

MARILLANA POWER 2030

DETAILED FAUNA SURVEY

PREPARED FOR: BHP WAIO



Spectrum
ECOLOGY & SPATIAL



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EXECUTIVE SUMMARY

BHP Western Australian Iron Ore are investigating the biological values of the potential Marillana Power project to provide contextual biological information to inform future environmental approvals within and in the vicinity of the area.

To support this investigation, BHP Western Australian Iron Ore commissioned Spectrum Ecology and Spatial to undertake a detailed terrestrial fauna survey of the Marillana Power project (the Survey Area). The Survey Area is located approximately 85 km northwest of Newman, encompassing an area of 7,330 ha.

This document reports on the results of a single-phase detailed terrestrial vertebrate fauna survey. Specific objectives included:

- Completing a desktop study, consolidating fauna records from relevant past biological surveys and relevant available database returns within a 50 km buffer of the Survey Area (the Study Area).
- Completing a detailed vertebrate fauna survey.
- Identification and mapping of fauna habitats within the Survey Area.
- Assessing suitability of habitats within the Survey Area to support significant fauna species, considering habitat preferences and desktop study results.
- Determining the likelihood of occurrence for significant fauna species within the Survey Area.
- Supply of all relevant spatial data collected during the survey, provided in Shapefile format, suitable for submission to the Index of Biodiversity Surveys for Assessments, and, in line with BHP Western Australian Iron Ore standards.

A desktop study of relevant biological data sources was undertaken to identify fauna species previously recorded in the Study Area. This comprised a literature review and biological database searches. Regional information was also reviewed to describe the biophysical characteristics of the Survey Area. The survey was conducted from 16 to 28 October 2024, in accordance with relevant State and Commonwealth guidance.

Sampling effort within the Survey Area included:

- Systematic trapping at eight locations within representative habitats; comprising pitfalls and funnel traps (except one site which consisted of only funnel traps), with trap effort of 490 pit trap days and 1,120 funnel trap days.
- A minimum of four, 30-minute avifauna censuses at each systematic site, totalling 16.5 hours.
- Deployment of motion sensitive cameras at five sites (five per site), for a total effort of 109 nights.
- Deployment of bat echolocation call recorders at eight locations, totalling 33 nights.
- Deployment of acoustic call recorders, targeting Night Parrots, at four locations, totalling 24 nights.
- Non-systematic survey activities targeting vertebrate fauna, including hand foraging and identification of secondary signs.

Fauna habitats were described and mapped, considering collected habitat data, aerial imagery, land systems, geology and pre-European vegetation. A likelihood of occurrence assessment was conducted for significant fauna species, considering individual species habitat preferences.

The desktop study identified a total of 360 vertebrate fauna species, comprising 51 mammal species (including nine introduced), 180 bird species, 120 reptile species, and nine amphibian species that have previously been recorded or deemed to potentially occur in the Survey Area.

The desktop study identified 29 significant fauna species that have the potential to occur in the Survey Area. Of these five have been recorded previously. The significant species include:

- Eleven threatened species, comprising four mammals, six birds and one reptile.
- 14 species of bird listed as Migratory under the *Environment Protection and Biodiversity Conservation Act 1999* and/or *Biodiversity Conservation Act 2016*.
- One bird listed as species otherwise in need of special protection under the *Biodiversity Conservation Act 2016*.
- Six species, four mammals and two reptiles, are listed as Priority by Department of Biodiversity, Conservation and Attractions.
- The previously recorded species included:
 - Northern Quoll (*Dasyurus hallucatus*, *Environment Protection and Biodiversity Conservation Act 1999* & *Biodiversity Conservation Act 2016* - Endangered).
 - Ghost Bat (*Macroderma gigas*, *Environment Protection and Biodiversity Conservation Act 1999* & *Biodiversity Conservation Act 2016*, Vulnerable).
 - Western Pebble-mound Mouse (*Pseudomys chapmani*, Department of Biodiversity, Conservation and Attractions Priority 4).
 - Pilbara Olive Python (*Liasis olivaceus barroni*, *Environment Protection and Biodiversity Conservation Act 1999* & *Biodiversity Conservation Act 2016*, Vulnerable).
 - Gane's Blind Snake (*Anilius ganei*, Department of Biodiversity, Conservation and Attractions Priority 1).

Five broad fauna habitats were characterised within the Survey Area, comprising:

- Hillcrest/Hillslope
- Gorge/Gully
- Minor Drainage Line
- Breakaway/Cliff
- Major Drainage Line

The Hillcrest/Hillslope habitat was the most common, covering 73.5% of the Survey Area. Cleared/Disturbed areas accounted for 12.2% of the Survey Area.

A total of 106 vertebrate species were recorded during the survey: 16 mammals, 60 birds and 30 reptiles:

- Native ground dwelling mammals comprised one carnivorous marsupial species (Dasyuridae); two macropod species (Macropodidae); and two native rodent species (Muridae). Introduced mammals consisted of House Mouse (*Mus musculus*), European Cattle (*Bos primigenius*) and the naturalised Dingo (*Canis familiaris*). Eight bat species were recorded consisting of two species of sheath-tailed bat (Emballonuridae), three species of free-tailed bat (Molossidae), and three species of vesper bat (Vespertilionidae). Combined, the mammals recorded represent 31% of mammal species identified as potentially occurring in the Study Area.
- Bird species were from 27 families, representing 33% of all bird species recorded in the Study Area.
- Reptiles included one dragon species (Agamidae), nine gecko species (Diplodactylidae and Gekkonidae), 14 skink species (Scincidae), three goanna species (Varanidae) and three snake species (Elapidae), representing 25% of herpetofauna species identified as potentially occurring in the Study Area.

One significant fauna species was recorded during the survey: Western Pebble-mound Mouse (*Pseudomys chapmani*, Department of Biodiversity, Conservation and Attractions Priority 4). Two individuals were trapped during the survey, and 10 mounds were recorded, ranging from active to very old.

Of the 29 significant species identified as potentially occurring, three were recorded within the last 10 years, six have a high likelihood to occur and the remaining 20 have a very low to low likelihood to occur. The species recorded within the last 10 years included:

- Northern Quoll (*Dasyurus hallucatus*, *Environment Protection and Biodiversity Conservation Act 1999 & Biodiversity Conservation Act 2016* Endangered).
- Ghost Bat (*Macroderma gigas*, *Environment Protection and Biodiversity Conservation Act 1999 & Biodiversity Conservation Act 2016* Vulnerable).
- Western Pebble-mound Mouse (*Pseudomys chapmani*, Department of Biodiversity, Conservation and Attractions Priority 4).

While the six high likelihood species included:

- Pilbara Leaf-nosed Bat (*Rhynonictis aurantia*, Pilbara form, *Environment Protection and Biodiversity Conservation Act 1999 & Biodiversity Conservation Act 2016* Vulnerable).
- Grey Falcon (*Falco hypoleucos*, *Environment Protection and Biodiversity Conservation Act 1999 & Biodiversity Conservation Act 2016* Vulnerable).
- Peregrine Falcon (*Falco peregrinus*, *Biodiversity Conservation Act 2016* Specially protected species).
- Pilbara Olive Python (*Liasis olivaceus barroni*, *Environment Protection and Biodiversity Conservation Act 1999 & Biodiversity Conservation Act 2016* Vulnerable) – previously recorded.
- Pilbara Barking Gecko (*Underwoodisaurus seorsus*, Department of Biodiversity, Conservation and Attractions Priority 2).
- Gane's Blind Snake (*Anilius ganei*, Department of Biodiversity, Conservation and Attractions Priority 1) – previously recorded.

Critical, supporting and important habitats for these species include:

- Breakaway/Cliff:
 - Critical habitat for the Northern Quoll and Pilbara Olive Python.
 - Supporting habitat for Pilbara Leaf-nosed Bat, Ghost Bat, and Grey Falcon.
 - Important habitat for Peregrine Falcon.
- Gorge/Gully:
 - Critical habitat for the Northern Quoll, Ghost Bat, and Pilbara Olive Python.
 - Supporting habitat for Pilbara Leaf-nosed Bat.
 - Important habitat for Peregrine Falcon, Pilbara Barking Gecko, and Gane's Blind Snake.
- Major Drainage Line:
 - Critical habitat for Grey Falcon.
 - Supporting habitat for Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat (in proximity to Category 1 or 2 Ghost Bat roosts), and Pilbara Olive Python.
 - Important habitat for Peregrine Falcon.
- Minor Drainage Line:
 - Supporting habitat for Pilbara Leaf-nosed Bat, Ghost Bat (in proximity to Category 1 or 2 Ghost Bat roosts), Grey Falcon, and Pilbara Olive Python.
 - Important habitat for Peregrine Falcon and Gane's Blind Snake.
- Hillcrest/Hillslope:
 - Critical habitat for Ghost Bat in proximity to Category 1 or 2 Ghost Bat roosts.

- Supporting habitat for Northern Quoll, Ghost Bat, Ghost Bat, Pilbara Leaf-nosed Bat, and Grey Falcon.
- Important habitat for Western Pebble-mound Mouse, Pilbara Barking Gecko and Gane's Blind Snake.

1. INTRODUCTION

1.1. Project Background

BHP Western Australian Iron Ore (BHP WAIO) are investigating the biological values of the potential Marillana Power project to provide contextual biological information to inform future environmental approvals within and in the vicinity of the area.

To support this investigation, BHP WAIO commissioned Spectrum Ecology and Spatial (Spectrum) to undertake a detailed terrestrial fauna survey of the Marillana Power project (the Survey Area). The Survey Area is located approximately 85 km northwest of Newman, encompassing an area of 7,330 ha (Map 1.1).

1.2. Project Scope

This document reports on the results of a single-phase detailed terrestrial vertebrate fauna survey. Specific objectives included:

- Completing a desktop study, consolidating fauna records from relevant past biological surveys and relevant available database returns within a 50 km buffer of the Survey Area (the Study Area; Map 1.1).
- Completing a detailed vertebrate fauna survey.
- Identification and mapping of fauna habitats within the Survey Area.
- Assessing suitability of habitats within the Survey Area to support significant fauna species, considering habitat preferences and desktop study results.
- Determining the likelihood of occurrence for significant fauna species within the Survey Area.
- Supply of all relevant spatial data collected during the survey, provided in Shapefile format, suitable for submission to the Index of Biodiversity Surveys for Assessments (IBSA), and, in line with BHP WAIO standards.

1.3. Legislation

Western Australian native fauna species that are rare, threatened with extinction, or have high conservation value are afforded special protection and are referred to as 'significant species' (EPA, 2020). Such fauna are legally protected under the State *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; Appendix A).



Legend

- Survey Area
- Study Area
- Major Towns
- Main Roads



0 5 10 15 20 25 km
Scale 1:750,000 @ A4

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



Author: JW

Date: 01-12-2025

Location of the Survey Area

Marillana Power 2030 Fauna

MAP

Prepared for
BHP WAIO

1.1

1.4. Bioregion

Thackway and Cresswell (1995) developed the Interim Biogeographic Regionalisation for Australia (IBRA), providing a framework for establishing priorities for Australia's National Reserve System, based on broad habitat characteristics.

The Survey Area is located within the southern section of the Pilbara bioregion, specifically the Hamersley subregion (Figure 1.1). The Hamersley subregion is characterised as being a mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by basalt, shale and dolerite gorges (Kendrick, 2001; McKenzie, May and McKenna, 2003). The valley floors of this subregion support low Mulga woodland over bunch grasses on fine textured soils, and ranges support *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils (Kendrick, 2001; McKenzie, May and McKenna, 2003).

