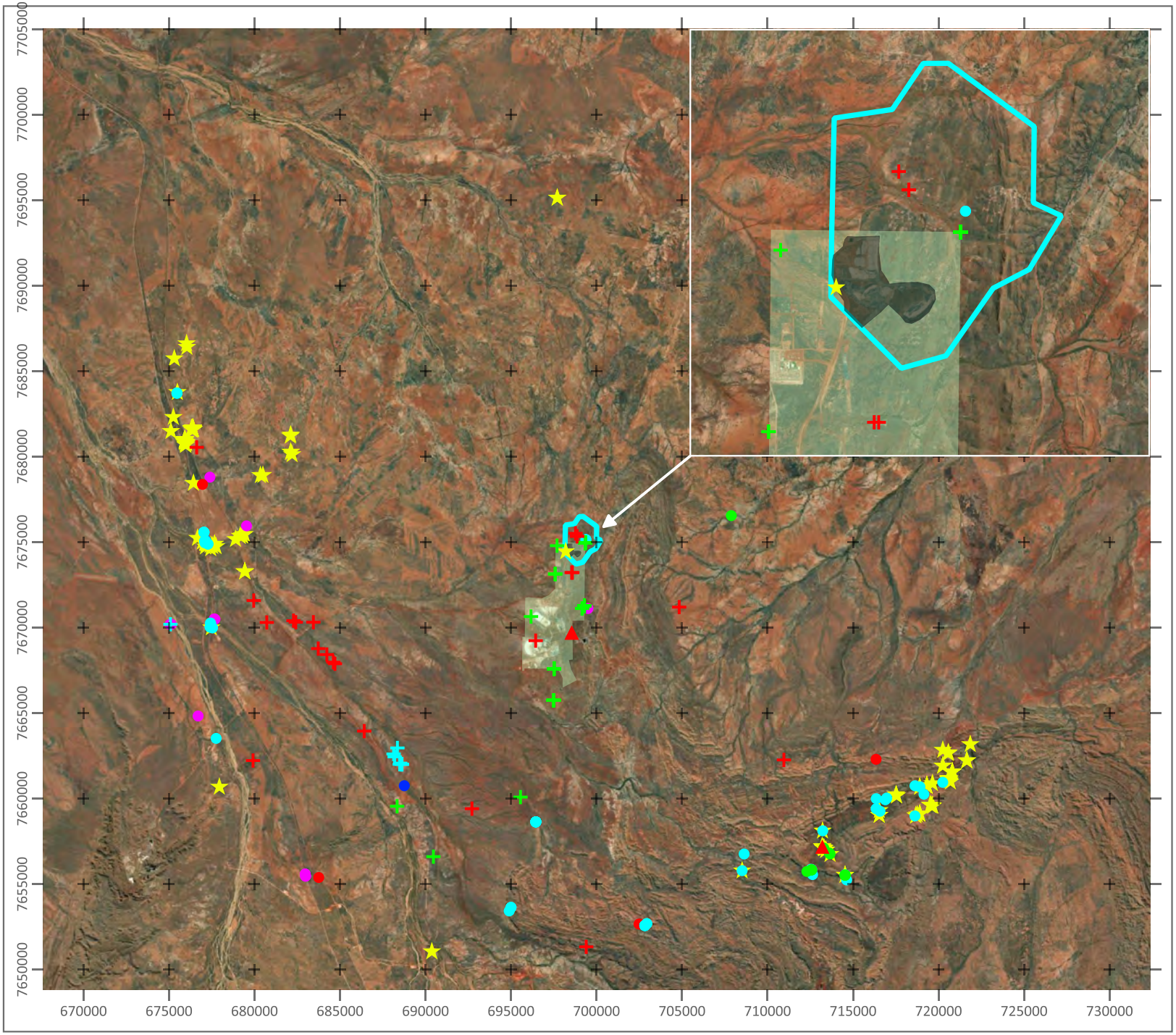
The Literature review returned additional information about the locations and abundance of Pilbara leaf-nosed bat and Northern quoll records.

Database search results of T, P and MI fauna within 30 km of the Study 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 Study Area and records in the local area is included in Appendix G.

5.1.2 Introduced Fauna

NatureMap records for eight introduced fauna recorded within 30 km of the Study Area were returned and are listed below:

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



Legend

- Study Area
- Cleared
- Pilgangoora Mine Operations

Endangered

- Northern quoll

Vulnerable

- Bilby
- Ghost bat
- Grey falcon
- Pilbara leaf-nosed bat
- Pilbara olive python

Priority 1

- Gane's blind snake (Pilbara)

Priority 4

- Brush-tailed mulgara
- Spectacled hare-wallaby (mainland)
- Western pebble-mound mouse

Scale: @ A4
1: 32,000

0 5 10 km

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

Author: TB Approved: EH Date: 18/08/2022

Threatened and Priority Fauna Records

Prepared for:
Pilbara Minerals

Figure: 5-1

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

Species	Common Name	Conservation Code		Assessment of Occurrence
		BC Act	EPBC Act	
Actitis hypoleucos	Common Sandpiper	MI	MI	Unlikely. No habitat occurs in the Study Area. No saline or coastal habitats available. Freshwater habitats are limited to drainage lines that are ephemeral, fast flowing, first and second order streams with no permanent or semi-permanent pools. The sandy plain fauna habitat is in a valley floor and would receive run-on following significant rainfall, however substrate is sandy therefore unlikely to retain water and provide wading habitat.
Arenaria interpres	Ruddy Turnstone	MI	MI	
Calidris acuminata	Sharp-tailed Sandpiper	MI	MI	
Calidris ferruginea	Curlew Sandpiper	CR	CR, MI	
Calidris melanotos	Pectoral Sandpiper		MI	
Calidris ruficollis	Red-necked Stint	MI	MI	
Numenius madagascariensis	Eastern Curlew	CR	CR, MI	
Pluvialis fulva	Pacific Golden Plover	MI	MI	
Thalasseus bergii	Crested Tern	MI	MI	
Tringa brevipes	Grey-tailed Tattler	MI, P4	MI	
Tringa glareola	Wood Sandpiper	MI	MI	
Tringa nebularia	Common Greenshank	MI	MI	
Fregata ariel	Lesser Frigatebird	MI	MI	

Species	Common Name	Conservation Code		Assessment of Occurrence
		BC Act	EPBC Act	
Apus pacificus	Fork-tailed Swift	MI	MI	Possible. Not habitat dependent.
Charadrius veredus	Oriental Plover	MI	MI	Unlikely. No suitable habitat available for this species.
Erythrotriorchis radiatus	Red Goshawk	VU	VU	Unlikely. No habitat occurs in the Study Area.
Falco hypoleucos	Grey Falcon	VU	VU	Possible. Suitable foraging habitat in the plains. No nesting habitat is present.
Falco peregrinus	Peregrine Falcon	OS	-	Unlikely. No habitat occurs in the Study Area.
Hirundo rustica	Barn Swallow	MI	MI	Unlikely. No habitat occurs in the Study Area.
Motacilla cinerea	Grey Wagtail	MI	MI	Unlikely. No habitat occurs in the Study Area.
Motacilla flava	Yellow Wagtail	MI	MI	Unlikely. No habitat occurs in the Study Area.
Pandion cristatus	Eastern Osprey	MI	MI	Unlikely. No habitat occurs in the Study Area.
Pezoporus occidentalis	Night Parrot	CR	EN	Possible. Some suitable spinifex, however foraging resources are limited.
Rostratula australis	Australian Painted-Snipe	EN	EN	Unlikely. No habitat occurs in the Study Area.
Dasycercus blythi	Brush-tailed Mulgara	P4	-	Possible. Sandy plains habitat is suitable.
Dasyurus hallucatus	Northern Quoll	EN	EN	Present. Denning and foraging habitats present, camera records and scats previously recorded.
Hipposideros stenotis	Northern Leaf-nosed Bat	P2		Unlikely. Species not known to occur in the Pilbara, generally being confined to more northern areas.

Species	Common Name	Conservation Code		Assessment of Occurrence
		BC Act	EPBC Act	
Lagorchestes conspicillatus leichardti	Spectacled Hare-wallaby	P4	-	Present. Historic records and suitable habitat across the Study Area.
Leggadina lakedownensis	Lakeland Downs Mouse	P4		Unlikely. No suitable habitat.
Macroderma gigas	Ghost Bat	VU	VU	Possible. Foraging habitat available across the Study Area. No roosting habitat available.
Macrotis lagotis	Greater Bilby	VU	VU	Possible. Suitable habitat includes the plains and low hills habitats.
Pseudomys chapmani	Western Pebble-mound Mouse	P4	-	Present. Mounds located in the low rolling hills.
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	VU	VU	Present. No roosting habitat available. Foraging habitat of low quality.
Sminthopsis longicaudata	Long-tailed Dunnart	P4		Possible. Suitable habitat in the low hills, boulder rock outcrops and platy rock outcrops.
Anilios ganei	Gane's Blind Snake (Pilbara)	P1		Unlikely. Suitable habitat unlikely to be present as drainage lines small and highly ephemeral. Very few termite mounds present for foraging resource.
Ctenotus nigrilineatus	Pin-striped Finesnout Ctenotus	P1		Possible. Suitable habitat occurs in the low hills and outcrops.
Liasis olivaceus subsp. *baronni*	Pilbara Olive Python	VU	VU	Unlikely. There are no gorges or significant water filled gullies in the Study Area.
Liopholis kintorei	Great Desert Skink		VU	Unlikely. Suitable habitat may occur 15 km to the southeast.

5.2 FIELD SURVEY

5.2.1 Fauna Habitats

The Study Area is characterised by rocky hills throughout the eastern half and into stony plains in the western half.

Drainage lines originate in the rocky eastern half and flow west towards the sandplains where formed channels cease and wash out areas are present and water moves as sheetflow. East of the high ground, small rocky first order streams join and flow to the northeast.

Six fauna habitats are described for the Study Area and are summarised in Table 5-2 below. The distribution of fauna habitats is shown in Figure 5-2. Photos of the habitat assessment locations are shown in Appendix D.

Table 5-2. Fauna Habitats within the Study Area

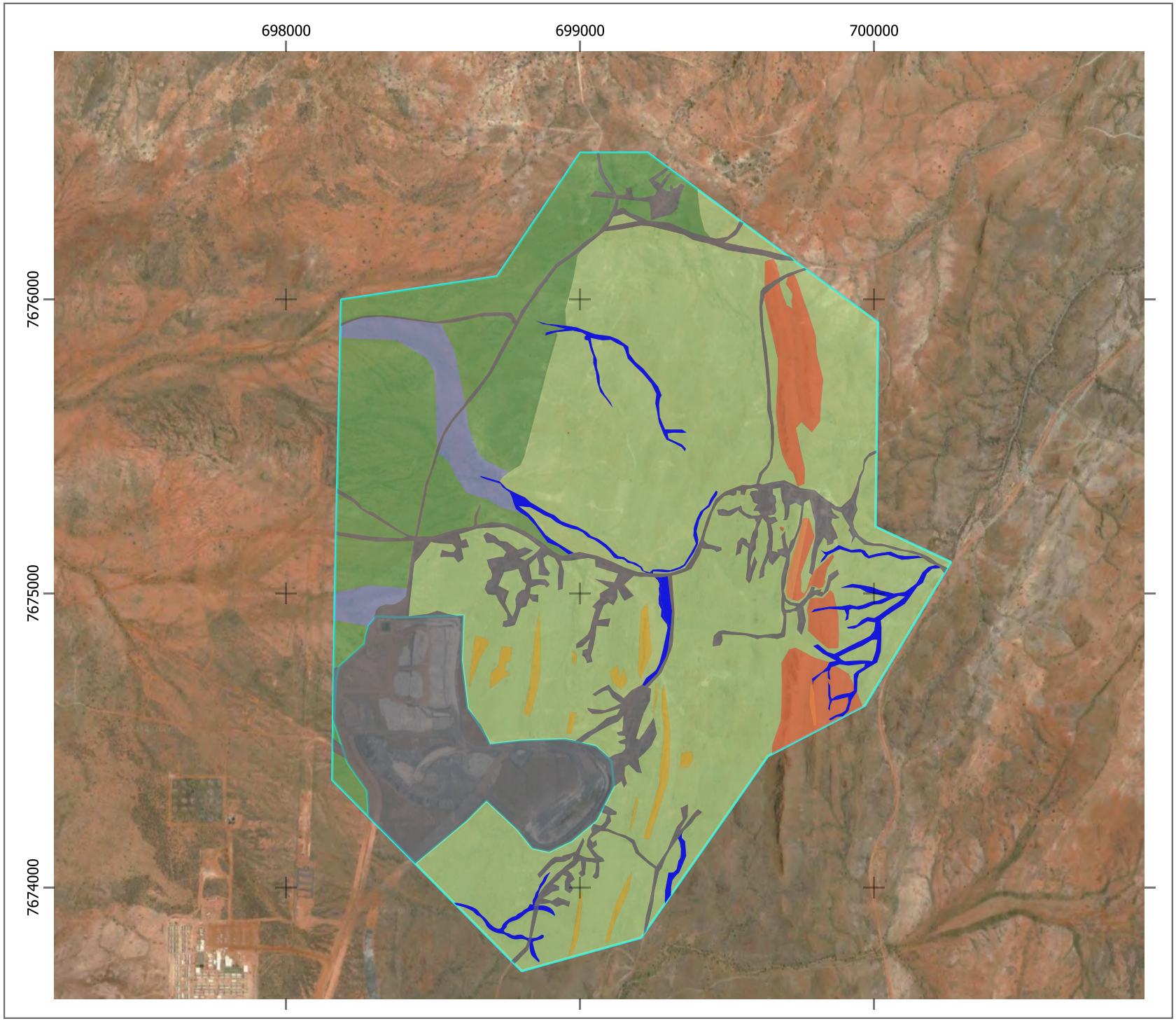
Habitat Code	Name	Sites	Description	Photo	Extent in Study Area (ha)
FH1	Boulder Rock Outcrops	MSC01, MSC08, MSC09, MSC13, MSC15	Rocky outcrops and ridges composed of angular, red granite boulders with >75% cover. Exposed bedrock provided cracks and crevices as important shelter sites for small and large reptiles such as goannas and snakes, and mammals such as the Northern Quoll. Soils were hard and unsuitable for burrowing species due to the surface rock cover. This habitat type is considered to have the highest habitat value relative to the others in the Study Area. The vegetation consists of tall, isolated shrubs of *Acacia inaequilatera, Atalaya hemiglauca* and *Acacia colei* over a low sparse shrubland of *Hibiscus sturtii, Acacia acradenia, *Aerva javanica*, and *Triodia wiseana, Triodia brizoides* and *Triodia chichesterensis* (P3) mid open hummock grassland. One individual *Ficus aculeata* var. *indecora* (Fig tree) occurred.		17.21

Habitat Code	Name	Sites	Description	Photo	Extent in Study Area (ha)
FH2	Platy Rock Outcrops	MSC02	Rocky outcrops and ridges composed of platy, sharp, red granite or schist with >75% cover. Exposed bedrock provided cracks and crevices as important shelter sites for small ground dwelling reptiles and small mammals. Soils were hard and unsuitable for burrowing species due to the surface rock cover. The habitat value is moderate. The vegetation consists of low isolated trees of *Corymbia hamersleyana* over tall, isolated shrubs of *Acacia colei, Acacia inaequilatera,* and *Senna glutinosa* subsp. *glutinosa* over *Triodia wiseana, Triodia chichesterensis* (P3), and *Triodia brizoides* mid hummock grassland.		5.44
FH3	Low Hills		This habitat type is characterised by rolling hills with an elevation of up to 250 m. The surface is generally stony and composed of quartzite and granite pebbles on red, loam soils. This habitat has a low diversity of microhabitats. Soils were hard and unsuitable for burrowing species due to the surface rock cover. No cracks and crevices are available for shelter sites for small or large animals. No trees are available to provide standing or fallen hollow logs. This habitat is suitable for small species of reptile (such as skinks and dragons) and small mammal species, such as the Western Pebble-mouse as they construct shelter mounds from small stones. Other than where conservation significant fauna occurs, this habitat provides limited value to fauna and given the lack of structure and microhabitats, is considered to have a low habitat value.		214.43

Habitat Code	Name	Sites	Description	Photo	Extent in Study Area (ha)
			The vegetation consists of tall, isolated shrubs of *Acacia inaequilatera, Acacia colei* and *Acacia acradenia* over *Triodia brizoides, Triodia wiseana,* and *Triodia epactia* mid hummock grassland.		
FH4	Sandy Plains	AS642022, NP002, NP04, AS450085, MSC12 MSC05	This habitat type is characterised by its red sandy loam soils with very little surface rock/pebble cover. It occurs on the valley floors as wide, linear corridors. The sandy substrate is suitable for burrowing species and in some places the spinifex hummocks are large, which can provide shelter for fauna. Availability of microhabitats in a sparse canopy, and in the groundcover of spinifex and soft substrate mean the habitat value is moderate. The vegetation consists of low *Corymbia hamersleyana* and *Acacia inaequilatera* isolated trees over *Acacia colei, Acacia ancistrocarpa,* and *Acacia bivenosa* sparse mid shrubland and *Triodia epactia, Triodia angusta* and **Cenchrus setiger* mid open hummock grassland.		11.13