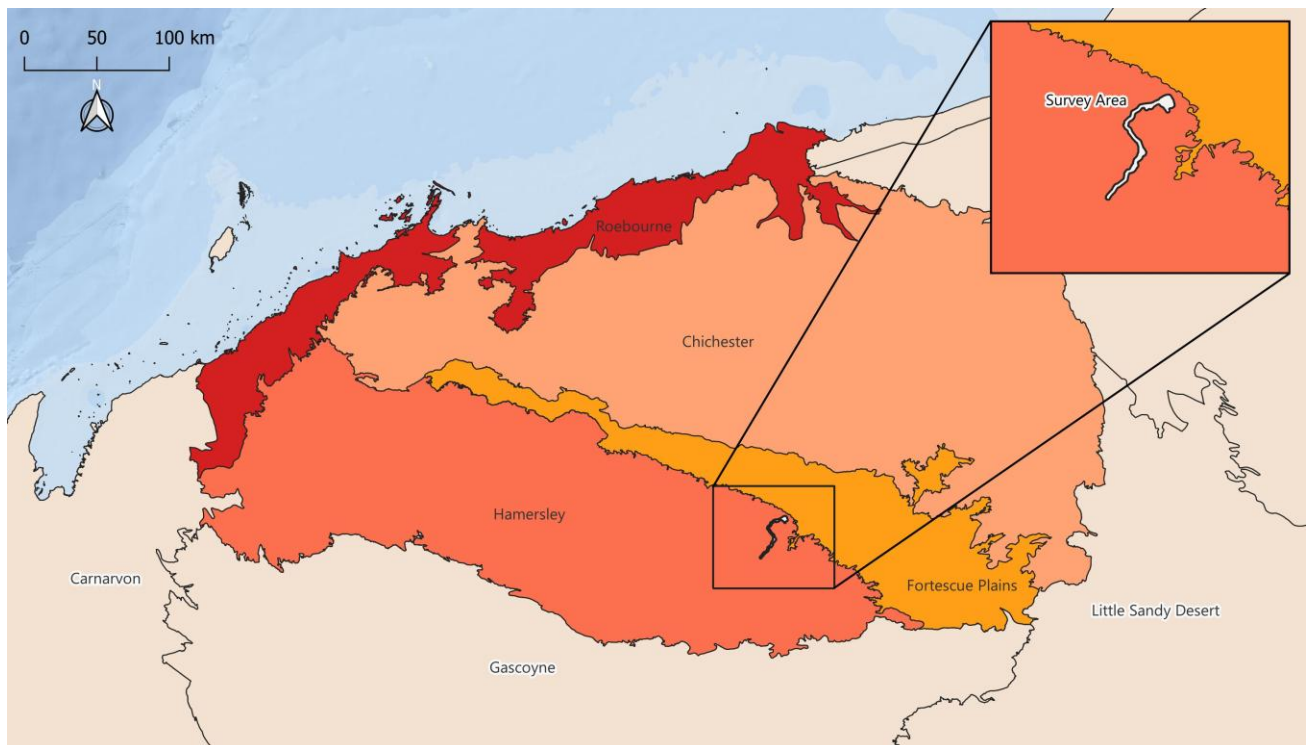


Figure 1.1: IBRA Classification

1.5. Climate

The climate of the Pilbara bioregion is classified as tropical, arid to semi-arid, with a median annual rainfall of 300 mm. Rainfall for the region can be variable, falling mainly in summer cyclonic events from December to February (Thackway and Cresswell, 1995).

Two broad climatic zones occur across the Pilbara region. Semi-desert tropical climatic conditions occur in coastal areas, as well as some higher-rainfall inland areas, which experience 9-11 months of dry weather, with hot humid summers and warm winters. Dry desert climatic conditions occur across the remaining inland areas, which typically experience higher temperatures and lower rainfall, with hot dry summers and mild winters with up to 12 months of dry weather (Leighton, 2004). The Survey Area is located within the dry inland area.

Annual rainfall is highly variable, but generally follows an inland to coastal and southern to northern increasing trend (Leighton, 2004). The driest months are in spring (September to October) with tropical cyclones and local thunderstorms producing much of the summer and early autumn rainfall (Mckenzie, Van Leeuwen and Pinder, 2009). Winter rainfall is also highly variable, generally decreasing from the coast through to inland areas (Leighton, 2004).

Monthly maximum temperatures in the Pilbara region range from an average of 25°C in July to 37°C in January, while minimum temperatures range between 12°C in July and 25°C in January (Mckenzie, Van Leeuwen and Pinder, 2009). According to the Köppen-Geiger climate classification, the Survey Area has a hot desert climate (Class BWh; Peel *et al.*, 2007). This classification includes arid regions where annual evaporation exceeds annual precipitation and has a mean annual temperature $\geq 18^{\circ}\text{C}$.

1.6. Land Systems

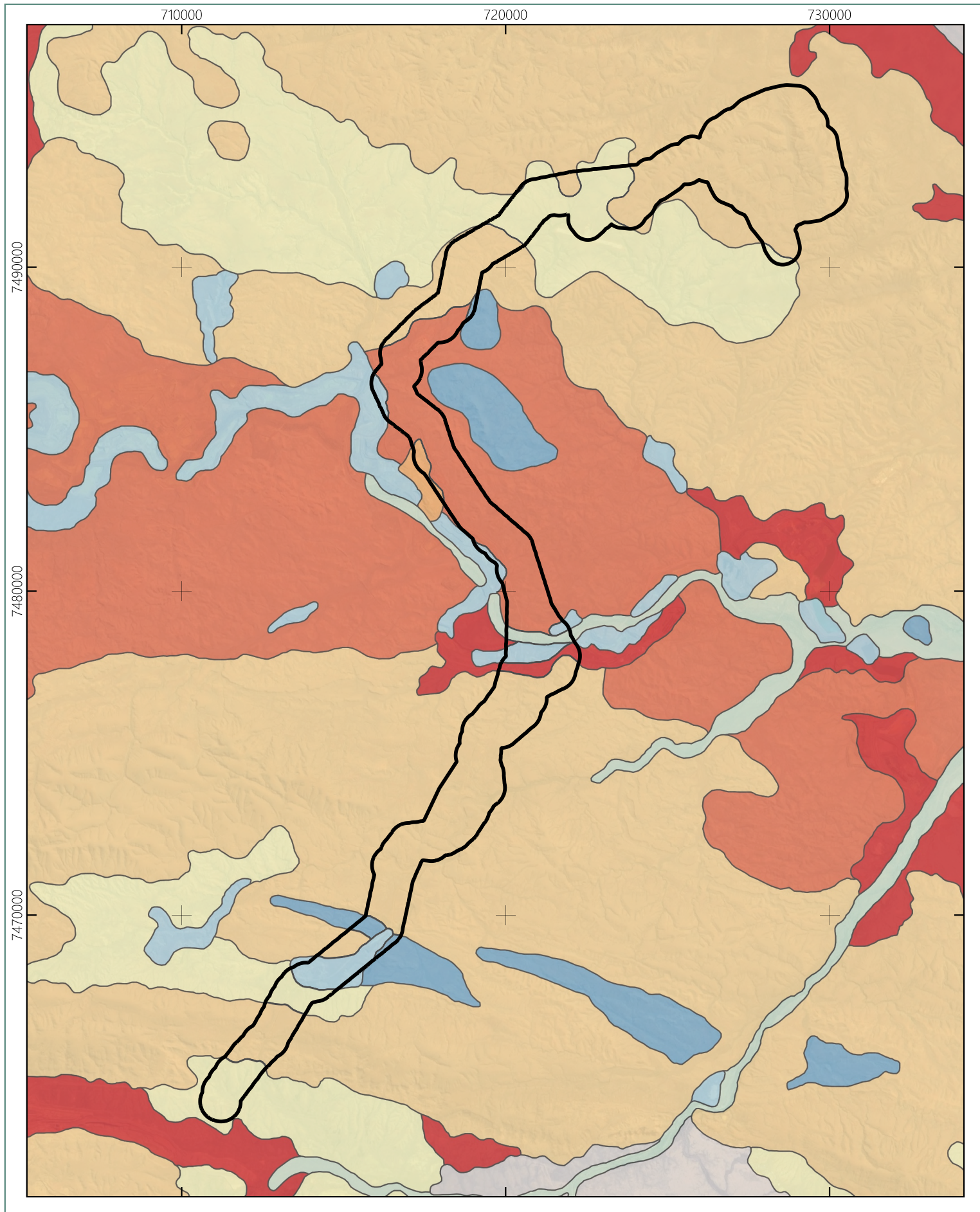
Fauna habitats may be broadly defined by land systems, which are characterised by topography, soils and vegetation (Van Vreeswyk *et al.*, 2004). Land systems of WA have been mapped by the Department of Primary Industries and Regional Development (DPIRD) at a scale of 1:250,000 (DPIRD, 2016).

Seven land systems occur within the Survey Area, with the Newman land system accounting for almost 60% of the Survey Area. A further 32% of the Survey Area is comprised of the McKay and Platform land systems (Table 1.1 and Map 1.2). All seven land systems occur extensively in the Pilbara bioregion, with the Survey Area containing only a small percentage of representative land systems in the bioregion.

Table 1.1: Survey Area Land Systems

Land System and Description	Survey Area Extent		Pilbara Extent (ha)	% of Pilbara Extent in Survey Area
	Survey Area Extent (ha)	Percent of Survey Area		
Newman - Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.	4,313	58.9	1,994,338	0.2
McKay - Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.	1,354	18.5	425,967	0.3
Platform - Dissected slopes and raised plains supporting shrubby hard spinifex grasslands.	977	13.3	236,389	0.4

Land System and Description	Survey Area Extent		Pilbara Extent (ha)	% of Pilbara Extent in Survey Area
	Survey Area Extent (ha)	Percent of Survey Area		
Robe - Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands.	404	5.5	128,176	0.3
Boolgeeda - Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	91	1.2	961,847	<0.1
Rocklea - Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	71	1.0	2,880,023	<0.1
River - Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	69	0.9	481,994	<0.1
Mining - Land associated with mining at the time of the land systems mapping.	51	0.7	-	-



Legend

Survey Area

Land Systems

Boolgeeda Land System

McKay Land System

Mining

Newman Land System

Platform Land System

River Land System

Robe Land System

Rocklea Land System

Not present in Survey Area



0 1 2 3 4 5 km

Scale 1:150,000

@ A4

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



Author: JW

Date: 18-11-2025

Prepared for BHP WAIO

Land Systems

Marillana Power 2030 Fauna

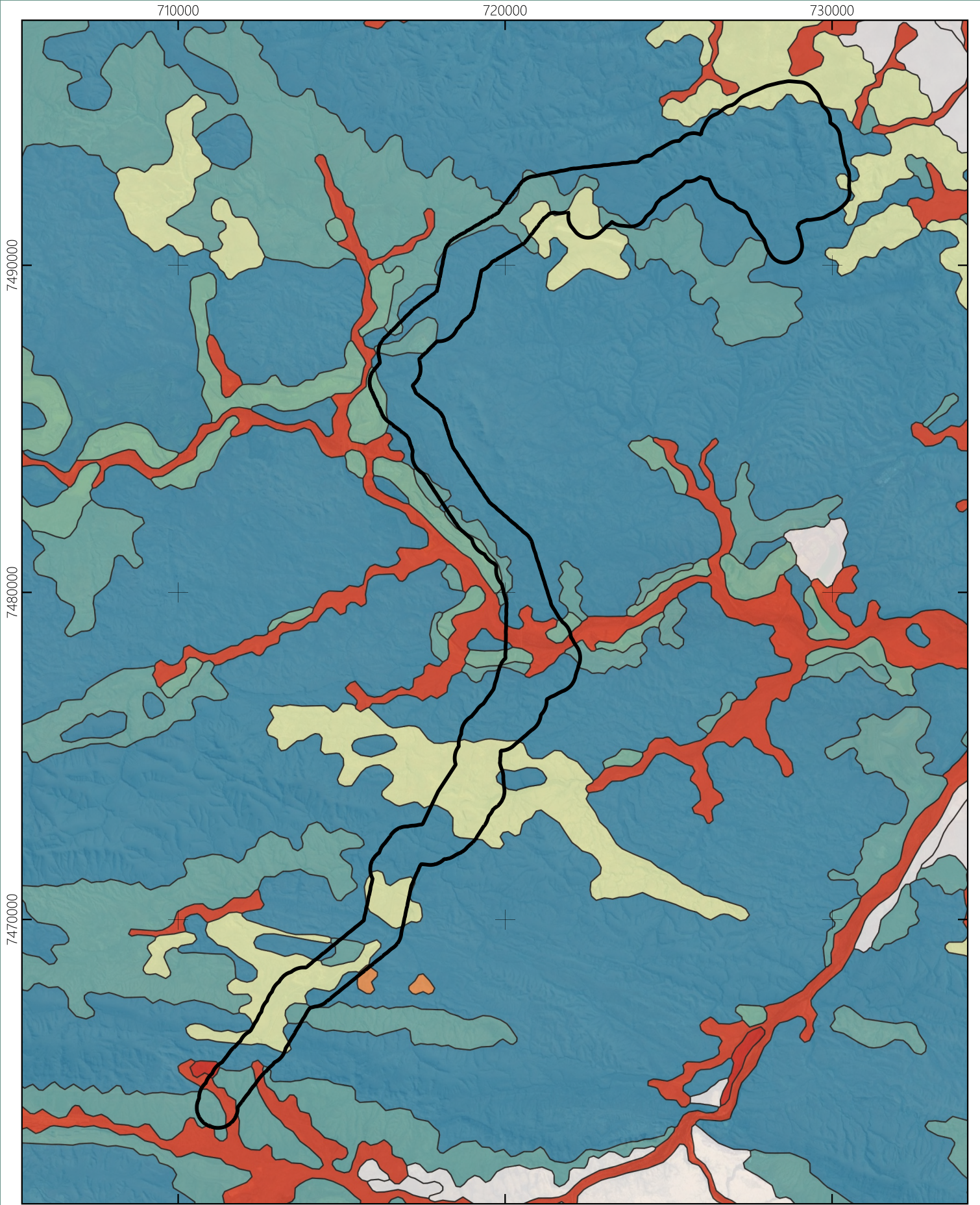
MAP
1.2

1.7. Geology

The surface geology of Western Australia has been mapped at a scale of 1:500,000 (DMIRS, 2020), which represents the most comprehensive statewide mapping available. Seven geology units occur within the Survey Area (Table 1.2 and Map 1.3), comprised predominantly of exposed bedrock (X-PIP, 65.3%), with residual, alluvial and colluvial geology types.

Table 1.2: Survey Area 1:500,000 Surface Geology

Unit Code	Description	Survey Area Extent		Pilbara Extent (ha)	% of Pilbara Extent in Survey Area
		Survey Area Extent (ha)	Percent of Survey Area		
X-PIP	Exposed bedrock	4,786	65.3	8,412,613	0.1
Rr-fh-PIP	Hematitic duricrust, massive to rubbly; includes iron-cemented reworked products	1,286	17.5	25,693	5.0
Rt-PIP	Transported duricrust; cemented sand, gravel, cobbles, and boulders in alluvial/colluvial deposits	849	11.6	513,376	0.2
Ac-PIP	Clay, silt, sand, and gravel in fluvial channels	267	3.6	646,611	<0.1
Rt-fl-PIP	Transported limonitic duricrust; iron-cemented sand, gravel, cobbles and boulders	133	1.8	26,911	0.5
Aa-PIP	Sand- or clay-rich alluvium on alluvial plain	5	0.1	356,816	<0.1
C-PIP	Colluvium derived from different rock types; includes gravel, sand, silt and clay	4	0.1	1,218,679	<0.1



Legend

- | | |
|---|--|
|  Survey Area |  Rr-fh-PIP |
| Surface Geology |  Rt-fl-PIP |
|  Aa-PIP |  Rt-PIP |
|  Ac-PIP |  X-PIP |
|  C-PIP |  Not in Survey Area |



0 1 2 3 4 5 km

Scale 1:150,000

@ A4

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



Author: JW

Date: 18-11-2025

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Surface Geology

Marillana Power 2030 Fauna

MAP
1.3

1.8. Pre-European Vegetation

The Survey Area is located within the Hamersley Botanical District, of the Eremaean Botanical Province (Beard *et al.*, 2013) for which vegetation of the Pilbara was originally described and mapped at a scale of 1:3,000,000. Mapping has since been updated to be consistent with the National Vegetation Information System (NVIS) descriptions at a scale of 1:250,000 (DPIRD, 2019).

Two vegetation sub-association units have been mapped within the Survey Area (Table 1.3 and Map 1.4). The Survey Area is dominated by hummock grassland (sub-association 82.3) which was mapped across 87% of the Survey Area. Although Beard vegetation mapping is broad scale in nature, it demonstrates that vegetation units occurring in the Survey Area are widespread in the Pilbara bioregion and occur contiguously outside the Survey Area (Map 1.4).

Table 1.3: Beard Vegetation Associations

Sub-association	Vegetation Description	Survey Area Extent		Pilbara Extent (ha)	% of Pilbara Extent in Survey Area
		Survey Area Extent (ha)	Percent of Survey Area		
82.3	Hummock grassland (<i>Triodia</i> spp.) with scattered bloodwoods (<i>Corymbia dichromophloia</i>) and snappy gum (<i>Eucalyptus leucophloia</i>)	6,379	87.0	2,156,547	0.3
18.11	Mulga (<i>Acacia aneura</i>) and associated species	951	13.0	575,808	0.2



Legend

-  Survey Area
- Beard Vegetation Association
-  18.11
-  82.3
-  Not in Survey Area



0 1 2 3 4 5 km

Scale 1:150,000 @ A4

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

 **Spectrum**
ECOLOGY • SPATIAL

Author: JW

Date: 18-11-2025

Prepared for BHP WAIO

Beard Vegetation Associations

1.9. Surface Hydrology

Most of the surface water that flows across the Pilbara region catchments are focused towards the Weeli Wolli Spring. This spring area comprises channels and floodplains and is associated with surface and groundwater. The drainage systems within the Survey Area are linked to the Fortescue River catchments and mostly contain ephemeral drainage systems that flow in response to rainfall. In the larger river channels, which drain the larger catchments, runoff can persist for several weeks (RPS, 2015).

One major creek, Marillana Creek, intersects the Survey Area. Other minor tributaries may occur within the Survey Area and may be seasonally inundated and therefore ephemeral in nature (S. Crossman and O. Li, 2015).

Significant wetlands located in the Study Area are discussed in Section 1.10.

1.10. Significant Lands

Significant lands include conservation estates, environmentally sensitive areas (ESA), and significant wetlands. No significant lands are located within the Survey Area; however, four occur within the Study Area, and are described in further detail in the following sections (Sections 1.10.1, 1.10.2, and 1.10.3). Additionally, 11 Priority Ecological Communities (PECs) were identified in the Study Area and are detailed in Table 1.4 and shown on Map 1.5.

Table 1.4: Significant Lands within the Study Area

Name	Distance and Direction from Survey Area	Significant Land Type		
		Conservation Estate	Environmentally Sensitive Area	Wetland
Fortescue Marsh	17 km N	X	X	DIWA ¹ WA066 and DRAFT proposed Ramsar Addition
Karijini National Park	44 km W	X	X	-
Karijini (Hamersley Range) Gorges	45 km NW	-	-	DIWA WA067
Priority Ecological Communities				
P1: Weeli Wolli Spring Community	4 km E	-	-	-
P3: Vegetation of sand dunes of the Hamersley Range / Fortescue Valley	6 km E	-	-	-
P1: Fortescue Marsh (Marsh Land System)	8 km N	-	-	-
P3: Coolibah – Lignum Flats sub type 1	20 km SW	-	-	-
P1: Coolibah – Lignum Flats sub type 2	22 km SW	-	-	-
P2: Riparian communities of springs and pools Pilbara	30 km E	-	-	-
P3: Kumina Land System	31 km SE	-	-	-
P1: Freshwater claypans of the Fortescue Valley	36 km NNW	-	-	-

Name	Distance and Direction from Survey Area	Significant Land Type		
		Conservation Estate	Environmentally Sensitive Area	Wetland
P1: Brockman Iron cracking clay communities	41 km NW	-	-	-
P3: Narbung Land System	46 km E	-	-	-
P1: Wona Land System	47 km NNE	-	-	-

¹Directory of Important Wetlands (DIWA)

1.10.1. Conservation Estates

Conservation estates include land and waters vested in the Conservation and Parks Commission under the *Conservation and Land Management Act 1984*. These typically comprise National Parks, Nature Reserves, Conservation Reserves, and other areas managed primarily for biodiversity conservation (DCCEEW, 2022).

Two conservation estates occur within the Study Area, Karijini National Park, located approximately 44 km west of the Survey Area and Fortescue Marsh Nature Reserve, located approximately 17 km north of the Survey Area (Table 1.4, Map 1.5).

1.10.2. Environmentally Sensitive Areas

The current list of ESAs was gazetted on April 2005 (Government of Western Australia, 2005). ESAs comprise areas of native vegetation where the exemptions for clearing vegetation under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply (DWER, 2021). These include:

- World Heritage sites.
- Register of the National Estate (RNE) areas listed for natural heritage value.
- Defined wetlands including a buffer area of 50 m (Ramsar, conservation category and nationally important wetlands).
- Threatened flora (previously Declared Rare) including vegetation within 50 m.
- Threatened Ecological Communities (TECs).
- Bush Forever sites.

There are no ESAs in the Survey Area; however, three are present in the Study Area (Table 1.4, Map 1.5). These include Karijini National Park (RNE), Fortescue Marsh (defined wetland), and 27 locations of threatened flora which represent populations of *Lepidium catapycnon*. This species was previously listed as threatened but has since been downgraded to Priority four (P4) and as such, these locations are no longer considered to be an ESA.

No TECs were recorded in the Study Area; however, 11 PECs occur, with the Weeli Wolli Spring Community (P1), located 4 km from the Survey Area (Table 1.4, Map 1.5).

1.10.3. Significant Wetlands

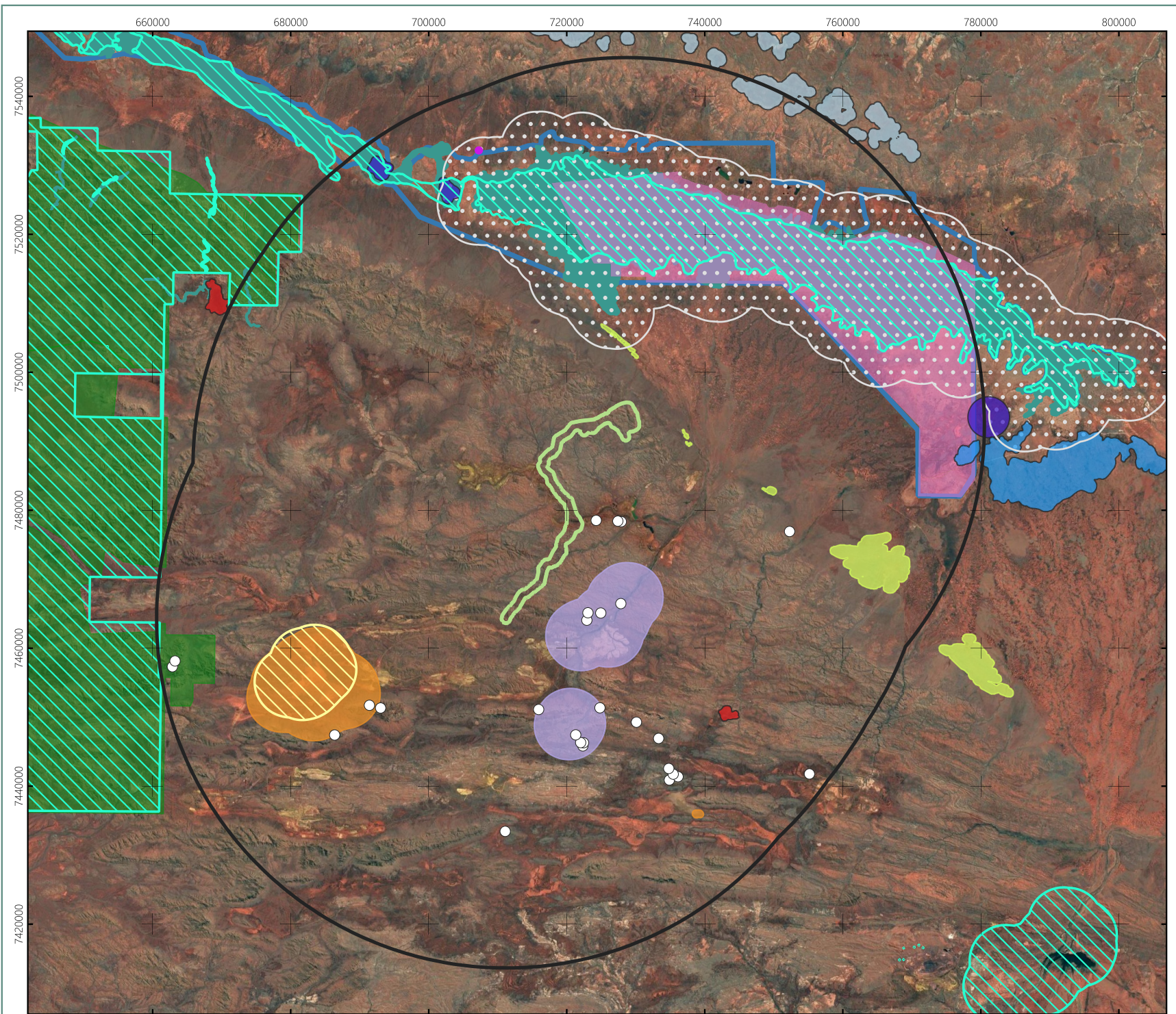
The Australian wetlands database includes nationally significant wetlands listed on the Directory of Important Wetlands (DIWA) and wetlands listed under the Ramsar convention (DCCEEW, 2025b). Wetlands listed under DIWA include those that are:

- Considered representative.
- Provide habitat or refugia for animal taxa.
- Contain 1% or more of a population of any native flora or fauna species.

- Provide an important ecological or hydrological role in a major wetland system.
- Are of historical, cultural or international significance.

Additionally, Ramsar sites are considered of international importance and include wetlands that are significant for conserving biological diversity, or considered rare, representative or unique (DCCEEW, 2025b).

Two significant wetlands are located within the Study Area; the Fortescue Marsh located 13 km north which is listed as DIWA (WA066) and a proposed Ramsar addition; and Karijini (Hamersley Range) Gorges (DIWA WA067; Table 1.4, Map 1.5).