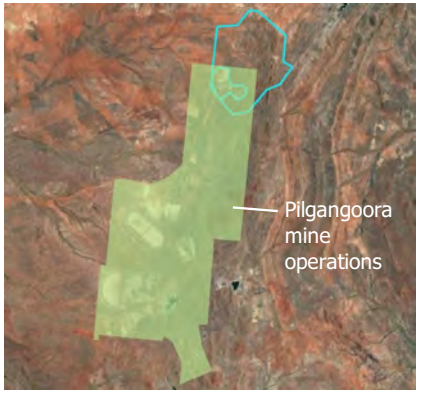
Habitat Code	Name	Sites	Description	Photo	Extent in Study Area (ha)
FH5	Stony Gullies	AS45007, AS642029, MSC03, MSC04, MSC06, MSC07, MSC10, MSC11, MSC14	Narrow to wide, shallow drainage lines and gullies with red, stony surfaces of quartzite and granite. Occasionally exposed rock including some rock walls, rock piles, crevices and cracks are present. Occasionally soft sandy soil in the stream beds due to deposition. Where softer soils in stream beds occur, they may be suitable for burrowing species. Occasional trees but generally of insufficient size to have hollows and no fallen hollow branches observed. This habitat may act as a wildlife corridor for birds, bats, mammals, and reptiles. The habitat value is high. The vegetation consists of isolated low trees of *Corymbia hamersleyana* over high open shrubland of *Grevillea wickhamii* subsp. *hispidula, Acacia acradenia, Acacia inaequilatera* and *Acacia colei* over scattered shrubs of *Acacia bivenosa* and *Cajanus cinereus* over open hummock grassland of *Triodia epactia, Triodia wiseana* and *Triodia angusta* over very open tussock grassland of *Eriachne mucronata* and *Cymbopogon ambiguousx.*		7.61

Habitat Code	Name	Sites	Description	Photo	Extent in Study Area (ha)
FH6	Stony Plains	AS450085, MSC12, MSC16, NP01, NP03	Gently undulating stony surfaces of quartzite or granite on red sandy loam soils. This habitat is suitable for small species that construct shelters from small stones. This habitat type contains limited microhabitats providing limited vegetation with no midstory, very few, small tree hollows, few to no logs and limited leaf litter. This habitat provides limited value to fauna and given the lack of structure and microhabitats, is considered to have a low habitat value. Low *Corymbia hamersleyana* isolated trees over, *Acacia ancistrocarpa*, *Acacia colei*, *Acacia bivenosa*, *Acacia inaequilatera* and *Grevillea wickhamii* sparse to open mid shrubland and *Triodia wiseana, Triodia epactia* and *Triodia chichesterensis* (P3) mid hummock grassland with *Alysicarpus muelleri* forbs and *Aristida holathera* tussock grasses.		65.89
D	Disturbed		Completely Degraded – cleared land including areas that have been rehabilitated but where vegetation has not yet re-established.		72.96



Legend

- FH1
- FH2
- FH3
- FH4
- FH5
- FH6
- D
- Study Area



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

Author: EH Approved: ML Date: 25/10/2022

Fauna Habitats

Prepared for:
Pilbara Minerals

Figure: 5-2

5.2.2 Acoustic bat recorders

The recording dataset comprised a total of 51 recording nights from four bat detector units.

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

Five call sequences of the Pilbara leaf-nosed bat were detected and are listed in Table 5-3.

Table 5-3. Acoustic recording results

Species	Detector serial #	Date	Time (hh:mm:ss)
Pilbara leaf-nosed bat	450007	14-08-2022	00:06:38
Pilbara leaf-nosed bat	450007	17-08-2022	00:39:22
Pilbara leaf-nosed bat	450085	21-08-2022	21:20:51
Pilbara leaf-nosed bat	642029	15-08-2022	21:28:01
Pilbara leaf-nosed bat	642029	16-08-2022	22:33:42

All call sequences of the Pilbara leaf-nosed bat were recorded well after sunset and therefore when the individual was out foraging away from a diurnal roost.

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

No calls of the Northern leaf-nosed bat were detected.

5.2.3 Motion triggered cameras

Motion-triggered cameras returned 62 captures of individuals, where records from the same species were separated by more than one hour. The complete list of captures is included in Appendix H. The sub-sections below discuss captures in two groups, target significant species and incidental records.

5.2.3.1 Target significant species

Targeted significant species comprised two individuals. These were one Northern quoll at MSC01 and one at MSC09. The MSC09 capture was just of the tail. Images from these two captures are shown in Plate 5-1 and Plate 5-2.

Plate 5-1. Northern quoll captured on MSC01

Plate 5-2. Northern quoll captured by MSC09 (tail only)

5.2.3.2 Incidental records

Non-target captures returned a diversity of species, including Introduced fauna. Table 5-4 lists the incidental records from the motion-triggered cameras.

Table 5-4. Non-target captures

Common name	Species name	Number of captures
Birds		
Bush Stone-curlew	*Burhinus grallarius*	1
Common Bronzewing	*Phaps chalcoptera*	2
Crested Pigeon	*Ocyphaps lophotes*	1
Diamond Dove	*Geopelia cuneata*	1
Magpie-lark	*Grallina cyanoleuca*	3
Painted Finch	*Emblema pictum*	1
Red-capped Plover	*Charadrius ruficapillus*	2
Singing Honeyeater	*Gavicalis virescens*	1
Spinifex Pigeon	*Geophaps plumifera*	4
Stubble Quail	*Coturnix pectoralis*	5
Willie Wagtail	*Rhipidura leucophrys*	1
Yellow-throated Miner	*Manorina flavigula*	1
Zebra Finch	*Taeniopygia castanotis*	1
Mammals		
Common Rock-rat	*Zyzomys argurus*	10
Cattle	*Bos taurus*	5
Dingo	*Canis familiaris dingo*	2
Euro	*Osphranter robustus*	3
Fat-tailed Pseudantechinus	*Pseudantechinus macdonnellensis*	3
Reptiles		
Coarse Sands Ctenotus	*Ctenotus piankai*	3
Lined Fire-Tailed Skink	*Morethia ruficauda*	2
Panther Skink	*Ctenotus pantherinus*	1
Perentie	*Varanus giganteus*	2
Northern Pilbara Rock Goanna	*Varanus pilbarensis*	3

All captures were of good image quality and were able to be identified.

Five captures were of cattle, which is expected as the land is within Wallareenya and Strelly Stations and pastoralism is the active land use within all the surveyed areas. No other introduced fauna were captured.

Two bird species, the Red-capped plover and Stubble quail have not previously been recorded for the Pilgangoora Project.

5.2.4 Acoustic bird recording devices

No Night parrot calls were recorded in the 56 hours of assessed recordings.

5.2.5 Traverses

During traverses, the following fauna signs were identified:

- Three Northern quoll scats; and
- 11 Western pebble mouse mounds (four active, four intermediate and three inactive).

No signs of Greater bilby, Night parrot, Brush-tailed mulgara, Spectacled hare-wallaby or Long-tailed dunnart were observed.

No T bird species were observed.

Notes were taken on habitat quality, disturbances, and the availability/unavailability of habitat micro-niches.

5.2.6 Conservation Significant Fauna

5.2.6.1 Northern Quoll

In the Pilbara region, the species tends to prefer the Rocklea, Macroy and Robe land systems (Biota Environmental Services 2008). These land systems are comprised of basalt hills, mesas (and buttes of limonites), high and low plateaux, lower slopes, occasional tor fields and stony plains supporting either hard or soft spinifex grasslands (van Vreeswyk *et al*. 2004).

The Northern quoll has also been recorded in other land systems which are comprised of sandstone and dolomite hills and ridges, shrublands, sandy plains, clay plans and tussock grasslands and coastal fringes including dunes, islands and beaches (Biota Environmental Services 2008).

This species has been located on several occasions within the Lynas Find Study Area and south into the Pilgangoora project area (DBCA Database record, Ecologia Environmental 2018; Terrestrial Ecosystems 2020). Locally this species seems to be most encountered in the boulder hill tops (FH1) of the north/south tending ridgeline running along the eastern half of the Study Area. This is the most rugged landform in the Study Area, at the highest elevations. Boulders on the ridge tops form a mosaic of cracks and crevices large enough to provide denning habitat for the quoll. Two camera records and three quoll scats were recorded in this area in the present study. Ecologia Environmental (2018) recorded 5 scats and Terrestrial Ecosystems (2020) made captures on 12 cameras within this habitat type.

The lithology of the other lower hills and breakaways in the remainder of the Study Area differs significantly. These schists are more plate like and provide no denning opportunity. Trees within the Study Area were generally small and did not provide hollows for denning opportunities. No quoll scats were recorded in gullies.

Foraging or dispersal habitat is recognised to be any land comprising predominantly native vegetation in the immediate area (*i.e.* within 1 km) of shelter habitat, quoll records or land comprising predominately native vegetation that is connected to shelter habitat within the range of the species (CoA 2016).

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). The Northern quoll within FH1 are a population important for the long-term survival of the Northern quoll as it is a population occurring in habitat that

is free of cane toads and unlikely to support cane toads upon arrival *i.e.* granite habitats in WA, populations surrounded by desert and without permanent water.

Habitat critical to the survival of the Northern quoll is present in the Study Area and includes:

- habitat FH1;
- areas of native vegetation within 1 km of FH1; and
- dispersal and foraging habitat associated with or connecting the population within FH1 to other nearby populations or foraging habitats.

The FH1 habitat is contained within the A-KEe-xmws-mus; Euro Basalt; Mafic and ultramafic schists geological unit (Geological Survey of Western Australia 2014). Examination of aerial imagery in conjunction with the geological units indicates that the best local denning and foraging habitats would be within this unit, based upon the expectation of denning suitable outcrops occurring within the same geological formation.

Within the Study Area, creek lines are small, fast flowing and have only sporadic small trees of *Corymbia hamersleyana*. These provide little to no denning and foraging opportunities as no standing or fallen hollow logs are available and very sparse litter is present. No quoll records or signs were recorded in the creeks. Whilst in other environs creek lines would be a dispersal and foraging habitat for northern quoll, in the Study Area this habitat type does not appear to be frequented by the species.

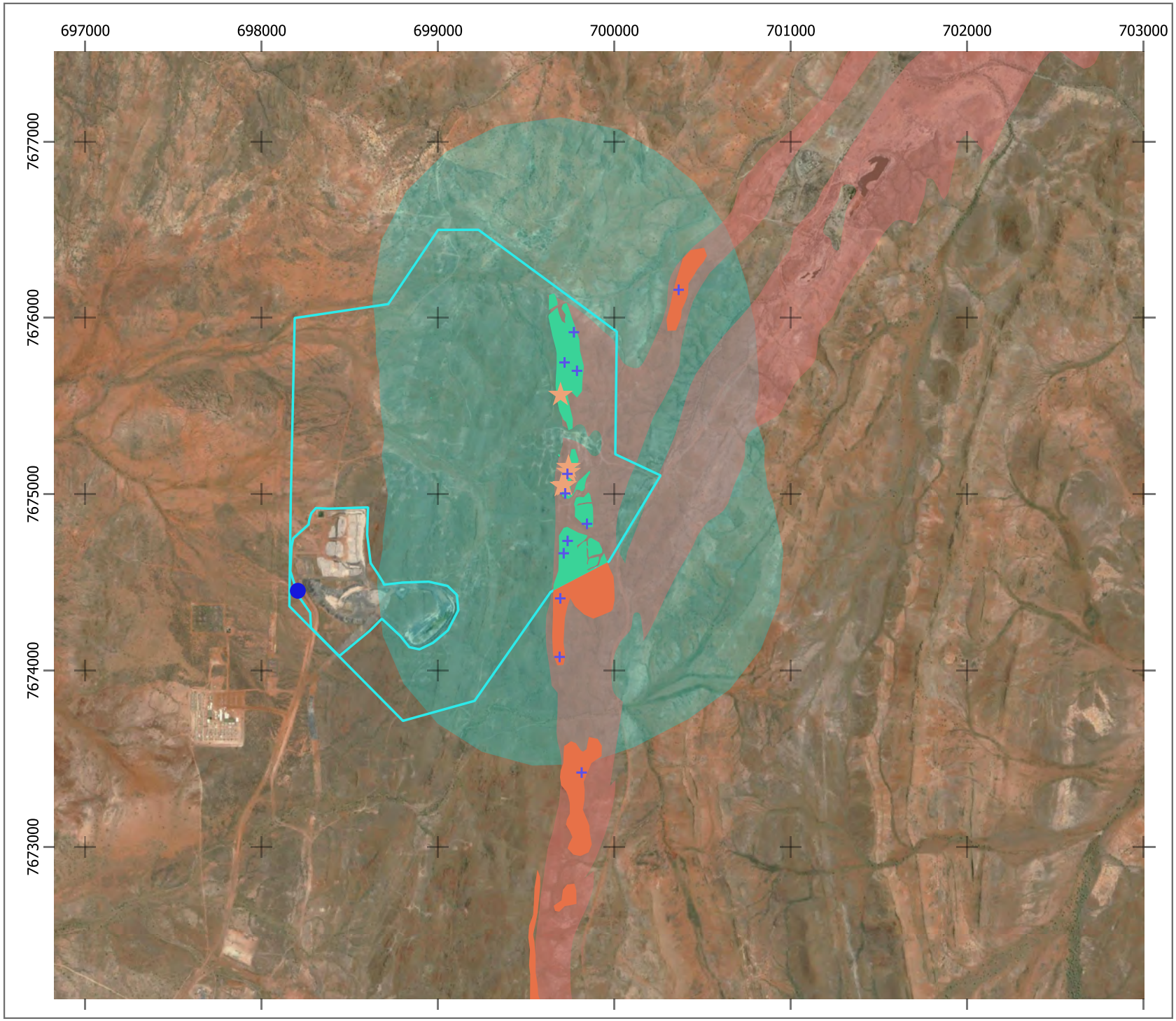
All habitats occurring within the Study Area may be utilised by the species, at some time, to forage and or during dispersal activities; however, their significance to the species will vary depending on resource availability and connectivity. An opportunistic sighting of northern quoll was made in 2018 within the Study Area near to the entrance of the active mining area, demonstrating the species moves reasonable distances from the core shelter habitat, including into disturbed areas. Open surface water – a turkey's nest constructed for the mining operations - is currently present near to the location of sighting. It is not known whether the surface water was present at the time of the quoll sighting but if so, the open water may attract the quoll searching for food and water.

Foraging habitat within the Study Area is likely to vary depending on resource availability, which may be seasonally dependant.

Figure 5-3 shows the location of Northern quoll records, F1 habitat, areas within 1km of the FH1 habitat and the A-KEe-xmws-mus geological unit.

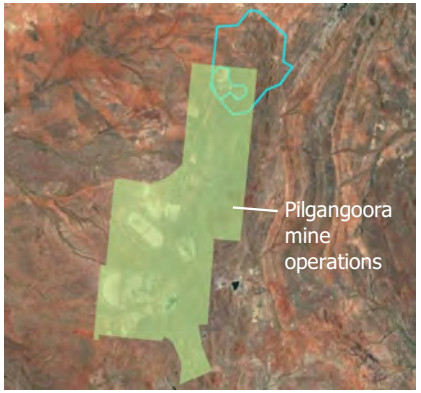
Three quoll scats were recorded during the traverses, within 30 to 113 m south of camera MSC01 (the southern of the two camera records). Quoll scat locations are (GDA 1994, MGA Zone 50):

- 699741, 7675127;
- 699703, 7675048; and
- 699719, 7675052.



Legend

- Camera captures and scat locations - present study
- Camera captures Terrestrial Ecosystems (2020)
- Database record (2018)
- FH1 - Critical Habitat
- Rocky Hills Habitat identified by Terrestrial Ecosystems (2020) outside of Lynas Find Study Area
- A-KEe-xmws-mus Geological unit -likely dispersal habitat
- 1 km critical habitat buffer
- Study Area



Scale: @ A4
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0 250 500 m

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

Author: EH Approved: ML Date: 25/10/2022

Northern Quoll

Prepared for:
Pilbara Minerals

Figure: 5-3

5.2.6.2 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 4 categories of roosting habitat used by Ghost bats in the Pilbara region (Bullen 2021):

- Category 1 maternity/diurnal roost sites with permanent Ghost bat occupancy;
- Category 2 maternity/diurnal roost caves with regular occupancy;
- Category 3 diurnal roost caves with occasional occupancy; and
- Category 4 nocturnal roost caves with opportunistic usage.

Within the Study Area there are no Category 1, 2 or 3 sites/caves available to this species. The largest crevices/fissures located within the Study Area would not provide the required temperature and humidity regulation or any security from predators, such as cats. At best, the FH1 habitat may provide Category 4 nocturnal roost caves with opportunistic usage.

Numerous observations suggest that most shallow caves, shelters and deep overhangs in the Pilbara are used in at least an opportunistic manner by itinerant Ghost bats. This may be anything from a single foraging visit to a longer visit, with a resting period or possibly a feeding session. Evidence of such visits is the widespread presence of small numbers of scats and/or food scraps found, or occasional echolocation calls recorded during surveys. These visits may or may not be repeated, depending on whether the bat is passing through a district or is a more permanent resident nearby. These are not considered critical habitat.

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). In the Study Area there are scattered *Corymbia hamersleyana* trees available for perching.

No Ghost bats were recorded during the acoustic survey, however acoustic recorders are not suited to Ghost bat detection as the species seldom uses its echolocation away from caves. Visual inspection of the FH1 habitat was made and no scats or food scraps were recorded.