Legend

Survey Area

Study Area

Significant Lands

ESAs - threatened flora

ESAs

Conservation Estates - Karijini National Park

Conservation Estates - Fortescue Marsh Nature Reserve

Wetlands - DIWA

Ramsar - Fortescue Marsh - Proposed Addition

PECs

P1 - Weeli Wolli Spring Community

P1 - Fortescue Marsh

P1 - Brockman Iron cracking clay communities

P1 - Wona Land System

P1 - Freshwater claypans of the Fortescue Valley

P2 - Coolibah - Lignum Flats, sub type 1

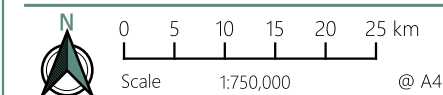
P2 - Coolibah - Lignum Flats, sub type 2

P2 - Riparian communities of springs and pools Pilbara

P3 - Fortescue Valley Sand Dunes

P3 - Kumina Land System

P3 - Narbung Land System



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

Spectrum
ECOLOGY • SPATIAL

Author: JW

Date: 19-11-2025

Significant Lands

Marillana Power 2030 Fauna

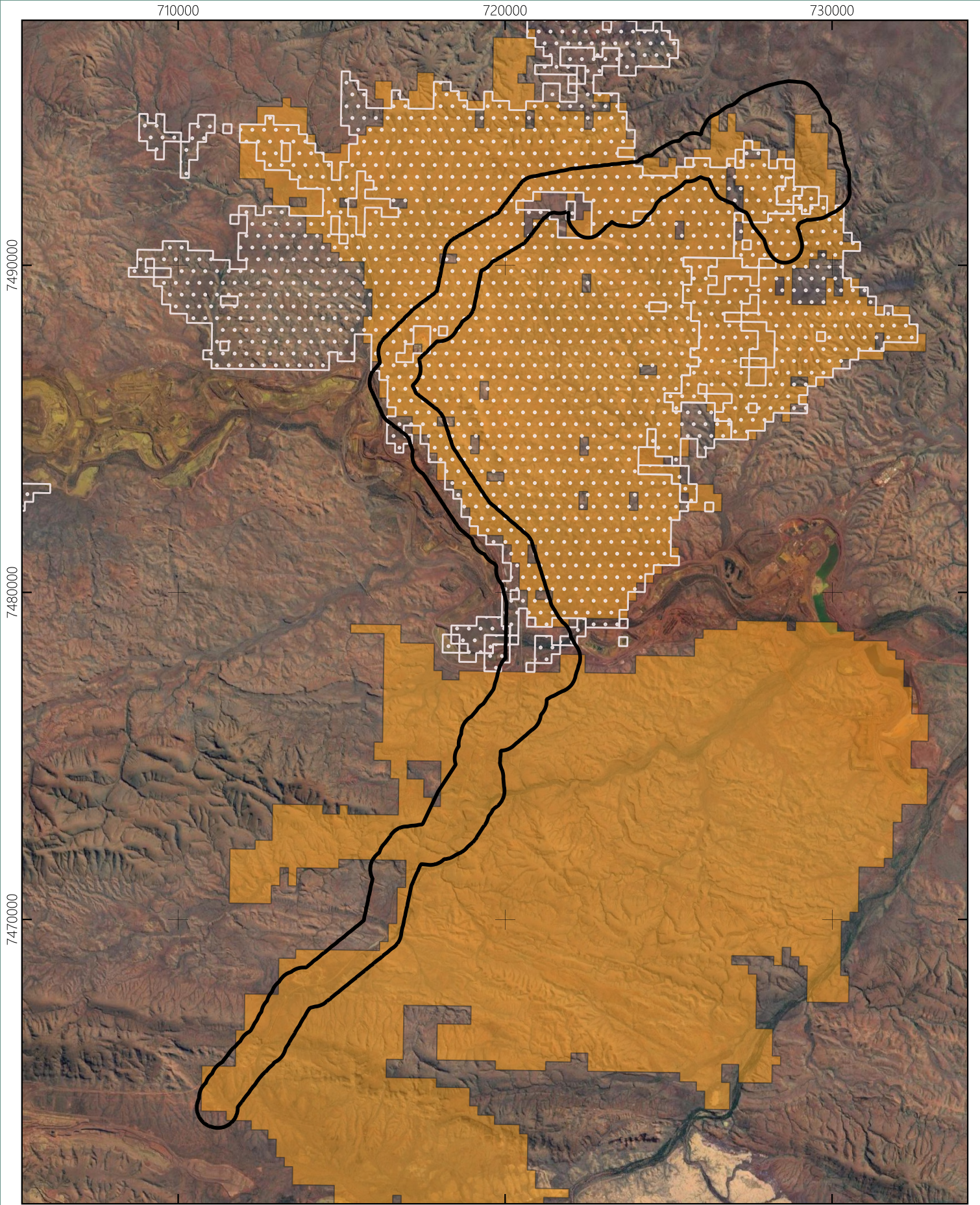
MAP

Prepared for
BHP WAIO

1.5

1.11. Fire History

The fire history for the previous 10 years (2015-2024) was assessed using the North Australia and Rangelands Fire Information (NAFI; Charles Darwin University, 2025). The Survey Area was extensively burnt in January 2024, nine months prior to the field survey. This burn covered approximately 41% of the Survey Area (2,999 ha) and covered most of the northern portion (Map 1.6). Prior to this, the last major fire was in 2015, covering 73% (5,330 ha) of the Survey Area. The 2015 fire comprised two separate burn events: one in January that affected 44% of the Survey Area, and another in December that impacted 29% of the Survey Area. The 2024 and 2015 fire scars are displayed on Map 1.6.



Legend



Survey Area

NAFI Fire History



2024



2015



0 1 2 3 4 5 km

Scale 1:150,000

@ A4

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



Author: EM

Date: 01-12-2025

Prepared for BHP WAIO

Fire History

Marillana Power 2030 Fauna

MAP
1.6

2. METHODS

2.1. Nomenclature

Naming conventions for herpetofauna and mammals align with the current Western Australian Museum checklist of terrestrial vertebrate fauna (EPA, 2020). Additionally, avifauna nomenclature adheres to the Australian Biological Resources Study Federal Australian Faunal Directory administered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW, 2025a), corresponding to the International Ornithological Congress (IOC) Bird List version 15.1 (Gill, Donsker and Rasmussen, 2025).

2.2. Desktop Study

A desktop study of relevant and available biological data sources of the Study Area was undertaken prior to the field survey, to assess the fauna likely to occur across the Survey Area. The Study Area includes a buffer of approximately 50 km surrounding the Survey Area (Map 1.1, Table 2.1).

2.2.1. Biological Database Searches

The following databases were searched and incorporated into the desktop study (Table 2.1).

Table 2.1: Summary of Database Searches

Data Source	Custodian	Data Access Date	Buffer around Survey Area
Commonwealth Protected Matters Search Tool (PMST)	Department of Climate Change, Energy, the Environment and Water (DCCEEW)	25/09/2024	50 km
Dandjoo	Department of Biodiversity, Conservation and Attractions (DBCA)	25/09/2024	50 km
Atlas of Living Australia	National Research Infrastructure for Australia (NCRIS) Commonwealth Scientific and Industrial Research Organisation (CSIRO) Global Biodiversity Information Facility (GBIF)	28/08/2025	50 km
DBCA Threatened Fauna Database	DBCA	25/07/2024	50 km
Previously conducted biological assessments	Various sources	09/09/2024	50 km

2.2.2. Literature Review

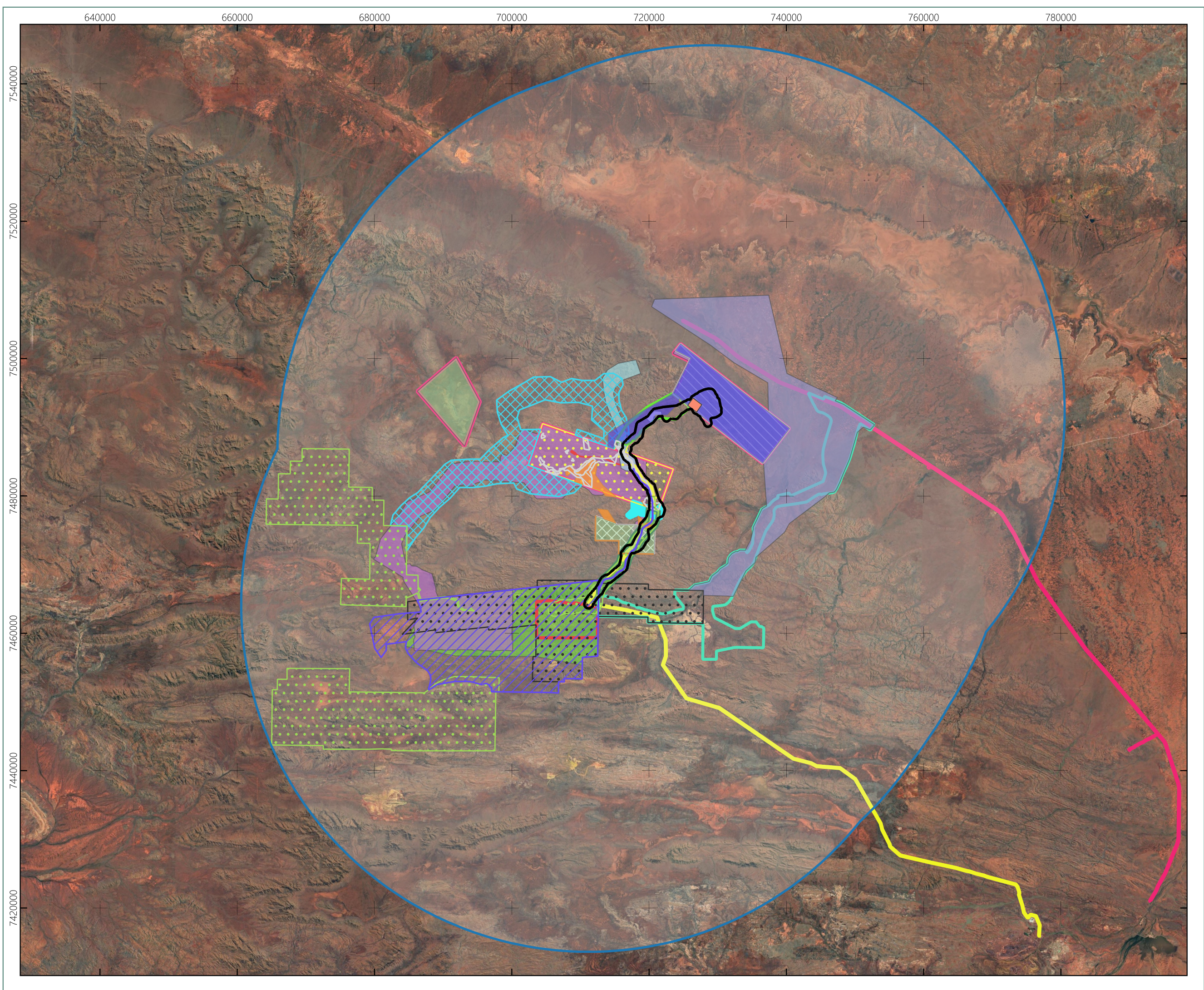
Data from relevant biological surveys and scientific papers previously completed within the Study Area were reviewed for assemblage data and the occurrence of significant vertebrate fauna (Table 2.2, Map 2.1). These included both publicly available reports and those provided by BHP WAIO.

Table 2.2: Previously Conducted Biological Surveys

Biological Assessment Name	Survey Level	Survey Timing	Distance from Survey Area
Marillana Meteorological Mast Targeted Significant Vertebrate Fauna Survey (Astron, 2024)	Targeted – vertebrate fauna	March 2024	Within