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. 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 Study Area may be within range of Category 1, 2 or 3 habitat.

It is possible that the Study Area offers foraging habitat to Ghost bat across all habitats and Category 4 nocturnal roosts in habitat FH1.

5.2.6.3 Pilbara Leaf-Nosed Bat

A recent review of Pilbara leaf-nosed bat (Bat Call WA 2022) 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 also 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 (Kulzer *et al*. 1970; Churchill *et al*. 1988; Jolly 1988; Churchill 1991; Baudinette *et al*. 2000; Armstrong 2001). There is a possibility that some roosts exist in the deeper spaces amongst granite tor rockpiles in the eastern Pilbara, (Armstrong and Anstee 2000; Armstrong 2001) although recent survey work is yet to identify any (Bat Call WA 2022). 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. 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 is 2.2 km from the Study Area to the north-northeast and the foraging habitat is 1.7 km to the northeast 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 approximately 20 km to the southwest and southeast of the Study Area (Bat Call WA 2022).

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 2022). Echolocation based records indicate that it can complete round trips of 50 km or longer in a night under favourable conditions (Bat Call WA 2022).

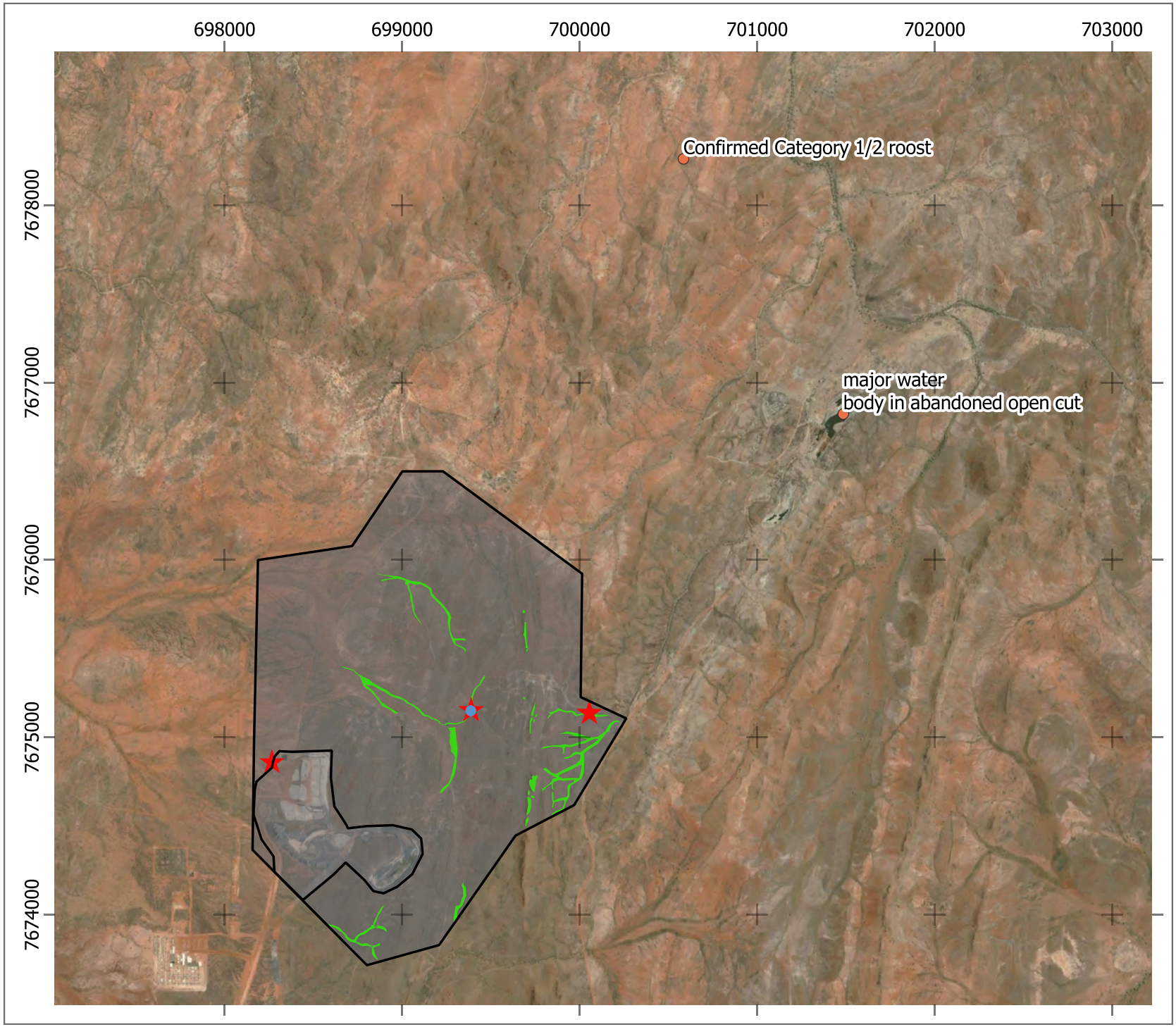
The Study Area does not contain any roosts described as Category 1, 2, 3 or 4. The FH1 habitat offers only shallow overhangs, therefore no roosting habitat is available. The Study Area is within range of three Category 1/2 roosts.

The Pilbara leaf-nosed bat was recorded using acoustic recorders within the site during the Pilgangoora Targeted survey and again in the present study. In August 2022 the Pilbara leaf-nosed bat was recorded on four occasions in stony gullies and one occasion in the stony plains. The stony plains location was near to some open surface water created through the construction of a turkey's nest and associated drainage channels. All call sequences of the Pilbara leaf-nosed bat were recorded well after sunset and therefore when the individual was out foraging away from a diurnal roost (Appendix E).

Habitat types found in the Pilbara have been scaled and a foraging habitat rating applied (Bat Call WA 2022). Plains and low hill habitats in the Study Area conform to the description of *Open plain with one layer of vegetation structure (excluding scattered trees).* These are of low habitat rating. Pilbara leaf-nosed bat are unlikely to forage in the plains and low hills of the Study Area but may traverse while crossing to more productive areas.

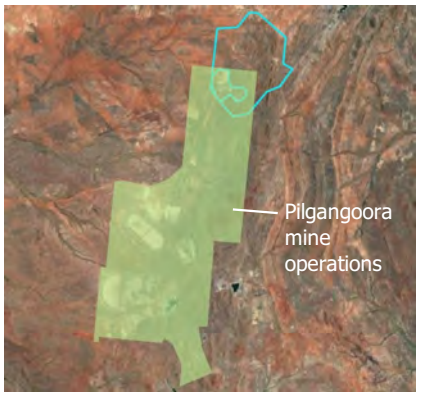
The FH1 and FH5 habitats fall within the description *Mesa side or long ridge line with deeply incised gullies in weathered strata (45° sloping walls). Caves and overhangs present. Shrubs in gully base. Ephemeral watercourse in gully or nearby.* These are of moderate habitat rating (Bat Call WA 2022). Pilbara leaf-nosed bat may occasionally forage in these areas due to presence of suitable vegetation, seasonal water and may also use areas as a flyway.

The recorded locations of the Pilbara leaf-nosed bat are consistent with the habitat rating. The FH1 and FH5 habitats are of moderate quality and the remaining habitats are of low quality. Man-made open water such as the turkey's nest may attract suitable prey and therefore attract Pilbara leaf-nosed bat.



Legend

- Acoustic recordings of Pilbara Leaf-nosed Bat
- Moderate habitat rating
- Low habitat rating
- Database record from previous Targeted Survey



Scale: @ A4
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0 250 500 m

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

Author: EH Approved: ML Date: 25/10/2022

Pilbara Leaf-nosed Bat

Prepared for:
Pilbara Minerals

Figure: 5-4

5.2.6.4 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. At its closest point, the Turner River is 23 km from the Study Area. The plains habitat in the Study Area is suitable foraging habitat for this species, and within range of the population likely to be nesting in the Turner River riparian zone. No nesting habitat is present in the Study Area.

5.2.6.5 Night Parrot

The Study Area is within the area where Night parrot are 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 parrots, 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 the FH6 habitat in the Study Area may be suitable for the Night parrot. There are no samphire or chenopod habitats proximal to the Study Area, therefore foraging habitats are limited locally, however 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 Western Australia (DPAW 2017) identifies when and where Night parrot surveys may be required. The Study Area is on the northwestern 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 suitable spinifex habitat passive acoustic survey was conducted at locations where the best spinifex habitat was found. Four devices were deployed for a total of 16 trap nights. No Night parrot calls were recorded.

Foot traverses through the plains habitat where the largest and oldest hummock grasses occur did not encounter any signs of 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.

5.2.6.6 Greater Bilby

Extant populations of the 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). It 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 Study Area is within the area where the species is listed in the PMST as known to occur. Database results returned 334 records within a 50 km radius of the Study Area, the closest being one record to the east of Pilgangoora made in 1979. The high number of records are due to monitoring (transect) surveys in association with the construction of rail corridors that pass the Study Area to the west.

Suitable habitat occurs in the Study Area across the sandy plains, stony plains and low hills habitats (FH3, FH4 and FH6). Extensive foot transects were walked across these habitats at 10-20 m intervals. No burrows were located, and no tracks or other traces were recorded. It is unlikely the species is currently present.

This species has the potential to occupy the Study Area in the future as bilbies can be relatively transient across their distribution. However, no historical burrows were observed suggesting they have not occupied the area in recent times.

5.2.6.7 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^2. 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 (Ford and Johnson 2007; 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. Eleven active and inactive 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 (classed 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 5-5.

Table 5-5. Western Pebble-mound Mouse mound status and location

Status	Location (GDA 1994; MGA zone 50)
Active	699553, 7676033
Active	699477, 7676125
Active	699489, 7675818
Active	698929, 7675803
Intermediate	699126, 7676089
Intermediate	698970, 7676056
Intermediate	698995, 7676300
Intermediate	698874, 7675599
Inactive	699073, 7676012
Inactive	699424, 7676228
Inactive	699359, 7676249

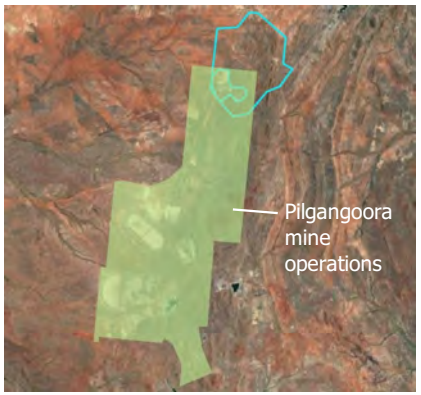
Legend

Pebble Mound status

- Active
- Inactive
- Intermediate
- Transect

Fauna Habitats

- FH3
- FH6



Scale: @ A4
1: 20,000

0 200 400 m

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

Author: EH Approved: ML Date: 25/10/2022

Western Pebble-mound Mouse

Prepared for:
Pilbara Minerals

Figure: 5-5

5.2.6.8 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 Study Area with the closest records 15 km to the southwest. Records originate from biological surveys assessing the impact of rail lines servicing the Pilbara region.

Suitable habitat in the Study Area includes Sandy Plain and some areas of Stony Plain, 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 but none were detected. Based on somewhat limited habitat, the Mulgara is considered as Possibly occurring in the Study Area.

5.2.6.9 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, including within the FH3 habitat of the Study Area and in the surrounding plains habitats to the west. These records are from the early 1990's.

No signs or records of spectacled hare-wallaby were made in the Study Area, despite targeted searches for individuals or signs (*e.g*. scats), motion triggered camera deployment and spotlighting. The species was not recorded during the detailed and reconnaissance fauna surveys for the Pilgangoora Project. The absence of the species is likely a consequence of the broader regional decline.

The presence of suitable habitat and the historic records indicate it is possible for the species to occur. Whilst it has been recorded in the FH3 habitat historically, the largest hummock grasses presenting the highest quality habitat for the species, is currently found in the Sandy Plains (FH4) habitat.

5.2.6.10 Long-tailed Dunnart

The Long-tailed dunnart is 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. All sites it is known to frequent are within rugged rocky landscapes that support a low open woodland or shrubland of Acacias (especially Mulga) with an understorey of spinifex hummocks and (occasionally) also perennial grasses and cassias.

Local records occur at two sites approximately 25 km south east and south west of the Study Area. The FH1 habitat is suitable for the Long-tailed dunnart and the species possibly occurs.

5.2.6.11 Pin-striped Finesnout Ctenotus

The Pin-striped finesnout ctenotus has been found on spinifex plains on granitic soils near watercourses (Wilson and Swan 2013). Record locations are near to granite outcrops in the hilly interior of the Pilbara. Very little information is available for the species. It is possible that the FH1 and FH5 habitats are suitable for the species. Local records are remote and are in association with a larger watercourse than are present in the Study Area. It is possible that the species occurs within the Study Area.

6 CONCLUSIONS

6.1 FLORA

The flora and vegetation survey recorded a total of 113 taxa within the Study Area which is comparable to the number of taxa recorded in other previous local surveys: 195 taxa (101 genera and 39 families) recorded by MMWC Environmental (2016) at the Pilgangoora Project, and 122 taxa (67 genera and 38 families) recorded by Outback Ecology (2009) at Wodgina. The current Study Area is smaller than these other local surveys and contains fewer landforms, therefore the lower diversity would be expected.

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

6.2 FLORA OF CONSERVATION SIGNIFICANCE

No Threatened flora was recorded in the Study Area. One Threatened flora species was returned from the database searches, *Quoya zonalis* (formerly *Pityrodia* sp. Marble Bar). The species is listed as Endangered under the EPBC Act and Threatened under the BC Act. Preferred habitat is steep, rocky, sandstone conglomerate and granite slopes in skeletal, brown, sandy loam soils of the Capricorn Land System. The Study Area is not within the Capricorn Land System (Figure 2-3), however granite outcropping is present in vegetation type 10a, and a targeted search was undertaken in this vegetation type. *Quoya zonalis* is a distinctive soft, grey, woody, perennial shrub to approximately 1.5 m in height, making it easily detectable and recognisable during targeted search. No records were made.

Two P3 species were recorded. *Triodia chichesterensis* was frequently recorded and no count of individuals was made, due to the high frequency and abundance of the species presence. It is a sub-dominant of the ground cover in four vegetation types - 8a, 9a, 10a and 11b at up to 15% cover, but more commonly at or below 5% cover. *Rothia indica* subsp. *australis* was recorded in two locations as one individual at each location. One location is within the 10a habitat and the other within the 11b habitat. As the species is small and the Study Area containing these vegetation types comparatively large, it is likely there are other individuals within these habitat types.

An additional P3 species was recorded in the local area during the MMWC Environmental (2016) survey but was not recorded in the current survey. Targeted searches were performed and no *Euploca mutica* (formerly *Heliotropium muticum*) were recorded. Seasonal conditions were suitable at the time of survey and the survey was conducted within the known flowering period; therefore, the species absence is determined with a high level of certainty.

Of the 12 Priority species returned from the DBCA database searches, one was assessed as present due to a historic record, and six were considered Possible to occur based on suitable habitat present and previous records from between 15 – 50 km of the Study Area. Of these species, seven are annuals: *Euphorbia clementii* (P3), *Eragrostis crateriformis* (P3), *Gomphrena leptophylla* (P3), *Nicotiana umbratica* (P3) *Bulbostylis burbidgeae* (P4), *Themeda* sp. Panorama (J. Nelson *et al.* NS 102) and *Goodenia nuda* (P4). Given the rainfall in the three months prior to the survey conducted in August 2022 was above average, these annual species are likely to have been present at the time of survey, should they occur in the area. It should be noted that most of that rainfall was received in May 2022 with the survey conducted in August 2022. This length of time may be a factor in absence of the species.

The remaining species considered Possible to occur is perennial and, as such, it can be expected these species would be present, should they occur in the area. The survey was thorough, and it is probable these species would have been recorded should they occur in the area. Given they were not recorded, the likelihood of these species occurring within the Study Area is considered Possible, not Likely.

6.3 INTRODUCED FLORA

No weeds Declared under the BAM Act or classed as a WoNS were recorded in the Study Area. Three weeds were recorded, two species of agricultural grasses in the genus *Cenchrus* and the environmental weed Kapok. *Cenchrus* grasses are valued by pastoralists and as the underlying land use is pastoralism it is not unexpected to record these weedy grasses. Whilst not being attributed any formal classification under weed management legislation, *Cenchrus* grasses are known to adversely alter fire regimes, which is a threatening process for some Threatened fauna in the region.

6.4 VEGETATION OF CONSERVATION SIGNIFICANCE

There are no recognised TECs, PECs or ESAs located within or adjacent to the Study Area.

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

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 Study Area.

No species known to be reliant on groundwater were recorded and therefore no Groundwater Dependent Ecosystems occur in the Study Area.