Biological Assessment Name	Survey Level	Survey Timing	Distance from Survey Area
Targeted Pilbara Olive Python Survey South Flank and Mining Area C (Biologic, 2023b)	Targeted – vertebrate fauna	March 2023	Partial overlap
Central Pilbara Hub Targeted Matters of National Significance Vertebrate Fauna Survey (Biologic, 2023a)	Targeted – vertebrate fauna	November 2021	Partial overlap
Yandi 45C Targeted Significant Vertebrate Fauna Survey (Astron, 2023)	Targeted – vertebrate fauna	September & October 2022	Partial overlap
Ministers North Fauna Survey Level 1 Survey (GHD, 2021)	Targeted – vertebrate fauna	September 2019	Partial overlap
Marillana Tenement and Infrastructure Corridor Targeted Vertebrate Fauna Survey (Biologic, 2019)	Targeted – vertebrate fauna	April – June 2018	Partial overlap
Ministers North Level 2 Vertebrate Fauna Survey (Biologic, 2017)	Detailed – vertebrate fauna	October 2016 & April 2017	Partial overlap
Marillana Targeted Vertebrate Fauna Survey (Biologic, 2016b)	Targeted – vertebrate fauna	December 2015 & January 2016	Partial overlap
Marillana Infrastructure Corridor Level 1 Vertebrate Fauna Survey (Biologic, 2016a)	Targeted – vertebrate fauna	January 2016	Partial overlap
Mining Area C - Desktop Review of Baseline Information on Vertebrate Fauna (Biologic, 2014)	Desktop Study	No survey	Partial overlap
Area C West to Yandi Level 2 Vertebrate Fauna Survey (Biota, 2013)	Detailed – vertebrate fauna	April 2011 & September 2011	Partial overlap
Marillana and Surrounds Targeted Mulgara Survey (Biologic, 2013)	Targeted – vertebrate fauna	June 2012	Partial overlap
Barimunya Camp Vertebrate Fauna Survey (Biologic, 2011c)	Basic – vertebrate fauna	April 2011	Within
Area C to Yandi Fauna Survey (Biologic, 2011b)	Targeted – vertebrate fauna	September 2010	Partial overlap
Yandi Vertebrate Fauna Review (Biologic, 2011d)	Targeted – vertebrate fauna	December 2010	Partial overlap
Area C and Surrounds Vertebrate Fauna Survey (Biologic, 2011a)	Detailed – vertebrate fauna	October 2009 & March 2010	Partial overlap
East Packsaddle Level 1 Vertebrate Fauna Survey (Biologic, 2010)	Targeted – vertebrate fauna	No survey	Partial overlap
Yandicoogina Junction South West and Oxbow Fauna Survey (Biota, 2010)	Detailed – vertebrate fauna	July 2008	Partial overlap
Area C to Jinyari to Mount Newman Railway Terrestrial Vertebrate Fauna Survey (Outback Ecology, 2010)	Detailed – vertebrate fauna	October 2008 & March 2009	Partial overlap
Yandicoogina Targeted Northern Quoll Survey (Biota, 2009)	Targeted – vertebrate fauna	October 2009	Partial overlap
Munjina and Ministers North (Yandi Hub) Fauna Assessment (ENV Australia, 2009a)	Detailed – vertebrate fauna	November 2007	Partial overlap
Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment (ENV Australia, 2009b)	Targeted – vertebrate fauna	May 2009	Partial overlap
RGP5 Yandi Flora Survey and Assessment of Barimunya Airport and a Potential Borrow Area (ENV Australia, 2009c)	Targeted – vertebrate fauna	November 2008	Partial overlap

Biological Assessment Name	Survey Level	Survey Timing	Distance from Survey Area
Survey for conservation significant bats between Kurrajura siding and the Yandi Wye (Specialised Zoological, 2008)	Targeted – vertebrate fauna	October 2008	Partial overlap
Area C Mining Operation Environmental Management Plan (Revision 4) (Outback Ecology, 2008)	Detailed – vertebrate fauna	March 2008	Partial overlap
Summary of Important Findings from RPG5 Railway Project Biological Assessments (ENV Australia, 2008)	Targeted – vertebrate fauna	May 2008	Partial overlap
Marillana Terrestrial Fauna Survey (ecologia, 2006a)	Detailed – vertebrate fauna	October 2005 & March 2006	Partial overlap
Ministers North Biological Survey (ecologia, 2006b)	Detailed – vertebrate fauna	May 2006	Partial overlap
Yandi Stockyard and Overland Conveyor Fauna and Flora Assessment (ecologia, 2004)	Basic – vertebrate fauna	October 2004	Partial overlap
Yandi Life of Mine Flora and Fauna (Maunsell Australia, 2003)	Targeted – vertebrate fauna	September 2003	Partial overlap
Marillana Creek Western Access Corridor (HGM, 1999)	Targeted – vertebrate fauna	April 1999	Partial overlap
Mining Area C Biological Survey (ecologia, 1998)	Detailed – vertebrate fauna	April 1997	Partial overlap



- Legend**
- Survey Area
 - Study Area
 - Previous Surveys**
 - Marillana Meteorological Mast Targeted Significant Vertebrate Fauna Survey
 - Targeted Vertebrate Fauna Survey: Pilbara olive python South Flank and Mining Area C
 - Central Pilbara Hub Targeted Matters of National Significance Vertebrate Fauna Survey
 - Yandi 45C Targeted Significant Vertebrate Fauna Survey
 - Ministers North Fauna Survey Level 1 Survey
 - Marillana Tenement and Infrastructure Corridor Targeted Vertebrate Fauna Survey
 - Ministers North Level 2 Vertebrate Fauna Survey & Ministers North Biological Survey
 - Marillana Targeted Vertebrate Fauna Survey & Marillana Terrestrial Fauna Survey
 - Marillana Infrastructure Corridor Level 1 Vertebrate Fauna Survey
 - Mining Area C - Desktop Review of Baseline Information on Vertebrate Fauna & Mining Area C Biological Survey
 - Area C West to Yandi Level 2 Vertebrate Fauna Survey
 - Marillana and Surrounds Targeted Mulgara Survey
 - Barimunya Camp Vertebrate Fauna Survey
 - Area C to Yandi Fauna Survey & East Packsaddle Level 1 Vertebrate Fauna Survey
 - Yandi Vertebrate Fauna Review & Yandi Life of Mine Flora and Fauna
 - Area C and Surrounds Vertebrate Fauna Survey
 - Yandicoogina Junction South West and Oxbow Fauna Survey
 - Area C to Jinyari to Mount Newman Railway Terrestrial Vertebrate Fauna Survey
 - Munjina and Ministers North (Yandi Hub) Fauna Assessment
 - Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment
 - Survey for conservation significant bats between Kurrajura siding and the Yandi Wye
 - Area C Mining Operation Environmental Management Plan (Revision 4)
 - Summary of Important Findings from RPG5 Railway Project Biological Assessments
 - Marillana Terrestrial Fauna Survey
 - Ministers North Level 2 Vertebrate Fauna Survey & Minste
 - Yandi Stockyard and Overland Conveyor Fauna and Flora Assessment
 - Yandi Life of Mine Flora and Fauna
 - Marillana Creek Western Access Corridor - Biological Assessment
 - Mining Area C - Desktop Review of Baseline Information on Vertebrate Fauna & Mining Area C Biological Survey

 0 5 10 15 20 km
Scale 1:500,000 @ A3

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

 **Spectrum**
ECOLOGICAL • SPATIAL

Author: JW Date: 19-11-2025

2.2.3. Likelihood of Occurrence of Significant Fauna

The following information was collated for each significant fauna species identified during the desktop study:

- Conservation status (EPBC Act, BC Act, DBCA listing).
- Description of habitat requirements.
- Description of previous records.
- Distance of record to the Survey Area.
- Recentness of records.

A likelihood of occurrence assessment was then conducted using the criteria listed in Table 2.3, with consideration to the above bullet points.

Table 2.3: Likelihood of Occurrence Criteria

Likelihood	Criteria
Recorded	• Species recorded within the Survey Area within the previous 10 years.
High	• Species recorded within the Survey Area, between 10 and 20 years ago; or • Species recorded within 20 km of the Survey Area and suitable habitat exists in the Survey Area.
Medium	• Species recorded within the Survey Area, more than 20 years ago; or • Species recorded within 50 km of the Survey Area and suitable habitat occurs in the Survey Area; • Species records are infrequent, or species is not easily detectable using standard survey methods.
Low	• Species rarely or not recorded within 50 km of the Survey Area and suitable habitat does not occur within the Survey Area; or • Suitable habitat occurs in the Survey Area, but species has not been recorded for more than 50 years.
Very Low	• Species not recorded within 50 km despite multiple recent surveys. Suitable habitat does not occur within the Survey Area. Species considered locally extinct or absent.

The Critically Endangered Night Parrot (*Pezoporus occidentalis*) is a rare and cryptic species that is difficult to record in the field, even if present (DBCA, 2024). Therefore, in determining likelihood of occurrence, the presence of suitable nesting, roosting or foraging habitat (critical habitat) is considered more relevant than previous records. The suitability of habitat is based largely on the habitat characteristics and quality (Table 2.4).

Table 2.4: Night Parrot Likelihood of Occurrence Criteria

Likelihood	Fauna
Recorded	• Species recorded within the Survey Area within the previous 10 years.
High	• <i>Triodia</i> with following characteristics present in Survey Area: ring forming; minimum hummock height of 40 cm; and structurally complex with mix of hummock sizes. • <i>Triodia</i> on treeless plain without shrubs, or only lightly wooded. • <i>Triodia</i> fragmented with natural 'fire barriers'. • <i>Triodia</i> is associated with shallow depressions or paleodrainage lines. • Suitable patches of <i>Triodia</i> are widespread at the landscape scale (within 10 km of Survey Area).
Medium	• <i>Triodia</i> with following characteristics present in Survey Area: ring forming; minimum hummock height of 40 cm; and structurally complex with mix of hummock sizes. • <i>Triodia</i> on treeless plain without shrubs, or only lightly wooded. • <i>Triodia</i> fragmented with natural 'fire barriers'. • Suitable patches of <i>Triodia</i> are <u>not</u> widespread at the landscape scale (within 10 km of Survey Area). • Foraging habitat present (floodplain rich in forbs and grasses and chenopods), with suitable roosting habitat in the wider landscape (within 10 km of Survey Area).

Likelihood	Fauna
Low	• <i>Triodia</i> with following characteristics present in Survey Area: ring forming; minimum hummock height of 40 cm; and structurally complex with mix of hummock sizes. • <i>Triodia</i> on areas with trees and shrubs. • <i>Triodia</i> fragmented with natural 'fire barriers'. • Suitable patches of <i>Triodia</i> are <u>not</u> widespread at the landscape scale (within 10 km of Survey Area). • Foraging habitat present (floodplain rich in forbs and grasses and chenopods), but without suitable roosting habitat in the wider landscape (within 10 km of Survey Area).
Very Low	• <i>Triodia</i> with following characteristics absent from Survey Area: ring forming; minimum hummock height of 40 cm; and structurally complex with mix of hummock sizes. • Foraging habitat absent.

2.3. Survey Timing & Personnel

The survey was conducted from 16-28 October 2024. The fauna survey was completed under DBCA Regulation 27 licence number BA27001164, BC Act Section 40 authorisation TFA-2425-0092, and DPIRD Wildlife Animal Ethics Committee permit number U246 / 2023 – 2025. Field personnel details are presented in Table 2.5.

The Survey Area is located within the Eremaean Botanical Province as described by Beard (1980). The Environmental Protection Authority (EPA) Technical Guidance (EPA, 2020) recommends terrestrial fauna surveys in this region be completed between September to April (the period of highest reptile activity), preferably immediately after rain events to coincide with peak amphibian and bird activity. There is no recommended preferred survey timing for mammals.

Table 2.5: Field Personnel

Name	Position	Qualification	Years Consulting Experience	Role
Astrid Moxham	Principal Zoologist	M.Sc	17	Field zoologist
Melinda Henderson	Senior Zoologist	B.Sc. Hons.	6	Field zoologist
Mickey Dwyer	Senior Zoologist	B.Sc. M.Sc	5	Field zoologist
Joel Wilson	Senior Zoologist	B.Sc. M.Sc	4	Team lead
Luciana Liberoff	Zoologist	B.Sc. M.Sc	3	Field zoologist
Ashlee Adams	Zoologist	B.Sc.	1	Field zoologist

2.4. Weather & Climate

Rainfall and temperature data were extracted from the Scientific Information for Landowners (SILO) database (Queensland Government, 2025) for the Study Area (-22.746514, 119.150078). SILO sources climatic data from the Bureau of Meteorology (BOM) and interpolates data between weather stations to provide a complete data set for any location.

During the survey, maximum temperatures ranged from 30.1°C to 40.3°C, with light rainfall occurring on two of the 13 survey days. Overnight minimum temperatures ranged from 17.4°C to 26.4°C (Table 2.6).

Table 2.6: Rainfall and Temperature Recorded During the Survey

	October 2024												
	16	17	18	19	20	21	22	23	24	25	26	27	28
Rainfall (mm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.1	0.0	0.0
Maximum Temperature (°C)	36.1	30.1	33.2	36.7	38.8	38.5	39.5	38.9	38.9	39.1	40.3	39.0	39.1
Minimum Temperature (°C)	20.1	17.5	18.2	17.9	17.4	22.9	25.0	24.5	25.5	22.5	26.4	23.3	24.9

Figure 2.1 represents the total monthly rainfall for 2023 and 2024 with the long-term monthly median rainfall and mean minimum and maximum temperature. The BOM reference climate normal period of January 1961 to December 1990 was used for calculating climate statistics and evaluating rainfall conditions recorded prior to the survey (Bureau of Meteorology, 2025a). Rainfall conditions were considered 'typical' if the total rainfall recorded over a period was between the 25th and 75th percentiles, for annual rainfall this range was 196.3 mm to 399.1 mm. Rainfall totals outside of the typical range were considered 'dry' or 'wet', and 'very dry' or 'very wet' if they were below the 10th or above the 90th percentiles, respectively (Bureau of Meteorology, 2025b). The following data was recorded (Figure 2.1):

- In the year preceding the survey, 324.2 mm of rainfall was recorded at the Survey Area, 39.1 mm higher than the median of the long-term total annual rainfall (285.1 mm).
- A total of 82.5 mm of rainfall was recorded in the three months prior to the survey (16 July to 16 October 2024), 70.7 mm higher than the median of the long-term total rainfall (11.8 mm) for the same period.
- The rainfall conditions were seasonally very wet for the three months preceding the detailed fauna survey and typical compared to the annual conditions of the climate reference period.

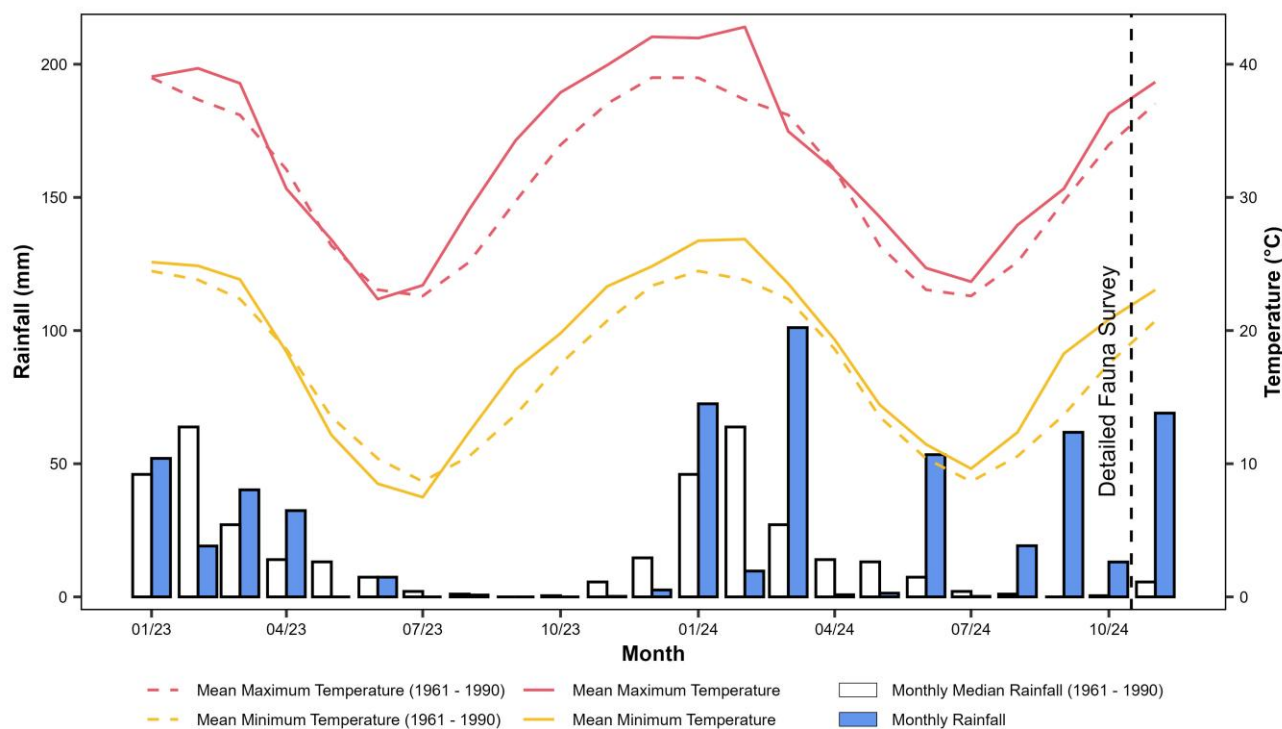


Figure 2.1: Rainfall and Long-term Climate Data at the Survey Area

2.5. Vertebrate Fauna Survey

2.5.1. Survey Design

The survey was conducted in accordance with relevant State, Commonwealth guidelines and policy including:

- Environmental Factor Guidelines – Terrestrial Fauna (EPA, 2016).
- EPA Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020).
- Survey guidelines for Australia's threatened mammals (DSEWPaC, 2011a).
- Survey guidelines for Australia's threatened birds (DEWHA, 2010b).
- Survey guidelines for Australia's threatened bats (DEWHA, 2010a).
- Survey guidelines for Australia's threatened reptiles (DSEWPaC, 2011b).
- Guidelines for determining the likely presence and habitat usage of night parrot (*Pezoporus occidentalis*) in Western Australia (DBCA, 2024).
- EPBC Act referral guideline for the endangered northern quoll *Dasyurus hallucatus* (DotE, 2016).
- Guidelines for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia (DBCA, 2017).
- EPBC Act Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DotE, 2013).

Additionally, relevant BHP WAIO guidelines were also observed:

- Vertebrate Fauna Surveys in Western Australia – SPR-IEN-EMS-012 (BHP WAIO, 2023b).
- Biodiversity Survey Spatial Data Requirements – SPR-IEN-EMS-015 (BHP WAIO, 2023a).

The fauna survey consisted of systematic fauna trapping, opportunistic sightings, targeted searches and deployment of passive monitoring equipment. Sampling sites were selected based on desktop study results, in combination with ground-truthing during the survey.

2.5.2. Habitat Assessment

Based on aerial imagery and on-ground assessments, fauna habitats were discerned considering landforms, land systems, geology, and vegetation. Collectively, these determine the fauna assemblage and the likelihood of occurrence of significant fauna. Habitat assessments were conducted at each sampling location as well as at an additional 18 locations within the Survey Area.

Habitats were classified as 'critical' in accordance with EPBC Significant Impact Guidelines (DotE, 2013). Critical habitats are defined as those that are necessary for the following:

- Activities such as foraging, breeding, roosting, or dispersal (excluding those used on a temporary or occasional basis).
- Long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators).
- Maintaining genetic diversity and long-term evolutionary development.
- Reintroduction of populations or recovery of the species.

2.5.3. Systematic Survey

2.5.3.1. Ground-dwelling vertebrates

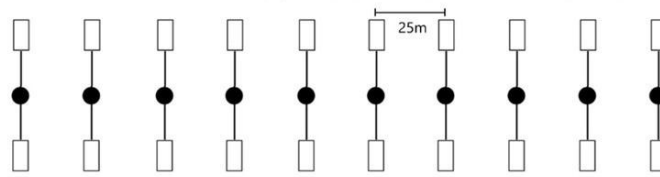
To document the species assemblage, eight systematic sampling sites were installed in representative habitats within the Survey Area (Table 2.7 and Map 2.2).

Trapping sites comprised the following:

- Pitfall traps - five 20 L bucket and five 50 cm PVC pipe pitfall traps, dug into the ground. A 10 m long, 30 cm high fence was installed, passing across the top of each pit to direct fauna into them.
- Funnel traps - a single funnel trap was placed at both ends of each fence to capture fauna that are not readily caught in pitfall traps (20 per trapping site). All funnel traps were equipped with shades to minimize overheating.

Trap layout and design is presented in Figure 2.2.

Trapping Site Overhead View



Trap Point Setup

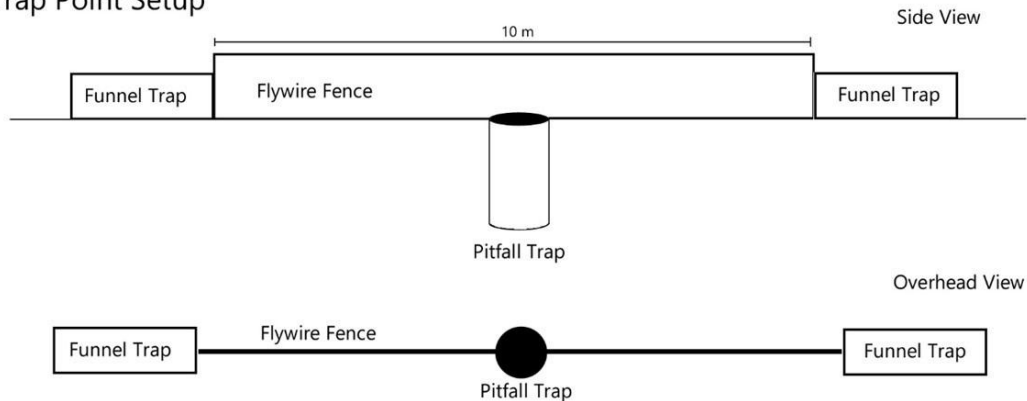


Figure 2.2: Trap Layout and Design

One of these systematic sites was situated in Gorge/Gully habitat and consisted of funnel traps only (including 10 m fence) without the installation of pitfalls due to difficulty digging into the exposed bedrock. Systematic trapping effort comprised a total of 490 pit trap days and 1,120 funnel trap days (Table 2.7).

Table 2.7: Systematic Sampling Site and Sampling Effort

Site	Easting (mE)	Northing (mN)	Habitat	Start Date	End Date	Effort (Trap Nights)
MPS-01	729029	7491970	Gorge/Gully	20/10/2024	27/10/2024	7
MPS-02	727283	7492523	Hillcrest/Hillslope	19/10/2024	26/10/2024	7
MPS-03	720963	7492380	Hillcrest/Hillslope	20/10/2024	27/10/2024	7
MPS-04	718121	7487994	Hillcrest/Hillslope	20/10/2024	27/10/2024	7
MPS-05	720763	7478510	Major Drainage	21/10/2024	28/10/2024	7
MPS-06	719080	7473887	Hillcrest/Hillslope	21/10/2024	28/10/2024	7
MPS-07	715723	7469920	Minor Drainage	21/10/2024	28/10/2024	7
MPS-08	714587	7468498	Hillcrest/Hillslope	21/10/2024	28/10/2024	7
Datum: GDA94/MGA zone 50						
Total Pitfall Effort						490
Total Funnel Effort						1,120

2.5.3.2. Avifauna

Avifauna censuses were carried out at least four times at each of the eight systematic sampling sites, for a duration of 30 minutes for each census. Censuses were conducted in the mornings when bird activity is typically high. If additional surveys were required, the afternoon period was utilised. A total of 990 minutes or 16.5 hours was allocated to the systematic census of avifauna during the survey (Table 2.8).

Table 2.8: Avifauna Census Effort

Site	Number of Censuses Conducted	Total Census Minutes
MPS-01	5	150
MPS-02	4	120
MPS-03	4	120
MPS-04	4	120
MPS-05	4	120
MPS-06	4	120
MPS-07	4	120
MPS-08	4	120
Total Effort		990

2.5.4. Motion Cameras

Motion sensitive cameras capable of recording in both day and night (infra-red) were deployed primarily to target the Endangered Northern Quoll (*Dasyurus hallucatus*), and to record further species not readily recorded by other methods (e.g. Long-tailed Dunnart, and other small mammals). Five cameras were deployed at five independent sites within the Survey Area and left in place for 4-5 nights (Table 2.9 and Map 2.2). Cameras were baited with non-food reward bait consisting of cotton rope soaked in fish oil.

Table 2.9: Motion Camera Sites

Site	Unit Number	Easting (mE)	Northing (mN)	Habitat	Deployment Date	Collection Date	Effort (Nights)
MPC-01	MC113	722197	7492129	Gorge/Gully	21/10/2024	26/10/2024	5
	MC155	722129	7492047	Gorge/Gully	21/10/2024	26/10/2024	5
	MC148	722083	7491926	Gorge/Gully	21/10/2024	26/10/2024	5
	MC138	722083	7491889	Gorge/Gully	21/10/2024	26/10/2024	5
	MC92	722065	7491869	Gorge/Gully	21/10/2024	26/10/2024	5
MPC-02	MC104	728855	7491875	Gorge/Gully	22/10/2024	26/10/2024	4
	MC04	728828	7491798	Hillcrest/Hillslope	22/10/2024	26/10/2024	4
	MC90	728988	7491748	Hillcrest/Hillslope	22/10/2024	26/10/2024	4
	MC05	729012	7491624	Hillcrest/Hillslope	22/10/2024	26/10/2024	4
	MC134	729003	7491552	Hillcrest/Hillslope	22/10/2024	26/10/2024	4
MPC-03	MC146	717163	7471507	Gorge/Gully	21/10/2024	25/10/2024	4
	MC103	717190	7471504	Gorge/Gully	21/10/2024	25/10/2024	4
	MC156	717226	7471524	Gorge/Gully	21/10/2024	25/10/2024	4
	MC152	717237	7471526	Gorge/Gully	21/10/2024	25/10/2024	4
	MC147	717266	7471536	Gorge/Gully	21/10/2024	25/10/2024	4
MPC-04	MC153	716641	7471670	Gorge/Gully	21/10/2024	25/10/2024	4
	MC132	716636	7471701	Gorge/Gully	21/10/2024	25/10/2024	4
	MC131	716638	7471722	Gorge/Gully	21/10/2024	25/10/2024	4
	MC91	716626	7471743	Gorge/Gully	21/10/2024	25/10/2024	4
	MC93	716590	7471759	Gorge/Gully	21/10/2024	25/10/2024	4
	MC89	716614	7466119	Gorge/Gully	21/10/2024	25/10/2024	4
MPC-05	MC143	712770	7466119	Gorge/Gully	22/10/2024	26/10/2024	4
	MC105	712814	7466101	Gorge/Gully	22/10/2024	26/10/2024	4
	MC150	712830	7466086	Gorge/Gully	22/10/2024	26/10/2024	4

Site	Unit Number	Easting (mE)	Northing (mN)	Habitat	Deployment Date	Collection Date	Effort (Nights)
	MC133	712857	7466069	Gorge/Gully	22/10/2024	26/10/2024	4
	MC149	712891	7466054	Gorge/Gully	22/10/2024	26/10/2024	4
Datum: GDA94/MGA zone 50						Total Effort	109

2.5.5. Bat Recorders

Wildlife Acoustics Song Meter SM4BAT full spectrum ultrasonic recorders (SM4BAT) were deployed to evaluate the bat assemblage within the Survey Area and determine the occurrence of the Vulnerable Pilbara Leaf-nosed Bat (*Rhinonictis aurantia*, Pilbara form) and the Vulnerable Ghost Bat (*Macroderma gigas*). These recorders are specifically designed to detect and record ultrasonic echolocation calls emitted by bats during flight. Selected filters, triggers and audio settings followed the manufacturer's recommendations for bat detection of call frequencies up to 130 kHz (Wildlife Acoustics, 2021).