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

6.5 FAUNA OF CONSERVATION SIGNIFICANCE

The survey identified:

- A population important for the long-term survival of the Northern quoll;
- Habitat critical to the survival of the Northern quoll in three categories:
  - rocky habitat such as ranges (habitat FH1);
  - areas of native vegetation within 1 km of FH1; and
  - dispersal and foraging habitat associated with or connecting the population within FH1 to other nearby populations or foraging habitats, assumed to be defined by geological unit A-KEe-xmws-mus;
- Pilbara leaf-nosed bat is present within the Study Area but the quality of habitat is limited to Moderate value foraging over FH1 and FH5 and Low value elsewhere, with no roosting habitat present;

- Western pebble-mound mouse is present in the Study Area and Targeted Search identified mound locations. Suitable habitat was within the FH3 and FH6 habitats but was confined to the northern central section of the Study Area;
- Foraging habitat suitable for the Grey Falcon populations known to occupy the Turner River area 23 km to the west; and
- Possible habitat for the Night parrot, Greater bilby, Ghost bat, Brush-tailed mulgara, Spectacled hare-wallaby, Long-tailed dunnart and Pin-striped finesnout ctenotus but no evidence of their presence was recorded.

A feature of the Northern quoll critical habitat is the lack of surface water suitable for cane toad breeding. Cane toad are a Threatening process for northern quoll (Hill and Ward 2010). Control and monitoring of surface water within developed areas may be required to prevent future cane toad establishment within foraging and dispersal distance of northern quoll critical habitats. The Cane Toad has not yet become established in the Pilbara, however, has been infrequently recorded.

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APPENDICES

APPENDIX A: CONSERVATION AND DECLARED CATEGORIES

Appendix A: Conservation Categories for Flora, Fauna and Ecological Communities, and Categories for Introduced Flora

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
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	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.
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (E)	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.
Vulnerable (V)	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.
Conservation dependent (CD)	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: i) the taxa is a species of fish; 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; 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. 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
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	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.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future, 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 A very high rate Precarious for its survival	Low A high rate Precarious for its survival	limited A substantial rate 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 threating process could cause it to be lost in:	Very restricted The immediate future	restricted The near future	limited 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 The immediate future	Severe decline The near future	Substantial decline The medium term future
4	The reduction in its integrity across most of its geographic distribution is: As indicated by degradation of the community or its habitat, or disruption of important community processes, that is:	Very severe Very severe	severe severe	substantial 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).

PD : Presumed Totally Destroyed
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats **or** B) All occurrences recorded within the last 50 years have since been destroyed.
CR : Critically Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, and one or more of the following apply (i, ii or iii): i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).
En : Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C): A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii) modification throughout its range is continuing such that in the short term future (within approximately

20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.
B) Current distribution is limited, and one or more of the following apply (i, ii or iii):
i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);
ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;
iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

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).

P1: Priority One – Poorly-known ecological communities
Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100 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.
P2: Priority Two – Poorly-known ecological communities
Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200 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.
P3: Priority Three – Poorly-known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four
Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five – Conservation dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

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* (DBCA 2019).

Code	Conservation Category	Definition
Threatened species		
Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.		
CR	**Critically Endangered**	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	**Endangered**	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora
VU	**Vulnerable**	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
Extinct species		
Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.		

EX	**Extinct**	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
EW	**Extinct in the Wild**	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species		
Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.		
MI	**Migratory Species**	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	**Species of special conservation interest (conservation dependent fauna)**	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
OS	**Other Specially protected species**	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

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*.

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

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
C1 (Exclusion)	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.
C2 (Eradication)	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.
C3 (Management)	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%20code%20definitions.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

APPENDIX B: PMST SEARCH RESULTS

Australian Government
Department of Agriculture, Water and the Environment

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: 19-Jul-2022

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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	13
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	4
Key Ecological Features (Marine):	None
Biologically Important Areas:	1
Bioregional Assessments:	None
Geological and Bioregional Assessments:	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	Buffer Status
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area	In feature area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Macrotis lagotis](#) Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Rhinonicteris aurantia (Pilbara form)](#) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area	In feature area
PLANT			
[Pityrodia sp. Marble Bar (G.Woodman & D.Coultas GWDC Opp 4)](#) [88310]	Endangered	Species or species habitat known to occur within area	In buffer area only
REPTILE			
[Liasis olivaceus barroni](#) Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Liopholis kintorei](#) Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
[Hirundo rustica](#) Barn Swallow [662]		Species or species habitat may occur within area	In feature area
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat likely to occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
[Bubulcus ibis as Ardea ibis](#) Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat likely to occur within area overfly marine area	In feature area
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Extra Information

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Development of iron ore resources in eastern Pilbara region, including port at P	2004/1562	Not Controlled Action	Completed	In buffer area only
Sulphur Springs Copper-Zinc Mining Project, Pilbara Region, WA	2013/6899	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Additional Rail Infrastructure	2012/6314	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Atlas Boodarie Link Project, WA	2012/6506	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Biologically Important Areas			
Scientific Name	Behaviour	Presence	Buffer Status
Seabirds			
Ardenna pacifica			
Wedge-tailed Shearwater [84292]	Breeding	Known to occur	In buffer area only

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

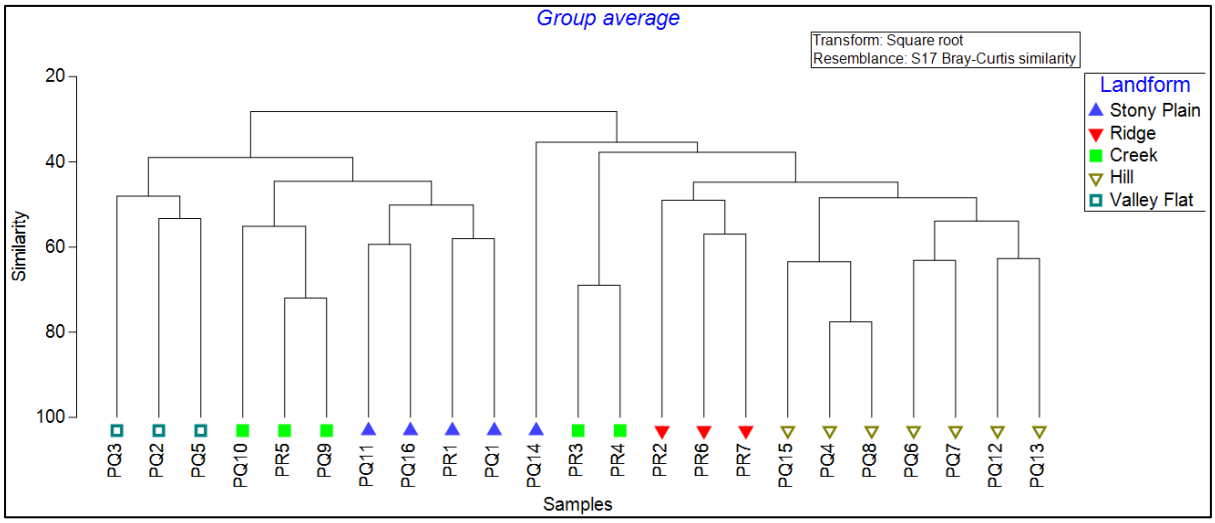


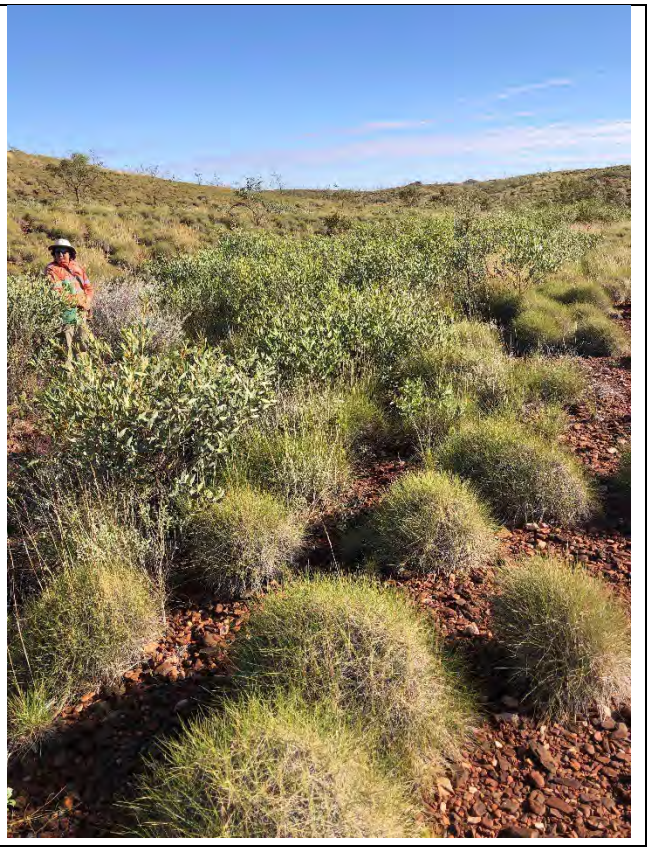
Figure C-1. Dendogram resulting from the cluster analysis of detailed vegetation sites

Job	Lynas Find - Pilgangoora		
PQ2	698562, 7675400		
Date	9/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	>5 years		
Seasonal Conditions	Cool dry season		
Rock Type	Granite/Quartz		
Soil Type	Sandy loam		
Soil Colour	Red		
Landform	Valley Flat		
Surface Rocks Size	Rounded, 0.05 - 10 cm		
Surface Rocks Cover	10%		
Slope aspect	Very gentle slope to the west		
Vegetation Description	Low *Acacia* shrubland with *Triodia* understory		
Condition/Disturbances	Very Good. Cenchrus grasses present. Moderate grazing.		
Strata	**Cover (%)**	**Height (m)**	**Species**
Overstorey	2.5	3	*Corymbia hamersleyana*, *Acacia* spp.
Understorey	0.5	1.2	*Tephrosia* sp., *Sida* sp.
Groundstorey	10	1	*Triodia* spp.
Notes	Recent rain wash out area, soil moist		

Job	Lynas Find - Pilgangoora		
PQ3	698525, 7675786		
Date	9/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	2 - 3 years		
Seasonal Conditions	Dry season, cool		
Rock Type	Granite/Quartz		
Soil Type	Loamy sand		
Soil Colour	Red		
Landform	Valley Flat		
Surface Rocks Size	Angular, 0.1 - 10 cm		
Surface Rocks Cover	50%		
Slope aspect	Flat plain		
Vegetation Description	Low sparse *Acacia* shrubland		
Condition/Disturbances	Very Good. Cenchrus grasses present. Moderate grazing.		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.1	3.5	*Acacia pyrifolia*, *Corymbia hamersleyana*
Understorey	0.5	1.5	*Acacia* spp.
Groundstorey	25	0.7	Triodia spp.
Notes	2 km west of mine pit		
	Quadrat		

Job	Lynas Find - Pilgangoora
PQ5	698799, 7675279
Date	10/08/2022
Botanist:	Neil Pettit / Danah Blache
Age since fire	2 - 3 years
Seasonal Conditions	Dry and cold
Rock Type	Granite
Soil Type	Sandy loam
Soil Colour	Red
Landform	Valley Flat
Surface Rocks Size	Angular, 0.1 - 20 cm
Surface Rocks Cover	20%
Slope aspect	Very slight slope, draining to West
Vegetation Description	Low open *Acacia* shrubland with occasional emergent *Corymbia hamersleyana*, *Acacia inequiterra* and understory of hummock grassland
Condition/Disturbances	*Cenchrus ciliaris* and *C. setiger* weeds, low cover. Moderate grazing. Very Good

	Cover (%)	**Height (m)**	**Species**
Overstorey	1	4	*A. pyrifolia*, *C. hamersleyana*
Understorey	10	1.8	*Acacia* spp.
Groundstorey	10	0.8	*Triodia* spp. (*epactia*)
Notes	Close to minim gw bore		

Job	Lynas Find - Pilgangoora		
PQ9	**699269, 7675602**		
Date	11/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	5 years		
Seasonal Conditions	Cool and dry		
Rock Type	Granite		
Soil Type	Sandy loam		
Soil Colour	Red		
Landform	First order stream, creek line (4m wide) between rocky hills		
Surface Rocks Size	Rounded/angular, 0.2 - 10 cm		
Surface Rocks Cover	40%		
Slope aspect	Very low slope to North/West		
Vegetation Description	Low open *Acacia* shrubland with emergent *Euc*		
Condition	Very good. Moderate grazing, Occasional kapok		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.5	3.5	*Corymbia hamersleyana*
Understorey	10	1.5	*Acacia colei*
Groundstorey	15	0.6	*Triodia* spp.
Notes	Quadrat, 100 x 25 m		

Job	Lynas Find - Pilgangoora		
PQ10	**698954, 7675890**		
Date	11/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	>5 years		
Seasonal Conditions	Cool and dry		
Rock Type	Granite/quartz		
Soil Type	Loamy sand		
Soil Colour	Red		
Landform	Rocky small creek line with granite hills (10 m wide)		
Surface Rocks Size	Angular/rounded, 0.2 - 20 cm		
Surface Rocks Cover	40%		
Slope aspect	Very low slope to North-West		
Vegetation Description	Low open *Acacia* shrubland over hummock grassland with emergent *Corymbia*		
Condition	Very good		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.5	3.5	*Corymbia hamersleyana*
Understorey	10	1.5	*Acacia colei*
Groundstorey	20	0.6	*Triodia* sp.
Notes	Quadrat, 25 x 100 m		

Job	Lynas Find - Pilgangoora		
PR5	**699271, 7675040**		
Date	10/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	2 - 3 years		
Seasonal Conditions	Dry, cool		
Rock Type	Granite		
Soil Type	Gravelly sand		
Soil Colour	Red		
Landform	Stony dry creekline, 10 m wide		
Surface Rocks Size	Angular, 0.5 - 10 cm		
Surface Rocks Cover	60%		
Slope aspect	Creek flowing west		
Vegetation Description	Low open shrubland with some emergent *Corymbia hamersleyana*, and understory of *Triodia* sp.		
Condition	Very Good. Mod grazing.		
	Cover (%)	**Height (m)**	**Species**
Overstorey	2	3.5	*Corymbia hamersleyana*
Understorey	10	1.2	*Acacia* spp., Fabaceae shrubs
Groundstorey	15	0.8	*Triodia* spp.
Notes	Relevé, 100 x 25 m		

Job	Lynas Find - Pilgangoora		
PR3	**700154, 7675032**		
Date	10/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	>5 years		
Seasonal Conditions	Recent rain, soil moisture		
Rock Type	Granite		
Soil Type	Loamy sand		
Soil Colour	Red		
Landform	Creek line (10 m wide) on back slopes of ridges		
Surface Rocks Size	Sharply angular plates, 0.5 - 20 cm		
Surface Rocks Cover	45%		
Slope aspect	Gentle north facing		
Vegetation Description	Low *Acacia* shrubland with hummock understory		
Condition	Very Good		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.1	3	*Acacia pyrifolia*
Understorey	0.5	1.5	Mixed shrubs
Groundstorey	10	1.2	*Triodia* hairy glumes
Notes	Relevé		

Job	Lynas Find - Pilgangoora		
PR4	700011, 7674788		
Date	10/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	>5 years		
Seasonal Conditions	Recent rainfall, soil moisture		
Rock Type	Granite		
Soil Type	Loamy sand		
Soil Colour	Orange		
Landform	Creekline (10 m wide) flowing from back-slope of hill		
Surface Rocks Size	Sharp, angular, platy, 0.5 - 20 cm		
Surface Rocks Cover	50%		
Slope aspect	-		
Vegetation Description	Low *Acacia* shrubland with hummock grass understory		
Condition	Very good		
	Cover (%)	**Height (m)**	**Species**
Overstorey	1	3.5	*Corymbia hamersleyana*
Understorey	5	1.6	*Acacia* spp.
Groundstorey	30	1.2	*Triodia* sp.
Notes	Relevé		

Job	Lynas Find - Pilgangoora		
PR1	**698202, 7674383**		
Date	8/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	>5 years		
Seasonal Conditions	Cool and dry, recent rain, soil moist		
Rock Type	Granite		
Soil Type	Loam		
Soil Colour	Red		
Landform	Flat stony plain		
Surface Rocks Size	Angular, 0.1 - 10 cm		
Surface Rocks Cover	40%		
Slope aspect	Flat		
Vegetation Description	Spinifex grassland with emergent *Acacia* shrubs		
Condition	Good. Buffel grass and moderate grazing.		
	Cover (%)	**Height (m)**	**Species**
Overstorey	1	3	*Corymbia hamersleyana*, *Acacia pyrifolia*
Understorey	2	1.5	*Acacia* sp.
Groundstorey	10	1.2	*Triodia* sp.
Notes	Adjacent road and mine spoil pit		
	Relevé		

Job	Lynas Find - Pilgangoora		
PQ1	**698260, 7675271**		
Date	9/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	2 - 3 years		
Seasonal Conditions	Cool dry season		
Rock Type	Granite/quartz		
Soil Type	Sandy loam		
Soil Colour	Red		
Landform	Stony sandplain		
Surface Rocks Size	Rounded, 0.05 - 5 cm		
Surface Rocks Cover	30%		
Slope aspect	Flat ground		
Vegetation Description	Low open shrubland with *Triodia* understory		
Condition	Good. Moderate grazing and Buffel grass.		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.1	3.5	*Acacia pyrifolia*
Understorey	2	1.8	*Acacia* spp.
Groundstorey	30	0.8	*Triodia* spp.
Notes	Numerous drill pads nearby, close proximity to mine pit		
	Quadrat, 50 x 50 m		