The recording period was set at night, from 30 minutes pre-sunset to 30 minutes post-sunrise. Recorders were placed in locations where bat species are likely to forage. Sampling activities were conducted at eight sites within the Survey Area, with a total sampling effort of 33 recording nights (Table 2.10).

Table 2.10: Bat Call Recorder Effort

Site	Easting (mE)	Northing (mN)	Habitat	Deployment Date	Collection Date	Recording Effort (Nights)
MPB-01	729824	7492501	Gorge/Gully	20/10/2024	24/10/2024	4
MPB-02	726741	7493601	Breakaway/Cliff	21/10/2024	25/10/2024	4
MPB-03	712773	7466104	Gorge/Gully	22/10/2024	26/10/2024	4
MPB-04	728831	7491795	Gorge/Gully	22/10/2024	26/10/2024	4
MPB-05	720762	7492119	Gorge/Gully	24/10/2024	27/10/2024	3
MPB-06	720800	7478435	Major Drainage Line	22/10/2024	27/10/2024	5
MPB-07	715730	7469923	Minor Drainage Line	22/10/2024	27/10/2024	5
MPB-08	717060	7471436	Gorge/Gully	21/10/2024	25/10/2024	4
Datum: GDA94/MGA zone 50					Total Effort	33

2.5.6. Night Parrot Call Recordings

Wildlife Acoustics Songmeter Mini (SMmini) acoustic recorders were used to evaluate the presence of Night Parrots (*Pezoporus occidentalis*) within the Survey Area between sunset to sunrise (DBCA, 2024). Large *Tridodia* hummocks (potential nesting and roosting habitat) were absent from the Survey Area. Sampling was conducted at four sites within the Survey Area, with a total sampling effort of 24 recording nights (Table 2.11 and Map 2.2). Detailed methodology for this analysis can be found in Appendix D.

Table 2.11: Night Parrot Recording Effort

Site	Easting (mE)	Northing (mN)	Habitat	Deployment Date	Collection Date	Recording Effort (Nights)
MPN-01	720888	7492504	Hillcrest/Hillslope	20/10/2024	27/10/2024	7
MPN-02	718139	7487953	Hillcrest/Hillslope	20/10/2024	27/10/2024	7
MPN-03	714716	7468451	Hillcrest/Hillslope	23/10/2024	27/10/2024	4
MPN-04	718978	7473975	Hillcrest/Hillslope	23/10/2024	27/10/2024	4
Datum: GDA94/MGA zone 50					Total Effort	22

2.5.7. Pilbara Olive Python eDNA Sampling

Water samples were collected to be analysed for the presence of Pilbara Olive Python environmental DNA (eDNA). A total of four eDNA samples were collected from a single waterbody by passing water through a 1.2 µm filter membrane (Table 2.12). The sample contained in the filter membrane was then preserved with DNA Shield.

Table 2.12: Pilbara Olive Python eDNA Sampling Effort

Site	Easting (mE)	Northing (mN)	Habitat	Collection Date	Number of Samples
MPE-01 S1	720685	7478464	Major Drainage Line	24/10/2024	1
MPE-01 S2	720685	7478464	Major Drainage Line	25/10/2024	1
MPE-01 S3	720685	7478464	Major Drainage Line	26/10/2024	1
MPE-01 S4	720685	7478464	Major Drainage Line	27/10/2024	1

2.5.8. Opportunistic Methods & Foot Traverses

The survey also incorporated opportunistic techniques and targeted foot traverses, for species such as the Western Pebble-mound Mouse (*Pseudomys chapmani*, Priority 4). Methods included:

- Incidental species observations.
- Identification of secondary signs of fauna, such as tracks, scats, skins, mounds, hollows, nests, and diggings.
- Identification of animal remains.

Activity level of Western Pebble-mound Mouse mounds was assessed following Anstee (1996).

2.5.9. Data Analysis

2.5.9.1. Sampling Adequacy

Survey adequacy can be assessed by estimating species richness from sample data by extrapolating Species Accumulation Curves (SAC) and using non-parametric estimators (Bunge and Fitzpatrick, 1993; Colwell and Coddington, 1994; Gaston, 1996; EPA, 2020). SACs plot the number of species recorded as a function of trapping effort. When a survey has sampled a high proportion of the detectable fauna assemblage (using specified methodologies), few new species are added with additional sampling, and the curve will plateau as it approaches an asymptote.

For this study, the 'specaccum' function of the vegan package (Oksanen *et al.*, 2024) was used to generate SACs based on 100 randomised permutations of species and abundance data recorded over the survey duration. Prior to generating the SACs, data were separated into fauna classes (Aves, Mammalia and Reptilia) and any introduced species records were removed. Although a combination of sampling methods is

required to comprehensively sample fauna (EPA, 2020), biases in specific sampling methods may influence SACs and richness estimates (Gwinn *et al.*, 2016). As a result, only data from systematic survey sites were used in the analysis.

Species richness estimates were then generated for using the 'specpool' function of the vegan package (Oksanen *et al.*, 2024). The Chao1 non-parametric estimator was interpreted as an adequate estimate of the SACs asymptote (Chao, 1984).

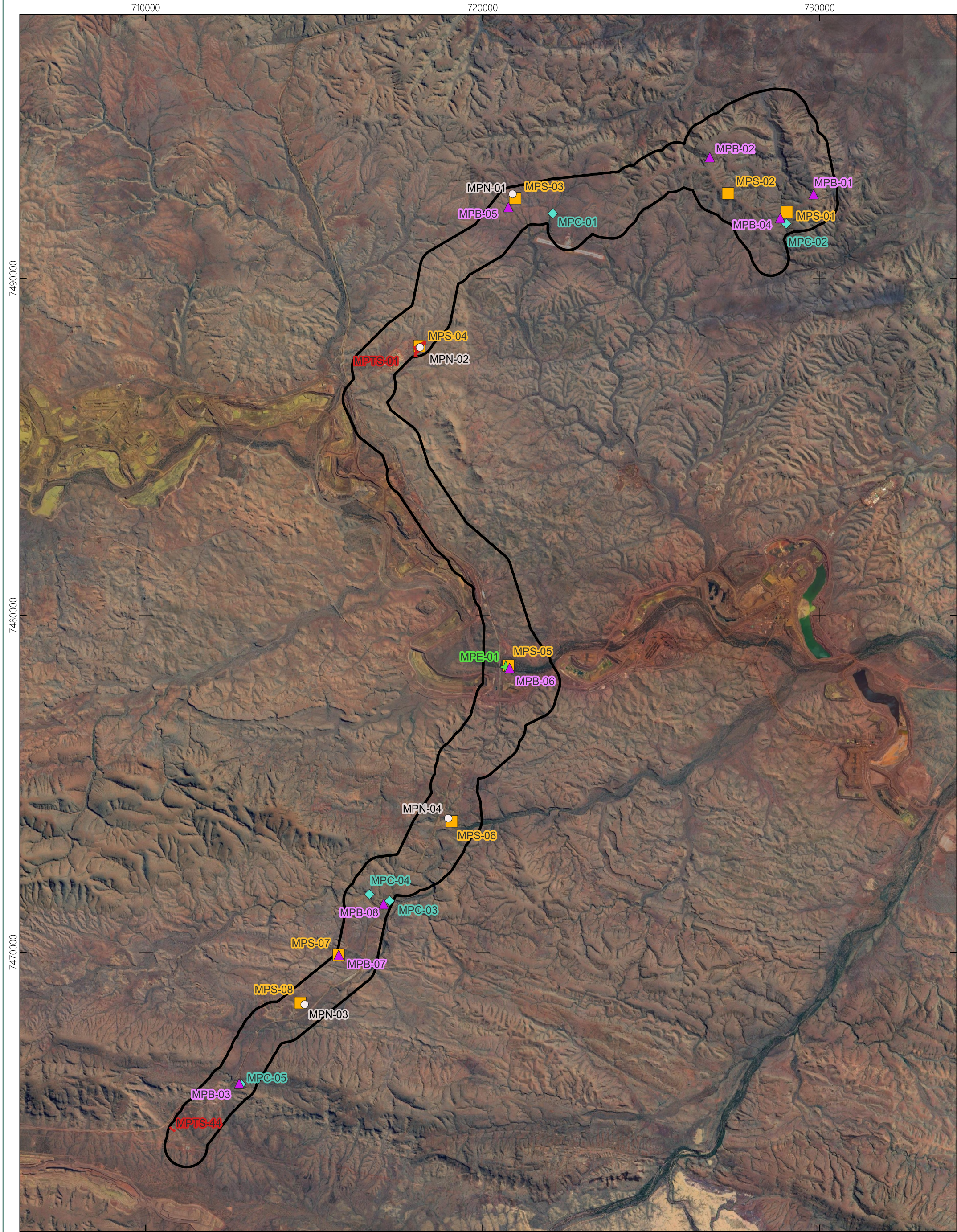
It should be noted that each survey provides a static record of a dynamic assemblage, which is influenced by ecological and stochastic variables. For example, daily weather or preceding precipitation can affect fauna activity and capture rates. Furthermore, a low species richness is typically recorded in survey areas with low habitat diversity.

2.5.9.2. Bat Call Analysis

Full spectrum call data were processed and analysed with Wildlife Acoustics Kaleidoscope Pro software version 5.7.0, using statistical pattern analysis to isolate and cluster similar vocalisations. Resultant clusters were categorised via Spectrum's call library, in conjunction with available reference material (Churchill, 2009; McKenzie and Bullen, 2009). Sonograms identified as Pilbara Leaf-nosed Bat or Ghost Bat were vetted manually to exclude any false positive identifications (Type I error). Additionally, calls assigned to clusters with similar or overlapping call characteristics to Ghost Bats were vetted manually.

2.5.9.3. Night Parrot Call Analysis

Acoustic recordings were analysed by Adaptive NRM using Wildlife Acoustics Kaleidoscope Pro software version 5.2.1. Analysis targeted frequencies of between 1,500 – 3,500 Hz for which all known calls of the Night Parrot occur (Leseberg *et al.*, 2019). Potential Night Parrot calls were compared to a reference library comprising several thousand Night Parrot calls from Western Australia and Queensland. More detail and the results of this analysis can be found in Appendix D.



Legend
 Survey Area

Sampling Effort

- Systematic Sites
- Motion Camera Sites
- Bat Recorder Sites
- Night Parrot Sites
- Pilbara Olive Python eDNA Site
- Targeted Search Tracks

0 1 2 3 4 km
Scale 1:100,000 @ A3

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

Author: JW Date: 21-11-2025

Sampling Effort

Marillana Power 2030 Fauna

Prepared for BHP WAIO

2.6. Limitations & Constraints

The field survey results offer a satisfactory representation of the fauna values within the Survey Area. However, certain limitations should be considered when interpreting and applying the findings presented in this report. Potential limitations adapted from the terrestrial vertebrate fauna survey technical guidance are presented in Table 2.13 (EPA, 2020).

Table 2.13: Survey Limitations

Potential Limitation	Limitation Applicable	Comment
Availability of the contextual information at a regional and local scale.	No	Database searches provided detailed information, adequate to guide field survey design and effort for the fauna survey. There were multiple surveys conducted within the Desktop Study Area and these have been included in the desktop study.
Competency/experience of the consultant carrying out the survey including experience in bioregion surveyed.	No	The team has appropriate experience conducting surveys in Pilbara bioregion (see Section 2.3).
Timing/weather/season/cycle.	No	Survey timing was in accordance with EPA guidance. The weather during the survey was optimal.
Disturbances (e.g., fire, flood, accidental human intervention) which affected results of survey.	Yes	A significant portion of the Survey Area had been burnt nine months prior to the field survey (Section 1.11). While this fire did not impact on the collection of data it may have impacted on the faunal assemblage present at the time of the survey.
Remoteness and/or access problems.	No	There were no access restrictions at the Survey Area.
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	No	All fauna groups were sampled, and no survey constraints were experienced.
Proportion of fauna identified, recorded, and/or collected.	No	All vertebrate fauna species encountered were identified in the field by experienced personnel.
The proportion of the task achieved and further work which might be needed.	No	A single phase of the detailed fauna survey was completed. A second phase is recommended to ensure adequate sampling effort.
Adequacy of the survey intensity and proportion of survey achieved, e.g. the extent to which the area was surveyed.	No	Seven of the systematic trapping sites comprised 10 pitfall traps and 20 funnel traps at each site. The eighth systematic trapping site was comprised of funnel traps only due to pitfall traps not being installed in the rock substrate. However, this was deemed a necessary compromise to allow sampling within the Gorge/ Gully habitat. Total systematic survey effort was deemed appropriate for a single phase. Trapping sites were replicated in each identified fauna habitat. Targeted searches for significant fauna species were completed within areas of suitable habitat.
Completeness (was the relevant area fully surveyed).	No	A single-phase detailed fauna survey was undertaken with adequate sampling undertaken across the extent of the Survey Area.
Problems with data and analysis, including sampling biases.	No	All appropriate sampling methods were undertaken and no problems with data analysis were encountered.