Job	Lynas Find - Pilgangoora		
PQ11	**6958881, 7676138**		
Date	11/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	2 - 3 years		
Seasonal Conditions	Cool and dry		
Rock Type	Granite		
Soil Type	Loam		
Soil Colour	Red		
Landform	Flat, open stony sandplain; water run-on area		
Surface Rocks Size	Rounded, 0.05 - 3 cm		
Surface Rocks Cover	1%		
Slope aspect	Flat plain, no slope		
Vegetation Description	Triodia hummock grassland with scattered emergent *Corymbia hamersleyana*, *Acacia inequiterra*		
Condition	Good. Cenchrus and moderate grazing.		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.5	3.5	*C. hamersleyana*, *Acacia pyrifolia*
Understorey	0.5	1	*A. tumida*
Groundstorey	60	0.8	*Triodia* sp.
Notes	Quadrat, 50 x 50 m		

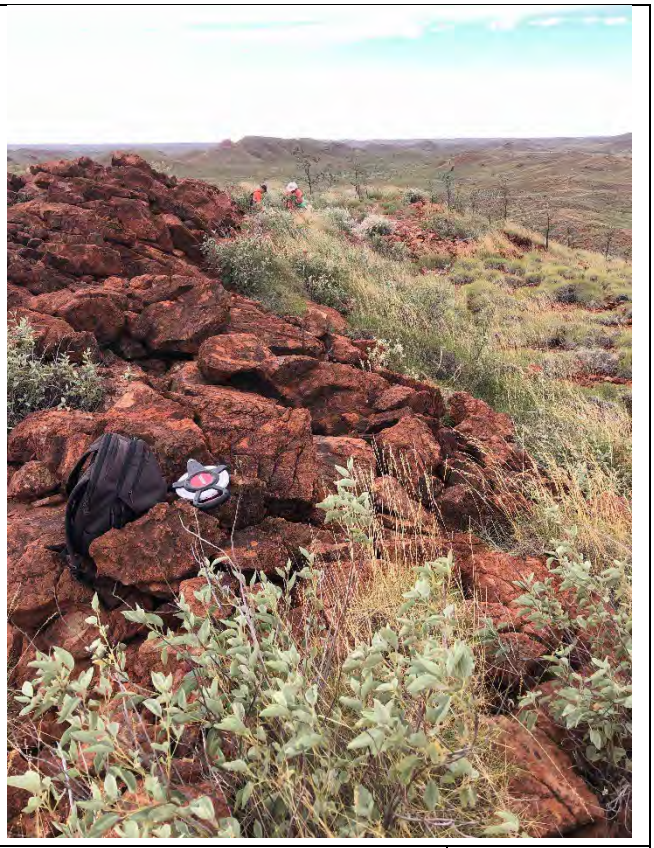
Job	Lynas Find - Pilgangoora
PQ16	**698231, 7675047**
Date	12/08/2022
Botanist:	Neil Pettit / Danah Blache
Age since fire	3 - 4 years
Seasonal Conditions	Cool and dry
Rock Type	Granite
Soil Type	Loamy sand
Soil Colour	Red
Landform	Stony sand plain
Surface Rocks Size	Rounded/angular, 0.1 - 10 cm
Surface Rocks Cover	15%
Slope aspect	Flat plain, no slope
Vegetation Description	Open *Acacia* woodland with *Triodia* hummock grass understory
Condition	Good

	Cover (%)	**Height (m)**	**Species**
Overstorey	0.1	3	*Acacia pyrifolia*, *Corymbia hamersleyana*
Understorey	2	1.5	*Acacia* spp., *Grevillea wickhamii*
Groundstorey	55	0.6	*Triodia* spp.
Notes	Quadrat, 50 x 50 m		

Job	Lynas Find - Pilgangoora
PQ14	**698247, 7675418**
Date	12/08/2022
Botanist:	Neil Pettit / Danah Blache
Age since fire	>5 years
Seasonal Conditions	Cool and dry
Rock Type	Granite/Quartzite
Soil Type	Loam
Soil Colour	Red
Landform	Stony, sandplain
Surface Rocks Size	Rounded/angular, 0.05 - 15 cm
Surface Rocks Cover	15%
Slope aspect	Flat ground
Vegetation Description	Low *Acacia* shrubland with *Triodia* hummock grass understory
Condition	Good. Moderate grazing

	Cover (%)	**Height (m)**	**Species**
Overstorey	0.1	3	*Acacia pyrifolia*
Understorey	15	1.6	*Acacia* sp.
Groundstorey	30	0.6	*Triodia* sp.
Notes	Quadrat, 50 x 50 m		

Job	Lynas Find - Pilgangoora
PR2	**699742, 7675131**
Date	9/08/2022
Botanist:	Neil Pettit / Danah Blache
Age since fire	>5 years
Seasonal Conditions	Dry and cool, dry season with same recent rain
Rock Type	Granite
Soil Type	Sand
Soil Colour	Red
Landform	Rock hilltop ridge
Surface Rocks Size	Angular and large, 5 - 100 cm
Surface Rocks Cover	90%
Slope aspect	-
Vegetation Description	Very sparse open hummock grassland with emergent *Acacia*
Condition	Very good. Kapok.



	Cover (%)	**Height (m)**	**Species**
Overstorey	0.1	2.5	*Acacia pyrifolia*
Understorey	1	0.6	Kapok bush
Groundstorey	20	0.5	*Triodia* sp.
Notes	Relevé		

Job	Lynas Find - Pilgangoora
PR6	**699724, 7676012**
Date	12/08/2022
Botanist:	Neil Pettit / Danah Blache
Age since fire	>5 years
Seasonal Conditions	Cool and dry
Rock Type	Granite
Soil Type	Sandy loam
Soil Colour	Red
Landform	Hilltop ridge of granite angular boulders
Surface Rocks Size	Angular, 5 to 80 cm
Surface Rocks Cover	100%
Slope aspect	Hilltop, all aspects surveyed
Vegetation Description	*Triodia* hummock grassland
Condition	Very good. Kapok.

	Cover (%)	**Height (m)**	**Species**
Overstorey	0.1	2	*Acacia pyrifolia*
Understorey	-	-	
Groundstorey	20	0.6	*Triodia* sp.
Notes	Relevé, 100 x 25 m		

Job	Lynas Find - Pilgangoora		
PR7	**699695, 7675688**		
Date	12/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	>5 years		
Seasonal Conditions	Cool and dry		
Rock Type	Granite		
Soil Type	Sandy loam		
Soil Colour	Red		
Landform	Rocky hilltop ridge		
Surface Rocks Size	Angular, 0.5 - 100 cm		
Surface Rocks Cover	100%		
Slope aspect	Top of ridge, all aspects surveyed		
Vegetation Description	*Triodia* hummock grasslands with emergent *A. inequiterra*		
Condition	Very good. Kapok.		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.1	2.5	*Acacia pyrifolia*
Understorey	2	1.5	*Acacia* spp
Groundstorey	35	0.6	*Triodia* spp.
Notes	Relevé, 100 x 25 m		

Job	Lynas Find - Pilgangoora		
PQ4	**699507, 7675425**		
Date	9/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	2 - 3 years		
Seasonal Conditions	Recent rain		
Rock Type	Granite		
Soil Type	Sandy		
Soil Colour	Red		
Landform	Rocky hilltop		
Surface Rocks Size	Sharp & angular, 0.5 - 50 cm		
Surface Rocks Cover	85%		
Slope aspect	Steep slope, facing South		
Vegetation Description	Hummock grassland with occasional evergreen tall shrub		
Condition	Very good. Occasional tracks		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.1	3.5	*Acacia pyrifolia*
Understorey	40	0.5	*Triodia* spp.
Groundstorey	-	-	-
Notes	Quadrat, 50 x 50 m		

Job	Lynas Find - Pilgangoora		
PQ8	**699144, 7675635**		
Date	11/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	>5 years		
Seasonal Conditions	Cool and dry		
Rock Type	Granite/quartz		
Soil Type	Loam		
Soil Colour	Red		
Landform	Rocky hilltop		
Surface Rocks Size	Sharp, angular		
Surface Rocks Cover	85%		
Slope aspect	Very slight slope to the North-West		
Vegetation Description	Low hummock grassland (*Triodia*) with scattered emergent *Acacia* low trees		
Condition	Very Good. Occasional tracks		
	Cover (%)	**Height (m)**	**Species**
Overstorey	1	3	*Acacia pyrifolia*
Understorey	-	-	-
Groundstorey	50	0.8	*Triodia* spp.
Notes	Quadrat, 50 x 50 m		

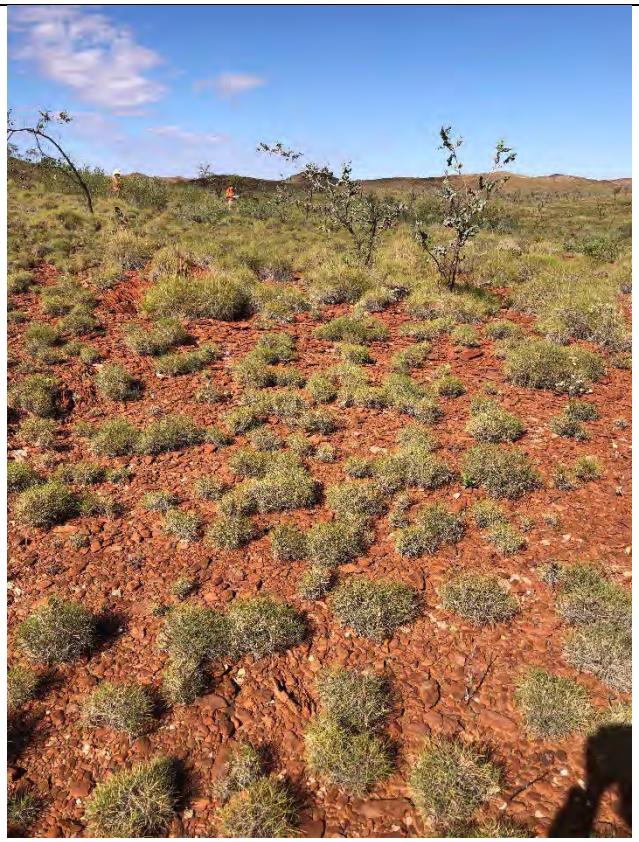
Job	Lynas Find - Pilgangoora		
PQ15	**699521, 7676016**		
Date	12/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	2 - 3 years		
Seasonal Conditions	Cool and dry		
Rock Type	Granite/Quartzite		
Soil Type	Loamy sand		
Soil Colour	Red		
Landform	Stony foot slope below hills		
Surface Rocks Size	Angular, 0.1 - 30 cm		
Surface Rocks Cover	80%		
Slope aspect	Very gentle slope to west		
Vegetation Description	*Triodia* hummock grassland with scattered *Acacia inequiterra*		
Condition	Very good. Occasional tracks		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.1	3.5	*Acacia pyrifolia*
Understorey	-	-	-
Groundstorey	60	0.6	*Triodia* spp.
Notes	Quadrat, 50 x 50 m		

Job	Lynas Find - Pilgangoora
PQ6	**698994, 7674786**
Date	10/08/2022
Botanist:	Neil Pettit / Danah Blache
Age since fire	>5 years
Seasonal Conditions	Cool and dry
Rock Type	Granite/schist
Soil Type	Sandy
Soil Colour	Yellow
Landform	Rocky hilltop, West facing
Surface Rocks Size	Platy sharply angular, 0.5 - 100 cm
Surface Rocks Cover	85%
Slope aspect	West
Vegetation Description	Low hummock grassland (*Triodia*) with emergent Acacia inequiterra
Condition	Very good. Tracks

	Cover (%)	**Height (m)**	**Species**
Overstorey	1	3	*Acacia pyrifolia*
Understorey	0.5	1.5	*Acacia* sp.
Groundstorey	45	1.2	*Triodia* sp.
Notes	Quadrat, 50 x 50 m		

Job	Lynas Find - Pilgangoora		
PQ7	**699197, 7674741**		
Date	10/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	3 - 4 years		
Seasonal Conditions	Cool and dry		
Rock Type	Granite/schist		
Soil Type	Sandy		
Soil Colour	Red		
Landform	Hillside slope		
Surface Rocks Size	Angular, 0.5 - 200 cm		
Surface Rocks Cover	85%		
Slope aspect	Steep stope, facing East		
Vegetation Description	Low hummock grassland (*Triodia* spp.) with emergent *Acacia inequiterra*		
Condition	Very good		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.5	3	*A. pyrifolia*
Understorey	2	1.2	*Acacia* spp.
Groundstorey	25	1	*Triodia* sp.
Notes	Survey trade through quadrat		
	Quadrat, 50 x 50 m		

Job	Lynas Find - Pilgangoora
PQ12	**699438, 7676300**
Date	11/08/2022
Botanist:	Neil Pettit / Danah Blache
Age since fire	3 - 4 years
Seasonal Conditions	Cool and dry
Rock Type	Granite
Soil Type	Loam
Soil Colour	Red
Landform	Gravelly lower slopes of hillslope
Surface Rocks Size	Angular, 0.5 - 10 cm
Surface Rocks Cover	90%
Slope aspect	Moderate slope, facing South
Vegetation Description	Low Triodia hummock grassland with emergent *Acacia inequiterra*
Condition	Very good. Occasional tracks



	Cover (%)	**Height (m)**	**Species**
Overstorey	1	3	*A. pyrifolia*, *Corymbia hamesleyana*
Understorey	2	1.1	*A. tumida*
Groundstorey	60	1	*Triodia* sp.
Notes	Quadrat, 50 x 50 m		

Job	Lynas Find - Pilgangoora		
PQ13	**698668, 7673987**		
Date	11/08/2022		
Botanist:	Neil Pettit / Danah Blache		
Age since fire	>5 years		
Seasonal Conditions	Cool and dry		
Rock Type	Granite		
Soil Type	Loam		
Soil Colour	Red		
Landform	Rocky hillslope (upper-slope); boulder strewn on upper slope		
Surface Rocks Size	Angular, 0.5 - 50 cm		
Surface Rocks Cover	85%		
Slope aspect	Steep slope to South-West		
Vegetation Description	*Triodia* hummock grassland with emergent *Acacia*		
Condition	Very good. Occasional tracks		
	Cover (%)	**Height (m)**	**Species**
Overstorey	0.5	4	*Acacia pyrifolia*
Understorey	0.5	1.5	*Acacia tumida*
Groundstorey	60	0.8	*Triodia* spp.
Notes	Quadrat, 50 x 50 m		

APPENDIX D: FAUNA HABITAT PHOTOS

Plate 1. AS45007 (699389, 7675152)

Plate 2. AS642022 (698157, 7674859)

Plate 3. AS450085 (698266, 7674859)

Plate 4. AS450085 (698266, 7674859)

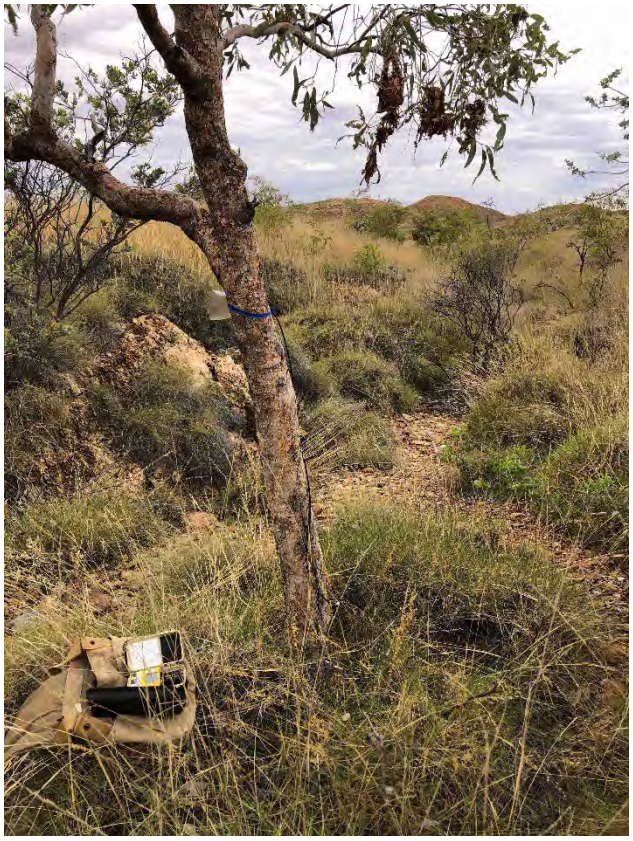


Plate 5. AS642029 (700055, 7675137)

Plate 6. MSC01 and MSC01TR (699741, 7675155)

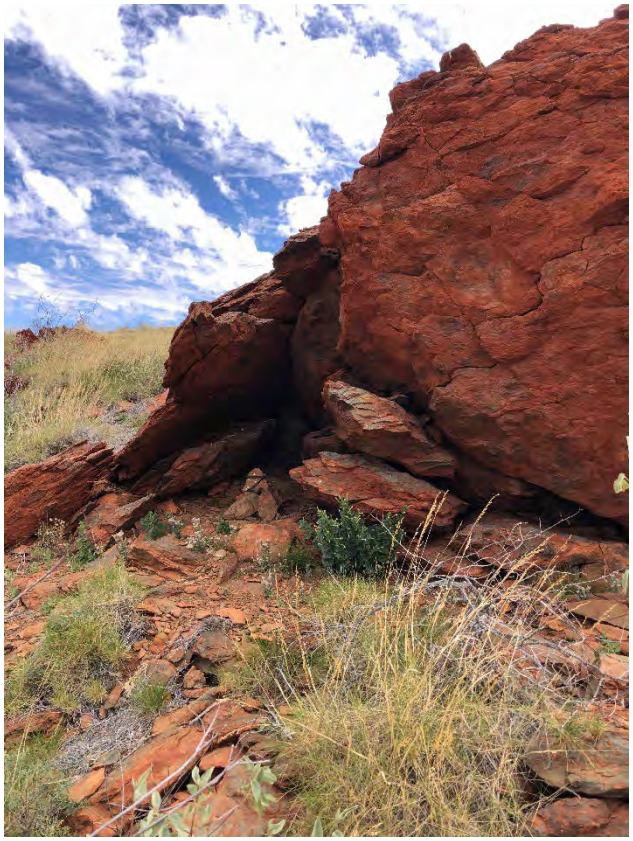


Plate 7. MSC02 (698870, 7674862)

Plate 8. MSC03 (699273, 7675040)

Plate 9. MSC04 (699387, 7675147)

Plate 10. MSC05 (698061, 7675864)

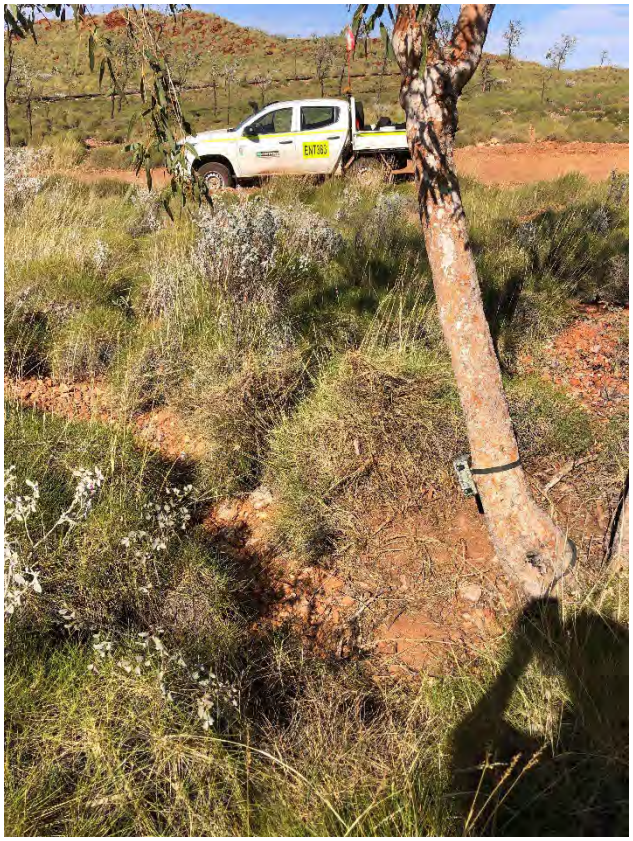


Plate 11. MSC06 (699757, 7676149)

Plate 12. MSC07 (699239, 7674711)

Plate 13. MSC08 (699681, 7675702)

Plate 14. MSC08 (699637, 7675721)

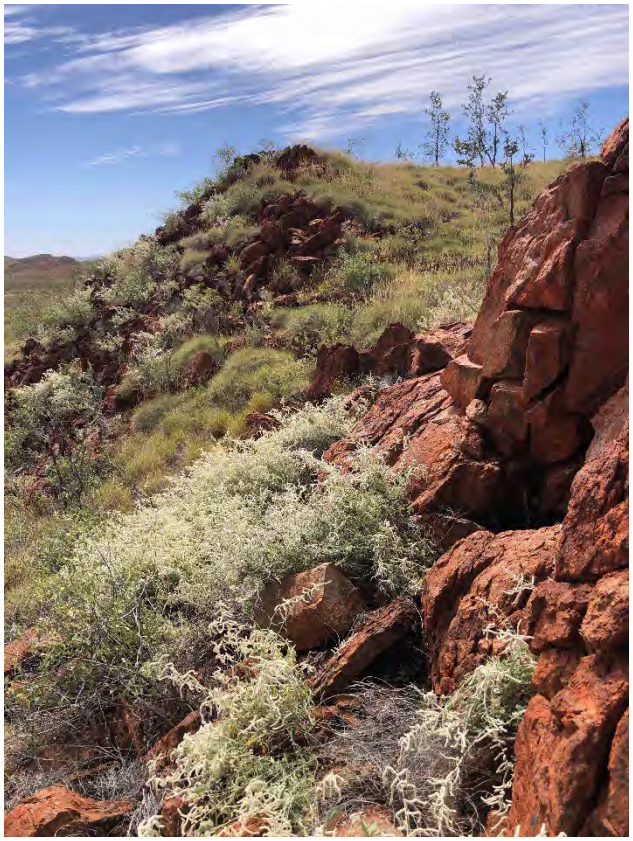


Plate 15. MSC09 (699695, 7675564)

Plate 16. MSC10 and EastCreekTR1 (699954, 7674832)

Plate 17. MSC11 and EastCreekTR2 (700056, 7675134)

Plate 18. MSC12 (698173, 7674865)

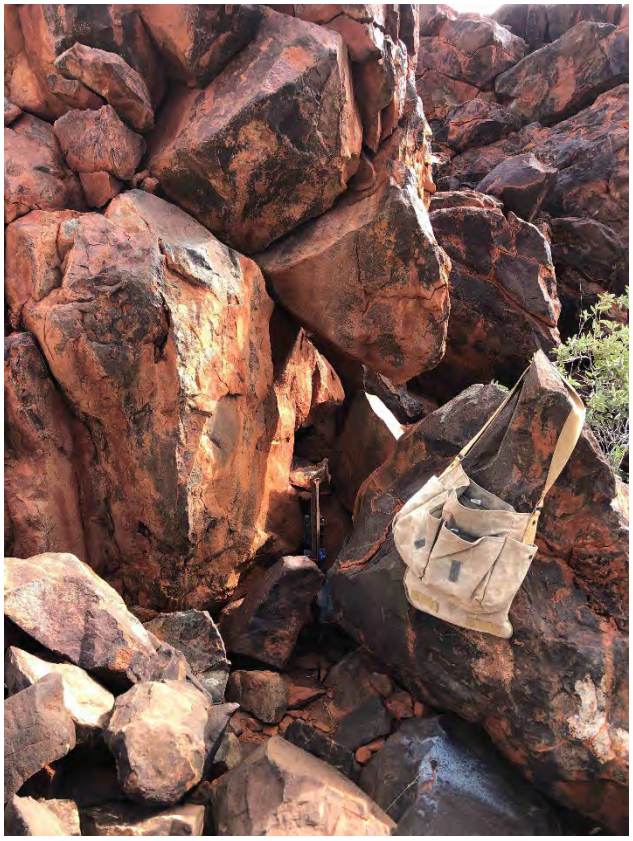


Plate 19. MSC13 (699687, 7675218)

Plate 20. MSC14 (698959, 7675233)

Plate 21. MSC15 (698961, 7675547)

Plate 22. MSC16 (698355, 7674908)

Plate 23. NP01 (698135, 7674606)

Plate 24. NP02 and NP004TR (698175, 7675211)

Plate 25. NP03 (698230, 7675941)

Plate 26. NP04 (689653, 7675944)

Plate 27. BilbyTR2 (699057, 7676233)

Plate 28. BilbyTR3 and NP003 (698413, 7675171)

Plate 29. PMoundTR1 (699104, 7675496)

Plate 30. PMoundTR2 (699087, 7675496)

Plate 31. PMoundTR3 (699032, 7676284)

Plate 32. QuollTR1 (north) (699688, 7676075)

Plate 33. QuollTR1 (south) (699833, 7674829)

Plate 34. NoQuollTR1 (699009, 7674729)

Plate 35. NoQuollTR2 (699239, 7674711)

Plate 36. NoQuollTR3 (north) (698649, 7673917)

Plate 37. NoQuollTR3 (south) (698963, 7673748)

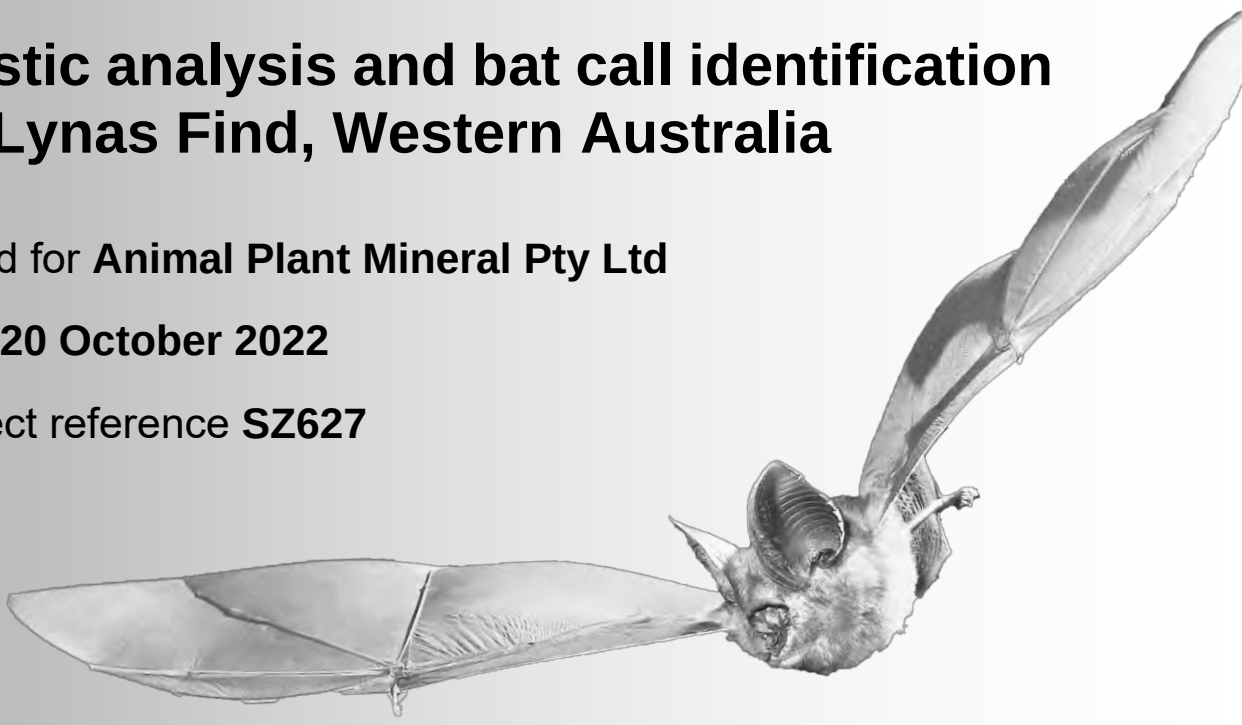
Plate 38. SouthCreekTR1 (699898, 7673749)

Plate 39. NP001TR (698474, 7676005)

Plate 40. BilbyPMMTR1 (6699476, 7676123)

APPENDIX E: SPECIALISED ZOOLOGICAL TECHNICAL REPORT

Acoustic analysis and bat call identification from Lynas Find, Western Australia



Prepared for **Animal Plant Mineral Pty Ltd**

Version **20 October 2022**

SZ project reference **SZ627**

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 (2022). Acoustic analysis and bat call identification from Lynas Find, Western Australia. Unpublished report by Specialised Zoological for Animal Plant Mineral Pty Ltd, 20 October 2022, project reference SZ627.

Summary

The outcome is provided of the analysis of acoustic (bat detector) recordings made at Lynas Find, in the Pilbara region of Western Australia. The identification of bat species from full spectrum WAV-format recordings of their echolocation calls was based on measurements of characteristic frequency, observation of pulse shape, and the pattern of harmonics.

The scope of the analysis was limited to the detection of the Threatened-listed Ghost Bat *Macroderma gigas* (Megadermatidae) and Pilbara Leaf-nosed Bat *Rhinonicteris aurantia* (Rhinonycteridae). Attention was also given to determining if the Northern Leaf-nosed Bat *Hipposideros stenotis* (Hipposideridae) based on an acoustics-based record as part of a previous biological survey (report and further details unavailable).

Acoustic processing of the bat detector recordings was conducted separately for each of these three species using methods optimised for the detection of their unique echolocation call types. The recording dataset comprised a total of 51 recording nights from four bat detector units (**Table 1**).

Five call sequences of the Pilbara Leaf-nosed Bat were detected (bat detector serial, date and time):

- 450007_2022-08-14_00-06-38.wav (illustrated in **Figure 1**)
- 450007_2022-08-17_00-39-22.wav
- 450085_2022-08-21_21-20-51.wav
- 642029_2022-08-15_21-28-01.wav
- 642029_2022-08-16_22-33-42.wav

All call sequences of the Pilbara Leaf-nosed Bat were recorded were well after sunset and therefore when the individual was out foraging away from a diurnal roost.

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

No calls of the Northern Leaf-nosed Bat were detected. The accepted distribution of this species does not include in the Pilbara region (e.g., Churchill 2008). While I have not seen the bat detector recording associated with a past record of detection, I suggest that this identification is more likely the result of an over-enthusiastic attribution.

Further details are 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 turn on automatically at sunset and off at 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 for bat echolocation calls using several parameter sets in the software SCAN'R version 1.8.3 (Binary Acoustic Technology), which also provides measurements (SCAN'R parameters) from each putative bat pulse. The outputs were then used to determine if putative bat pulses measured in SCAN'R could be identified to species. This was done using a custom [R] language application that performed three tasks:

1. undertook a Discriminant Function Analysis on training datasets from representative echolocation calls of Pilbara cave-roosting bat species, the Pilbara Leaf-nosed Bat and other northern Australian bat species;

2. from the measurements of each putative bat pulse from SCAN'R, calculated values for the first two Discriminant Functions that could separate the echolocation call types derived from the analysis of training data, and plotted these resulting coordinates over ellipses representing one standard deviation of the variation for the defined call types; and

3. facilitated an inspection in a spectrogram of multiple examples of each call type for each recording night by opening the original WAV files containing pulses of interest in Adobe Audition version 22.

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

References

Armstrong, K.N. and Coles, R.B. (2007). Echolocation call frequency differences between geographic isolates of *Rhinonicteris 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., Hoye 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

Churchill, S.K. (2008). *Australian bats.* 2nd ed. Allen and Unwin, Crows Nest, NSW.

DEWHA (2010). Survey guidelines for Australia's threatened bats. Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment, Water, Heritage and the Arts, Canberra.

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 three 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 during the survey.
4. Other than the general location of the study area, Specialised Zoological has not been provided with detailed information of the survey area, 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 analysis of ultrasonic recordings is one of several methods that can be used to survey for bats, and comprehensive surveys typically employ more than one method. If an identification in the present report is ambiguous or in question, a trapping programme would help to resolve the presence of the possibilities in the project area.
9. 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.
10. Predictions about whether the Pilbara Leaf-nosed Bat roosts within a particular surveyed cave (where a bat detector was placed at the entrance), or somewhere nearby, based on the time of first detection should be considered indicative only. If unambiguous information of diurnal roosting of this species is required, diurnal roosting should be confirmed using the entrance sheeting method described in DEWHA (2010).

Table 1. Summary of bat detector recordings analysed, with the number of passes for the Pilbara Leaf-nosed Bat shown (*continued next page*).

Unit	Night of	Location	PLNB
450007	9/08/2022	21.013703 S, 118.918538 E	
450007	10/08/2022	21.013703 S, 118.918538 E	
450007	11/08/2022	21.013703 S, 118.918538 E	
450007	12/08/2022	21.013613 S, 118.918518 E	
450007	13/08/2022	21.013613 S, 118.918518 E	1
450007	14/08/2022	21.013613 S, 118.918518 E	
450007	15/08/2022	21.013613 S, 118.918518 E	
450007	16/08/2022	21.013650 S, 118.918343 E	1
450007	17/08/2022	21.013600 S, 118.918433 E	
450007	18/08/2022	21.013600 S, 118.918433 E	
450007	19/08/2022	21.013600 S, 118.918433 E	
450007	20/08/2022	21.013398 S, 118.918028 E	
450007	21/08/2022	21.013527 S, 118.918248 E	
450007	22/08/2022	21.013548 S, 118.918325 E	
450007	23/08/2022	21.013415 S, 118.918447 E	
450007	24/08/2022	21.013563 S, 118.918380 E	
450085	8/08/2022	31.931842 S, 115.961795 E	
450085	9/08/2022	21.016350 S, 118.907525 E	
450085	10/08/2022	21.016357 S, 118.907628 E	
450085	11/08/2022	21.016355 S, 118.907640 E	
450085	12/08/2022	21.016350 S, 118.907615 E	
450085	13/08/2022	21.016350 S, 118.907638 E	
450085	14/08/2022	21.016348 S, 118.907650 E	
450085	15/08/2022	21.016328 S, 118.907643 E	
450085	16/08/2022	21.016365 S, 118.907635 E	
450085	17/08/2022	21.016373 S, 118.907667 E	
450085	18/08/2022	21.016358 S, 118.907623 E	
450085	19/08/2022	21.016367 S, 118.907658 E	
450085	20/08/2022	21.016360 S, 118.907623 E	
450085	21/08/2022	21.016343 S, 118.907633 E	1
450085	22/08/2022	21.016352 S, 118.907650 E	
450085	23/08/2022	21.016347 S, 118.907678 E	
450085	24/08/2022	21.016245 S, 118.907665 E	
642022	8/08/2022	21.006960 S, 118.906462 E	
642022	9/08/2022	21.006998 S, 118.906477 E	
642022	10/08/2022	21.007003 S, 118.906468 E	
642022	11/08/2022	21.007028 S, 118.906475 E	
642022	12/08/2022	21.007015 S, 118.906458 E	
642022	13/08/2022	21.007025 S, 118.906455 E	
642022	14/08/2022	21.007000 S, 118.906470 E	
642022	15/08/2022	21.007015 S, 118.906452 E	

Unit	Night of	Location	PLNB
642022	16/08/2022	21.007002 S, 118.906428 E	
642022	17/08/2022	21.006958 S, 118.906415 E	
642029	10/08/2022	21.013600 S, 118.924833 E	
642029	11/08/2022	21.013643 S, 118.924897 E	
642029	12/08/2022	21.013602 S, 118.924853 E	
642029	13/08/2022	21.013573 S, 118.924833 E	
642029	14/08/2022	21.013063 S, 118.924385 E	
642029	15/08/2022	21.013577 S, 118.924852 E	1
642029	16/08/2022	21.013568 S, 118.924837 E	1
642029	17/08/2022	21.013582 S, 118.924837 E	

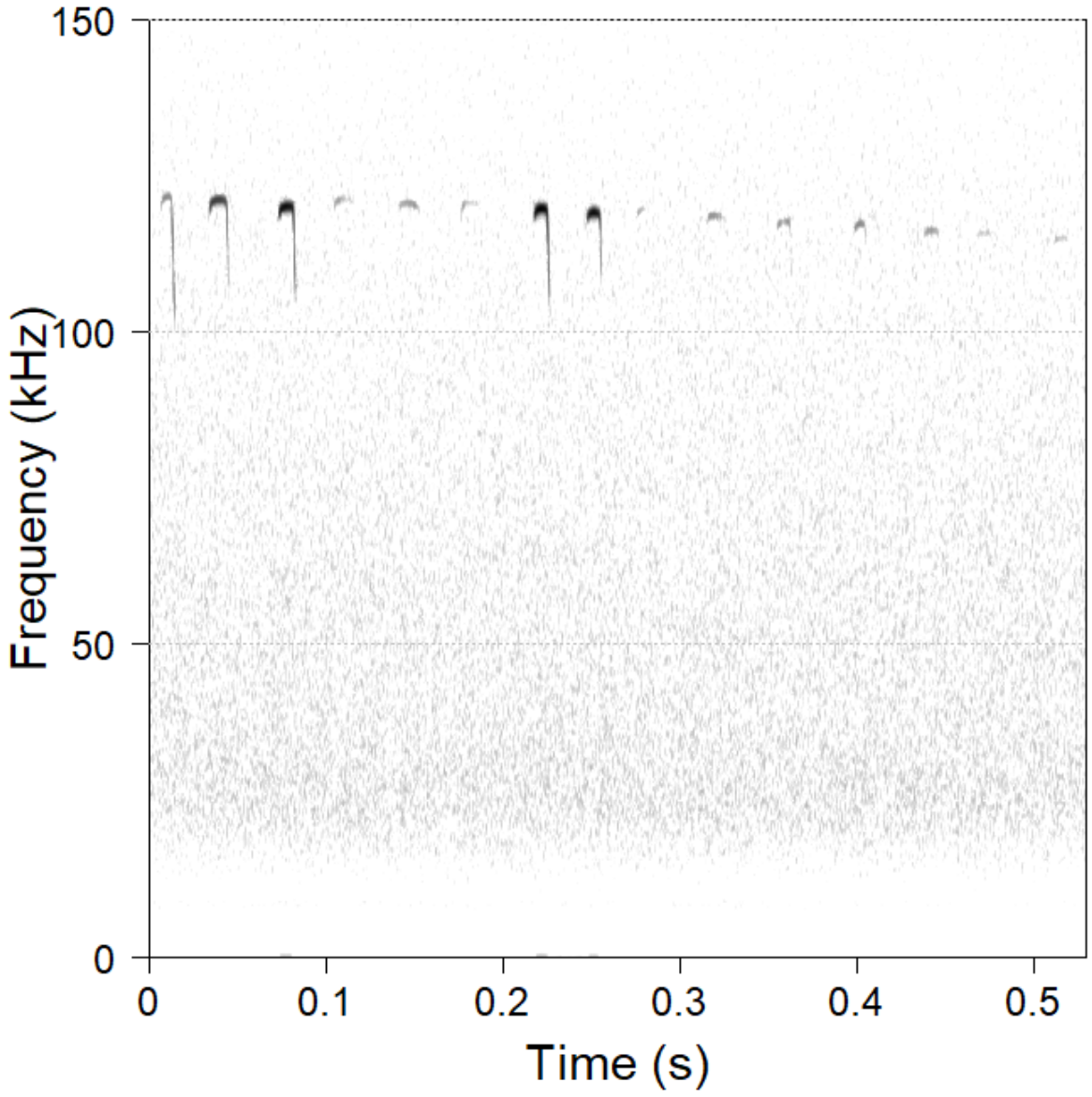

Figure 1. Example of an echolocation call sequence of the Pilbara Leaf-nosed Bat (file 450007_2022-08-14_00-06-38.wav; cropped).

APPENDIX F: SPECIES BY SITE MATRIX - FLORA

Species	Status	PR1	PR2	PR3	PR4	PR5	PR6	PR7	PQ1	PQ2	PQ3	PQ4	PQ5	PQ6	PQ7	PQ8	PQ9	PQ10	PQ11	PQ12	PQ13	PQ14	PQ15	PQ16	Opp Coll
Amaranthaceae																									
Aerva javanica	INT		0.5			0.5		0.5						0.1											
Amaranthus mitchellii			0.1					0.1																	
Gomphrena cunninghamii			0.1											0.1	0.1										
Ptilotus astrolasius		0.1							0.1		0.1			0.1	0.1		0.1		0.1	0.1				0.1	
Ptilotus auriculifolius						0.1							0.1	0.1			0.1		0.1	0.1			0.1		
Ptilotus axillaris							0.1												0.1						
Ptilotus calostachyus		0.1		0.1																0.1			0.1	0.1	
Ptilotus exaltatus																					0.1				
Ptilotus helipteroides																							0.1		
Asteraceae																									
Pluchea tetranthera					0.1																				
Pterocaulon sphaeranthoides																						0.1			
Streptoglossa decurrens										0.1												0.1			
Boraginaceae																									
Euploca chrysocarpa																		0.1							
Trichodesma zeylanicum														0.1				0.1							
Brassicaceae																									
Lepidium pedicellosum				0.1																					
Caryophyllaceae																									
Polycarpaea corymbosa															0.1						0.1				
Chenopodiaceae																									
Dysphania rhadinostachya			0.1												0.1										
Salsola australis																							0.1		
Cleomaceae																									
Arivela uncifera subsp. *uncifera*									0.1															0.1	
Arivela viscosa			0.1	0.1																	0.1				
Convolvulaceae																									
Bonamia erecta							0.1															0.5	0.1	0.1	
Bonamia linearis											0.1											0.1			
Bonamia pannosa																					0.1				
Bonamia rosea																	0.1								
Polymeria ambigua																			0.1						

Species	Status	PR1	PR2	PR3	PR4	PR5	PR6	PR7	PQ1	PQ2	PQ3	PQ4	PQ5	PQ6	PQ7	PQ8	PQ9	PQ10	PQ11	PQ12	PQ13	PQ14	PQ15	PQ16	Opp Coll
Cucurbitaceae																									
Cucumis variabilis																						0.1			
Euphorbiaceae																									
Euphorbia careyi			0.1		0.1									0.1							0.1				
Euphorbia mitchelliana								0.5		0.1			0.1	0.1								0.1		0.1	
Euphorbia tannensis							0.1					0.1		0.1	0.1										
Fabaceae																									
Acacia acradenia							0.5	0.5				0.1													
Acacia ancistrocapa									1	1	2				0.1				0.1			10		1	
Acacia bivenosa		0.1		0.1				0.1	0.1	2			0.6						0.1		0.1	5		0.5	
Acacia colei		1		1	2	5	1		0.5	10	0.1		2	0.5	1	0.1	10	10	0.5	0.5	0.5		0.5	0.5	
Acacia cowleana																			0.1						
Acacia inaequilatera		0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.5	1	0.5	0.1	0.1	1	0.5	0.1	0.2	0.1	
Acacia stellaticeps				0.5																					
Alysicarpus muelleri																			0.1			0.1			
Cajanus cinereus				0.5	1	0.5							0.2				0.1	0.1							
Crotalaria medicaginea																			0.1		0.1				
Cullen stipulaceum																					0.1				
Indigofera hirsuta												0.1				0.1		0.1	0.1				0.1		
Indigofera monophylla			0.1					0.1	0.1					0.1			0.1	0.1	0.1				0.1		
Indigofera trita								0.1																	
Isotropis atropurpurea				0.1	0.1	0.1						0.1					0.1	0.1							
Petalostylis labicheoides				0.1		0.1											0.1	0.1							
Rhynchosia minima			0.1				0.1			0.5			0.1						0.1			0.1			
Rothia indica subsp. *australis*	P3		0.1																		0.1				
Senna artemisioides																				0.1					
Senna ferraria													0.1												
Senna glutinosa subsp. *glutinosa*						0.1	0.1						0.1	0.1	0.2		0.1	0.1	0.1		0.5				
Senna glutinosa subsp. *luerssenii*										0.1													0.1		
Senna notabilis										0.1								0.1	0.1			0.1			
Swainsona formosa		0.1											0.1												
Tephrosia arenicola		0.1							0.1		0.1								0.1			0.1		0.1	
Tephrosia clementii						0.5				0.5		0.1	0.5							0.1					

Species	Status	PR1	PR2	PR3	PR4	PR5	PR6	PR7	PQ1	PQ2	PQ3	PQ4	PQ5	PQ6	PQ7	PQ8	PQ9	PQ10	PQ11	PQ12	PQ13	PQ14	PQ15	PQ16	Opp Coll
Tephrosia densa														0.1							0.1				
Tephrosia rosea																	0.1	0.1							
Goodeniaceae																									
Dampiera candicans				0.1	0.1	0.1						0.5				0.1	0.5	0.1							
Goodenia cusackiana					0.1																				
Goodenia lamprosperma										0.1	0.1		0.1												
Goodenia microptera															0.1				0.1						
Goodenia stobbsiana				0.1	0.1																				
Scaevola amblyanthera var. *centralis*				0.1	0.1	0.1		0.1		0.1	0.1			0.1	0.1		0.1	0.1	0.1	0.1		0.1	0.1		
Lauraceae																									
Cassytha filiformis				0.1				0.5	0.1	0.1							0.1	0.1			0.1				
Malvaceae																									
?Abutilon lepidum										0.1															
?Melhania oblongifolia											0.1														
Abutilon lepidum														0.1											
Corchorus incanus		0.5			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	0.1	0.1		0.1	0.1	
Corchorus laniflorus																							0.1		
Hibiscus sturtii			1		0.1	0.1	0.1	0.5		0.1	0.1								0.1						
Melhania oblongifolia			0.5		0.1			0.1						0.1				0.5							
Sida arenicola													0.1						0.1						
Sida cardiophylla					0.1	0.1								0.1	0.1										
Sida fibulifera													0.1												
Sida macropoda																								0.1	
Triumfetta appendiculata					0.1	0.1								0.1							0.1				
Molluginaceae																									
Trigastrotheca molluginea												0.1			0.1	0.1		0.1	0.1	0.1					
Moraceae																									
Ficus aculeata var *indecora*																									10a
Myrtaceae																									
Corymbia hamersleyana		1		0.1	0.1	2				0.5	0.1		0.5				0.5		0.5	0.5				0.1	
Nyctaginaceae																									
Boerhavia gardneri						0.1						0.1		0.1	0.1			0.1					0.1		
Phyllanthaceae																									

Species	Status	PR1	PR2	PR3	PR4	PR5	PR6	PR7	PQ1	PQ2	PQ3	PQ4	PQ5	PQ6	PQ7	PQ8	PQ9	PQ10	PQ11	PQ12	PQ13	PQ14	PQ15	PQ16	Opp Coll
Nellica maderaspatensis				0.2	0.1					0.1												0.1			
Plantaginaceae																									
Stemodia grossa				0.1	0.1						0.1		0.2	0.1	0.1		0.2	0.1		0.5					
Poaceae																									
Aristida holathera											0.1											0.1	0.1		
Cenchrus ciliaris	INT																		0.1						
Cenchrus setiger	INT									0.1	0.1		0.5												
Chrysopogon fallax																		0.1	2						
Cymbopogon ambiguus			0.1				0.5	0.1				0.1			0.1						0.5				
Cymbopogon obtectus				0.1	0.1	0.1				0.1	0.1														
Enneapogon lindleyanus								0.1						0.1	0.1										
Eragrostis eriopoda		0.1							0.1															0.1	
Eriachne aristidea																						0.1			
Eriachne benthamii																		0.1							
Eriachne mucronata					0.5										0.5		0.1	0.1							
Eriachne obtusa							0.5	5																	
Paraneurachne muelleri						0.1			0.1								0.1	0.1							
Paspalidium clementii			0.1																						
Sporobolus sp. PQ14																						0.1			
Themeda trianda																		2							
Triodia ?angusta											5														
Triodia angusta				5	5					2	5														
Triodia brizoides							5	5				15		5		30					10		40		
Triodia chichesterensis	P3	0.1					2		5								0.5	5		15	15				
Triodia epactia		4				10			5	5	10		10				10	2	40				5	15	
Triodia wiseana		6	20	10	25	2	15	20	2			25		40	25	20	2	15	20	45	35	30	15	40	
Portulaceae																									
Portulaca ?oleracea	Mixed										0.1		0.1												
Proteaceae																									
Grevillea pyramidalis				0.1			0.1																		
Grevillea wickhamii				0.5	0.1	0.5			1	0.1					0.1	0.1	0.5	0.1			0.1	0.1		0.1	
Sapindaceae																									
Atalaya hemiglauca								0.5																	

Species	Status	PR1	PR2	PR3	PR4	PR5	PR6	PR7	PQ1	PQ2	PQ3	PQ4	PQ5	PQ6	PQ7	PQ8	PQ9	PQ10	PQ11	PQ12	PQ13	PQ14	PQ15	PQ16	Opp Coll
Solanaceae																									
Solanum horridum			0.1					0.1						0.1											
Solanum phlomoides														0.1	0.1								0.1		
Violaceae																									
Afrohybanthus aurantiacus							0.1	0.1						0.1				0.1	0.1	0.1					
Zygophyllaceae																									
Tribulus hirsutus																			0.1				0.1		
Tribulus platypterus								0.5																	
INT: Introduced. Mixed: Native to pat of range, naturalised ot part of range.																									
Highlighted: additional species for the Pilgangoora project																									

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	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). 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).	Unlikely. No suitable habitat available for this species. Drainage lines in the Study Area are ephemeral, fast flowing first and second order streams with no permanent or semi-permanent pools.
Apus pacificus	Fork-tailed Swift	MI	MI	Broadly distributed aerial species that is not specifically limited to any particular habitat type. Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. (Pizzey and Knight, 2012). Occurs over dry or open habitats comprising of riparian woodland, low scrub, heathland, or saltmarsh, also grasslands and sandplains with spinifex. (Morcombe, 2011).	Possible. No local records but listed by the PMST as Likely to occur. Ten records are reported from 1998 – 2014 over a wide variety of habitats, from open plains to very abrupt rocky ridges. This species is distributed across Australia. It is an aerial species that rarely comes to land. Individuals would not

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
					be specifically dependant on any habitats present in the Study Area.
Arenaria interpres	Ruddy Turnstone	IA	IA	Tidal mud and reef flats, sheltered rocky coasts, stony and sea-weedy beaches and sandpits, dry coral ridges (Abrolhos) and pebbly shores of near-coastal saltlakes (including saltwork ponds). (Johnstone and Storr, 1998).	Unlikely. No habitat occurs in the Study Area. A coastal or near coastal species preferring saline environments.
Calidris acuminata	Sharp-tailed Sandpiper	IA	IA, M	Scarce to moderately common (much more plentiful near coasts than in interior). (Johnstone and Storr, 1998). 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).	Unlikely. No habitat occurs in the Study Area. All the drainage lines in the Study Area are highly ephemeral, fast flowing high order streams with no permanent or semi-permanent pools.
Calidris ferruginea	Curlew Sandpiper	CR	CR, IA, M	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) Tidal mudflats; saltmarsh, saltfields; fresh, brackish or saline wetlands; sewage ponds. (Pizzey and Knight, 2012)	Unlikely. No habitat occurs in the Study Area. No records within 25 km.
Calidris melanotos	Pectoral Sandpiper		IA, M	Mainly fresh waters (swamps, lagoons, river pools, irrigation channels and sewage ponds); also, samphire flats around estuaries and saltlakes. (Johnstone and Storr, 1998)	Unlikely. No habitat occurs in the Study Area. No records within 25 km.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
				Shallow fresh waters, often with low grass or other herbage; swamp margins, flooded pastures, sewage ponds, occasionally tidal areas, saltmarshes. (Pizzey and Knight, 2012)	
Calidris ruficollis	Red-necked Stint	IA	IA, M	Edge of sheltered salt, brackish or fresh waters; mainly estuaries, beaches, near-coastal saltlakes (including saltwork ponds) and freshwater swamps and lakes (especially when drying); also inland saltlakes and fresh waters, sewage ponds and bore overflows. (Johnstone and Storr, 1998) Tidal mudflats, saltmarshes; sandy or shelly beaches; saline and freshwater wetlands, coastal and inland; saltfields, sewage ponds. (Pizzy and Knight, 2012)	Unlikely. No habitat occurs in the Study Area. This species was recorded near the Turner River, 44 km north-west, in 1979.
Charadrius veredus	Oriental Plover	MI	MI	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).	Unlikely. No suitable habitat available for this species. One individual was recorded in 1999, less than 3 km from the Study Area. At the time this was a major broad drainage line that likely had heavily grassed flood plains and adjacent low rolling hills. This location is now the site of the Pilgangoora mine.
Erythrotriorchis radiatus	Red Goshawk	VU	VU	Well-wooded country. (Johnstone and Storr, 1998) Open forests, woodlands, especially near rivers, wetlands; rainforest fringes. (Pizzy and Knight, 2012)	Unlikely. No habitat occurs in the Study Area. No records within 25 km.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
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 (Pizzey and Knight, 2012).	Listed by EPBC as Known to Occur in the search radius due to seven records since 2012 near the Turner River. At its closest point, the Turner River is 23 km from the Study Area. The plains habitat in the Study Area is suitable foraging habitat for this species. No nesting habitat is present.
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. (Pizzey and Knight, 2012)	Unlikely. No habitat occurs in the Study Area. One record from 2002 is less than 3 km from the Study Area. At the time this was a major broad drainage line that would have supported large flooded gums, suitable for nesting. This location is now the site of the Pilgangoora mine.
Fregata ariel	Lesser frigatebird	MI	MI	Northern seas south to Dampier Archipelago, extending from coasts to beyond continental shelf. Moderately common in blue-water seas (more plentiful in the Kimberley than the Pilbara) (Johnstone and Storr, 1998)	Unlikely. No habitat occurs in the Study Area.
Glareola maldivarum	Oriental pratincole	IA	IA, M	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. No habitat occurs in the Study Area.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
Hirundo rustica	Barn swallow	IA	IA, M	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. No habitat occurs in the Study Area.
Motacilla cinerea	Grey Wagtail	IA	IA, M	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) In Australia, near running water in disused quarries; sandy, rocky streams in escarpments and rainforests; sewage ponds, ploughed fields, airfields. (Pizzey and Knight, 2012)	Unlikely. The drainage lines in the Study Area are highly ephemeral and would only flow for brief period of time. There are no previous records in the local area and the species is uncommonly recorded in Australia.
Motacilla flava	Yellow Wagtail	IA	IA, M	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)	Unlikely. No habitat occurs in the Study Area.
Numenius madagascariensis	Eastern Curlew	CR	IA	Mainly tidal mudflats; also reef flats, sandy beaches and rarely near-coastal lakes (including saltwork ponds). (Johnstone and Storr, 1998)	Unlikely. No habitat occurs in the Study Area.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
				Estuaries, tidal mudflats, sandspits, saltmarshes, mangroves; occasionally fresh or brackish lakes; bare grasslands near water. (Pizzey and Knight, 2012)	
Pandion cristatus	Eastern Osprey	IA	IA, M	Moderately common to very common in sheltered seas around north and west-coast islands south to 31°S; uncommon to common on mainland coasts, estuaries and larger rivers north of tropic; rare to uncommon elsewhere. Usually single, occasionally in twos. Young birds banded on Rottnest I. have been recovered up to 600 km away. (Johnstone and Storr, 1998) Coasts, estuaries, bays, inlets; islands and surrounding waters; coral atolls, reefs, lagoons, rock cliffs, stacks. Ascends larger rivers particularly in north, but also Murray R., SA; ventures far inland (Finke R., NT). (Pizzey and Knight, 2012)	Unlikely. No habitat occurs in the Study Area.
Pezoporus occidentalis	Night Parrot	CR	EN	Treeless or sparsely wooded spinifex *Triodia* spp. near water (including artesian bores) (Johnstone and Storr, 1998). 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).	Possible. No local records. Habitat modelling includes the Study Area at the extremity of the species potential extent and foraging resources are limited.
Pluvialis fulva	Pacific golden plover	IA	IA, M	Mainly salt or brackish marshes about estuaries and near-coastal saltlakes. Also near-coastal grassy flats, tidal	Unlikely. No habitat occurs in the Study Area.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
				mudflats, beaches, sewage and saltwork ponds and bore overflows. (Johnstone and Storr, 1998) Estuaries, mudflats, saltmarshes, mangroves; rocky reefs and stranded seaweed on ocean shores; margins of shallow open inland swamps; sewage ponds, short-grass paddocks, sportsgrounds, airfields, ploughed land. (Pizzey and Knight, 2012)	Where it occupies freshwater habitats, it is generally in association with open grasslands.
Rostratula australis	Australian Painted-Snipe	EN	EN	Evidently not uncommon in south and north-east Kimberley swampy plains before their degradation by cattle, but only five records since 1909. Only a 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. In south west evidently common in swamps of Swan Coastal Plain last century, but now only a very rare summer visitor (November to January); last breeding record in 1923 (near Moora). (Johnstone and Storr, 1998) 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)	Unlikely. No habitat occurs in the Study Area. No local records.
Thalasseus bergii	Crested Tern	IA	IA	Mainly blue-water seas (especially within 3 km of land), including southern estuaries in summer and autumn (when free of silt); also tidal creeks in north, but not	Unlikely. No habitat occurs in the Study Area.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
				penetrating far into larger estuaries (Cambridge Gulf, Prince Regent River, King Sound). (Johnstone and Storr, 1998) Coastal, offshore waters; beaches, bays, inlets, tidal rivers, salt swamps, lakes, larger rivers. (Pizzey and Knight, 2012)	Habitat descriptions note this species seldom ascends water ways beyond the estuarine environment.
Tringa brevipes	Grey-tailed Tattler	IA, P4	IA	Mainly tidal mud and reef flats. Also, estuarine sand flats, beaches and near-coastal fresh and brackish waters. (Johnstone and Storr, 1998) Estuaries, tidal mudflats, mangroves; wave-washed rocks and reefs; shallow river margins, coastal or inland. (Pizzey and Knight, 2012)	Unlikely. No habitat occurs in the Study Area. This species prefers predominantly saline habitats.
Tringa glareola	Wood Sandpiper	IA	IA	Mainly shallow fresh waters (lagoons, swamps, claypans, river pools, dams, bore overflows and sewage ponds); occasionally brackish swamps, rarely saltlakes and estuaries. (Johnstone and Storr, 1998) Muddy margins of wetlands; tidal mangroves; margins of tidal mudflats; saltmarshes, sewage ponds. (Pizzey and Knight, 2012)	Unlikely. No habitat occurs in the Study Area.
Tringa nebularia	Common Greenshank	IA	IA, M	Shallow fresh waters (claypans, lagoons, swamps, river pools, dams and sewage ponds) and salt waters (estuaries, mangrove creeks, lakes, samphire flats, reef flats and saltwork ponds). (Johnstone and Storr, 1998)	Unlikely. No habitat occurs in the Study Area.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
				Mudflats, estuaries, saltmarshes, margins of lakes; wetlands, claypans, fresh and saline; commercial saltfields, sewage ponds. (Pizzey and Knight, 2012)	
				-- Mammals --	
Dasycercus blythi	Brush-tailed Mulgara	P4	-	Inhabits spinifex grasslands and burrows on the flats between low sand dunes (Van Dyck and Strahan, 2008).	Possible. Sandy plains habitat is suitable.
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 present.
Hipposideros stenotis	Northern Leaf-nosed Bat	P2		It is found near the entrance of shallow caves and abandoned mines where they are usually very sensitive to the approach of an observer (Duncan *et al.* 1999). It forages in forest, woodlands and grasslands in close proximity to rocky outcrops and escarpments (Churchill 2008).	Unlikely. Very few records in the Pilbara. Database records from 2012 are a cluster of acoustic recordings, however the location is stated as 'Great Sandy Desert' therefore have low spatial accuracy. The accepted distribution of this species does not include in the Pilbara region (*e.g.*, Churchill 2008). Records may be a result of misidentification of echolocation records (Appendix E).
Lagorchestes conspicillatus leichardti	Spectable Hare-Wallaby	P4	-	Open *Acacia* forests, open woodlands and tall shrubland over tussock or hummock grasslands (Van Dyck and Strahan, 2008).	Present. Historic records and suitable habitat across the Study Area.
Leggadina lakedownensis	Lakeland Downs Mouse	P4		Mostly in moist tussock grassland or tropical savannah, but stony hummock grassland in the Pilbara. (Menkhorst and Knight, 2009). Most habitats are seasonally	Unlikely. Seasonal inundation unlikely, and nearest records are remote.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
				inundated areas on red or white sandy-clay soils. (Van Dyck and Strahan, 2008)	
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).	Possible. Foraging habitat available across the Study Area. No roosting habitat available.
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 plains and low hills habitats.
Pseudomys chapmani	Western Pebble-mound Mouse	P4	-	Found on stony hillsides with hummock grassland (Menkhorst and Knight, 2009)	Present. Mounds located in the low rolling hills.
Rhinonicteris 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 quality of habitats in the Study Area is Low. Record is likely of transitory individual.
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.	Possible. Suitable habitat occurs in the low hills, boulder rock outcrops and platy rock outcrops.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
-- Reptiles --					
Anilios 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 small and highly ephemeral. Very few termite mounds present for foraging resource.
Ctenotus nigrilineatus	Pin-striped Finesnout Ctenotus	P1		This species is reported as inhabiting spinifex at the base of granite outcrops in the hilly interior of the Pilbara.	Possible. Suitable habitat occurs in the low hills and outcrops.
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 fissures away from water sources. However, in the warmer months they become active and tend to stay near rocky outcrops and water. Their preference for water holes is likely due to resulting abundance of prey, rather than a need for drinking water. This species readily swims in water holes to hunt prey.	Unlikely. This species was not listed in the DBCA database search result, but was listed in the PMST database search result, due to the potential presence of suitable habitat. This species is often recorded in major drainage lines due to the presence of suitable refuges. However, it is not specifically dependant on such habitat, and is more typically associated with gorges and rocky breakaways, associated with water. There are no gorges or significant water filled gullies in the Study Area. No permanent or semi-permanent pools in the creeks.
Liopholis kintorei	Great Desert Skink		VU	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).	Unlikely. No local records, but was listed in the PMST database search, as suitable habitat may occur in the buffer area.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
				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 (*Triodia basedowii*, *T. pungens* and *T. schinzii*), with some scattered shrubs and occasional trees (*e.g.* Acacia spp., Eucalyptus spp., Hakea spp., Grevillea spp. and Allocasuarina decaisneana) (McAlpin 2001). Tend to utilise areas of habitat that have been burnt within the previous 2-15 years (McAplin 2001; Morre *et al.* 2015).	The area where suitable habitat may occur is 15 km to the southeast of the Study Area.

APPENDIX H: MOTION TRIGGERED CAMERA CAPTURES

APPENDIX H: MOTION TRIGGERED CAMERA CAPTURES

Camera ID	Common Name	Species Name	Date	Time	Temp (°C)	Habitat
MSC01	Northern Quoll	*Dasyurus hallucatus*	9/08/2022	1851		FH1
MSC01	Common Rock Rat	*Zyzomys argurus*	11/08/2022	2328		FH1
MSC01	Fat-tailed Pseudantechinus	*Pseudantechinus macdonnellensis*	12/08/2022	1457		FH1
MSC01	Fat-tailed Pseudantechinus	*Pseudantechinus macdonnellensis*	12/08/2022	1540		FH1
MSC01	Common Rock Rat	*Zyzomys argurus*	18/08/2022	1835		FH1
MSC03	Spinifex Pigeon	*Geophaps plumifera*	20/08/2022	0754		FH5
MSC03	Common Bronzewing	*Phaps chalcoptera*	25/08/2022	0715		FH5
MSC04	Perentie	*Varanus giganteus*	11/08/2022	1216		FH5
MSC04	Euro	*Macropus robustus*	15/08/2022	1954		FH5
MSC04	Stubble Quail	*Coturnix pectoralis*	22/08/2022	1457		FH5
MSC05	Dingo	*Canis lupus dingo*				FH4
MSC05	Dingo	*Canis lupus dingo*				FH4
MSC05	Cattle	*Bos taurus*				FH4
MSC05	Cattle	*Bos taurus*				FH4
MSC05	Cattle	*Bos taurus*				FH4
MSC05	Cattle	*Bos taurus*				FH4
MSC05	Cattle	*Bos taurus*				FH4
MSC06	Panther Skink	*Ctenotus pantherinus*	16/08/2022	0817		FH5
MSC07	Stubble Quail	*Coturnix pectoralis*	11/08/2022	1805	22	FH5
MSC07	Lined Fire-Tailed Skink	*Morethia ruficauda*	13/08/2022	0956	37	FH5
MSC07	Common Rock Rat	*Zyzomys argurus*	14/08/2022	1957	24	FH5
MSC07	Euro	*Macropus robustus*	17/08/2022	1320	47	FH5
MSC07	Common Rock Rat	*Zyzomys argurus*	17/08/2022	1953	25	FH5
MSC07	Common Rock Rat	*Zyzomys argurus*	17/08/2022	2111	23	FH5
MSC07	Stubble Quail	*Coturnix pectoralis*	21/08/2022	0728	17	FH5
MSC07	Stubble Quail	*Coturnix pectoralis*	22/08/2022	0656	13	FH5
MSC07	Common Rock Rat	*Zyzomys argurus*	22/08/2022	2357	17	FH5
MSC08	Spotted Dtella	*Gehyra punctata*	14/08/2022	0519	21	FH1
MSC08	Pilbara Rock Monitor	*Varanus pilbarensis*	14/08/2022	1312	50	FH1
MSC08	Pilbara Rock Monitor	*Varanus pilbarensis*	14/08/2022	1344	50	FH1
MSC08	Common Rock Rat	*Zyzomys argurus*	15/08/2022	2313	25	FH1
MSC08	Common Rock Rat	*Zyzomys argurus*	22/08/2022	2352	23	FH1
MSC09	Common Rock Rat	*Zyzomys argurus*	10/08/2022	1809	24	FH1
MSC09	Northern Quoll	*Dasyurus hallucatus*	12/08/2022	2311	22	FH1
MSC09	Spotted Dtella	*Gehyra punctata*	17/08/2022	0002	22	FH1
MSC09	Perentie	*Varanus giganteus*	21/08/2022	1307	33	FH1
MSC09	Pilbara Rock Monitor	*Varanus pilbarensis*	24/08/2022	1504	41	FH1
MSC10	Coarse Sand Ctenotus	*Ctenotus piankai*	10/08/2022	1220	34	FH5
MSC10	Coarse Sand Ctenotus	*Ctenotus piankai*	11/08/2022	1100	41	FH5
MSC10	Coarse Sand Ctenotus	*Ctenotus piankai*	11/08/2022	1626	34	FH5
MSC10	Fat-tailed Pseudantechinus	*Pseudantechinus macdonnellensis*	12/08/2022	0525	14	FH5
MSC11	Stubble Quail	*Coturnix pectoralis*	11/08/2022	0813	14	FH5
MSC11	Euro	*Macropus robustus*	18/08/2022	2139	20	FH5
MSC12	Common Bronzewing	*Phaps chalcoptera*	9/08/2022	0818	27	FH4
MSC12	Spinifex Pigeon	*Geophaps plumifera*	9/08/2022	0952	30	FH4
MSC12	Singing Honey-eater	*Lichenostomus virescens*	9/08/2022	1223	31	FH4
MSC12	Crested Pigeon	*Ocyphaps lophotes*	9/08/2022	1251	33	FH4
MSC12	Magpie Lark	*Grallina cyanoleuca*	9/08/2022	1251	33	FH4
MSC12	Magpie Lark	*Grallina cyanoleuca*	9/08/2022	1351	34	FH4
MSC12	Willie Wagtail	*Rhipidura leucophrys*	9/08/2022	1424	33	FH4
MSC12	Painted Fire-tail Finch	*Emblema pictum*	9/08/2022	1446	30	FH4
MSC12	Magpie Lark	*Grallina cyanoleuca*	10/08/2022	0639	17	FH4
MSC12	Zebra Finch	*Taeniopygia guttata*	10/08/2022	0925	18	FH4
MSC12	Red-capped Plover	*Charadrius ruficapillus*	12/08/2022	0605	14	FH4
MSC12	Red-capped Plover	*Charadrius ruficapillus*	12/08/2022	0713	17	FH4
MSC12	Bush Stone Curlew	*Burhinus grallarius*	23/08/2022	0005	18	FH4
MSC14	Yellow-throated Miner	*Manorina flavigula*	9/08/2022	1658	26	FH5
MSC14	Spinifex Pigeon	*Geophaps plumifera*	20/08/2022	1212	36	FH5
MSC15	Lined Fire-Tailed Skink	*Morethia ruficauda*	11/08/2022	1323	26	FH1
MSC15	Common Rock Rat	*Zyzomys argurus*	11/08/2022	2320	19	FH1
MSC16	Spinifex Pigeon	*Geophaps plumifera*	9/08/2022	1152	37	FH6
MSC16	Diamond Dove	*Geopelia cuneata*	15/08/2022	1346	41	FH6

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