3. RESULTS & DISCUSSION

3.1. Desktop Study

The desktop study identified a total of 360 vertebrate fauna species, comprising 51 mammal species (including nine introduced), 180 bird species, 120 reptile species, and nine amphibian species that have previously been recorded or deemed to potentially occur in the Survey Area. The complete desktop study species list is presented in Appendix B. Some species listed in Appendix B were excluded from the total count due to a variety of reasons (e.g. erroneous records, taxonomic updates). Species that were excluded were marked with a note for exclusion.

The total of 360 vertebrate fauna species recorded from the region is significantly higher than the results of any single vertebrate fauna survey completed in the area, including this survey. This is to be expected, as the desktop draws data from a wide range of sources that were collected over different time periods and seasons. The desktop study also includes occurrence data from fauna habitat types that are not present within the Survey Area, such as permanent water sources, cracking clays, and alluvial plains. A suitable example of this is the large number of shorebird and other water bird species reported only by Dandjoo (Appendix B). Dandjoo also has the potential to record vagrant species and those only present in the region during and/or following significant rainfall events and the resource boom that follows. These records may also include museum collection trips, public specimen collections/ observations, DBCA surveys, and the DBCA Fauna Survey Returns Database, which includes data from private sources.

The data reported by the database searches as well as previous survey reports provide a useful indication of regional vertebrate fauna assemblages. Whilst many species recorded during the desktop study have the potential to occur in the Survey Area, the fauna assemblage that typically uses the habitats found within the Survey Area forms a much smaller subset of species. Variations in population distributions and the availability of microhabitats within each area also limit the species that may occur. However, the accumulated data provided by the desktop study is invaluable during survey planning to ensure all major fauna assemblages are sampled, and any significant species that may occur are targeted appropriately.

3.1.1. Significant Fauna

The desktop study identified 42 significant species as potentially occurring in the Study Area. Of these, 13 species are not discussed further in this report as they are considered vagrant, erroneous records, or the Survey Area lies beyond the species documented distribution. These species are:

- Letter-winged Kite (*Elanus scriptus*, DBCA Priority 4) - vagrant or erroneous record.
- Bridled Tern (*Onychoprion anaethetus*, EPBC Act & BC Act Migratory) - vagrant or erroneous record.
- Curlew Sandpiper (*Calidris ferruginea*, EPBC Act & BC Act Critically Endangered/Migratory) – Survey Area beyond species documented distribution.
- Southern Giant Petrel (*Macronectes giganteus*, EPBC Act Endangered/Migratory & BC Act Migratory) - vagrant or erroneous record.
- Red Goshawk (*Erythrotriorchis radiatus*, EPBC Act Endangered & BC Act Vulnerable) - Survey Area beyond species documented distribution.
- Princess Parrot (*Polytelis alexandrae*, EPBC Act Vulnerable & DBCA Priority 4) - Survey Area beyond species documented distribution.
- Eastern Yellow Wagtail (*Motacilla tschutschensis*, EPBC Act & BC Act Migratory) - Survey Area beyond species documented distribution.

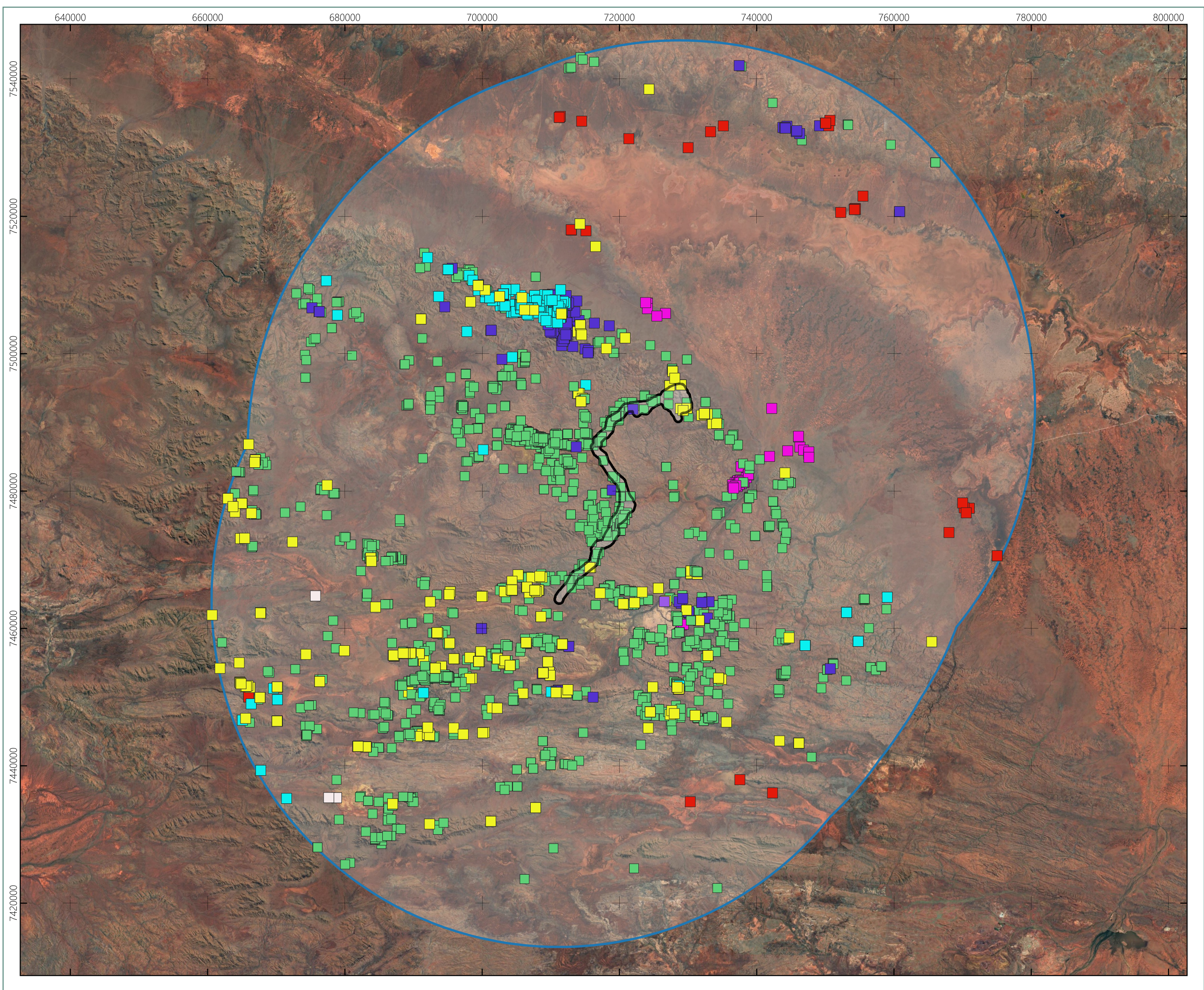
- Grey Wagtail (*Motacilla cinerea*, EPBC Act & BC Act Migratory) - Survey Area beyond species documented distribution.
- Barn Swallow (*Hirundo rustica*, EPBC Act & BC Act Migratory) - Survey Area beyond species documented distribution.
- Black-footed Rock-wallaby (*Petrogale lateralis lateralis*, EPBC Act & BC Act Endangered) – potentially erroneous record.
- Lesser Stick-nest Rat (*Leporillus apicalis*, BC Act Extinct) – species considered extinct.
- *Lerista macropisthopus remota* (DBCA Priority 2) - potentially erroneous record.
- Great Desert Skink (*Liopholis kintorei*, EPBC Act & BC Act Vulnerable) - Survey Area beyond species documented distribution.

Excluding the 13 species mentioned above, 29 significant species remain (Table 3.1). Of these, 11 are classified as threatened, comprising four mammals, six birds, and one reptile. Additionally, 14 species of bird are listed as Migratory under the EPBC Act and/or BC Act, one bird is listed as species otherwise in need of special protection under the BC Act and six species (four mammals and two reptiles) are listed as Priority by DBCA. Locations of significant fauna are depicted in Map 3.1 and Map 3.2. A total of five significant fauna species have previously been recorded within the Survey Area (Table 3.1).

Table 3.1: Significant Vertebrate Species Returned from the Desktop Study

Species Name	Common Name	Significant Species			Previously Recorded in Survey Area
		EPBC Act	BC Act	DBCA	
Mammals					
<i>Dasyurus hallucatus</i>	Northern Quoll	Endangered	Endangered	-	Yes
<i>Macrotis lagotis</i>	Bilby, Dalgyte	Vulnerable	Vulnerable	-	No
<i>Rhinonictis aurantia</i> Pilbara form	Pilbara Leaf-nosed Bat	Vulnerable	Vulnerable	-	No
<i>Macroderma gigas</i>	Ghost Bat	Vulnerable	Vulnerable	-	Yes
<i>Dasycercus blythi</i>	Brush-tailed Mulgara, Ampurta	-	-	Priority 4	No
<i>Lagorchestes conspicillatus leichardti</i>	Spectacled Hare-wallaby	-	-	Priority 4	No
<i>Leggadina lakedownensis</i>	Short-tailed Mouse	-	-	Priority 4	No
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	-	-	Priority 4	Yes
Birds					
<i>Pezoporus occidentalis</i>	Night Parrot	Critically Endangered	Critically Endangered	-	No
<i>Rostratula australis</i>	Australian Painted-snipe	Endangered	Endangered	-	No
<i>Tringa nebularia</i>	Common Greenshank	Endangered & Migratory	Migratory	-	No
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Vulnerable & Migratory	Migratory	-	No
<i>Falco hypoleucos</i>	Grey Falcon	Vulnerable	Vulnerable	-	No

Species Name	Common Name	Significant Species			Previously Recorded in Survey Area
		EPBC Act	BC Act	DBCA	
<i>Aphelocephala leucopsis</i>	Southern Whiteface	Vulnerable	Vulnerable	-	No
<i>Apus pacificus</i>	Pacific Swift	Migratory	Migratory	-	No
<i>Anarhynchus veredus</i>	Oriental Plover	Migratory	Migratory	-	No
<i>Calidris ruficollis</i>	Red-necked Stint	Migratory	Migratory	-	No
<i>Calidris melanotos</i>	Pectoral Sandpiper	Migratory	Migratory	-	No
<i>Actitis hypoleucos</i>	Common Sandpiper	Migratory	Migratory	-	No
<i>Tringa glareola</i>	Wood Sandpiper	Migratory	Migratory	-	No
<i>Glareola maldivarum</i>	Oriental Pratincole	Migratory	Migratory	-	No
<i>Gelochelidon nilotica</i>	Gull-billed Tern	Migratory	Migratory	-	No
<i>Hydroprogne caspia</i>	Caspian Tern	Migratory	Migratory	-	No
<i>Plegadis falcinellus</i>	Glossy Ibis	Migratory	Migratory	-	No
<i>Pandion haliaetus</i>	Osprey	Migratory	Migratory	-	No
<i>Falco peregrinus</i>	Peregrine Falcon	-	Other Specially Protected Species	-	No
Reptiles					
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	Vulnerable	Vulnerable	-	Yes
<i>Anilius ganei</i>	Gane's Blind Snake	-	-	Priority 1	Yes
<i>Underwoodisaurus seorsus</i>	Pilbara Barking Gecko	-	-	Priority 2	No



Legend

Survey Area

Study Area

**Significant Mammal Species
(DBCA Database Only)**

Northern Quoll (*Dasyurus hallucatus*)

Bilby (*Macrotis lagotis*)

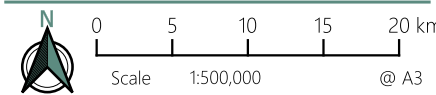
Pilbara Leaf-nosed Bat (*Rhinonictis aurantia*,
Pilbara form)

Ghost Bat (*Macroderma gigas*)

Brush-tailed Mulgara (*Dasycercus blythi*)

Northern Short-tailed Mouse
(*Leggadina lakedownensis*)

Western Pebble-mound Mouse
(*Pseudomys chapmani*)



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



Author: JW Date: 01-12-2025

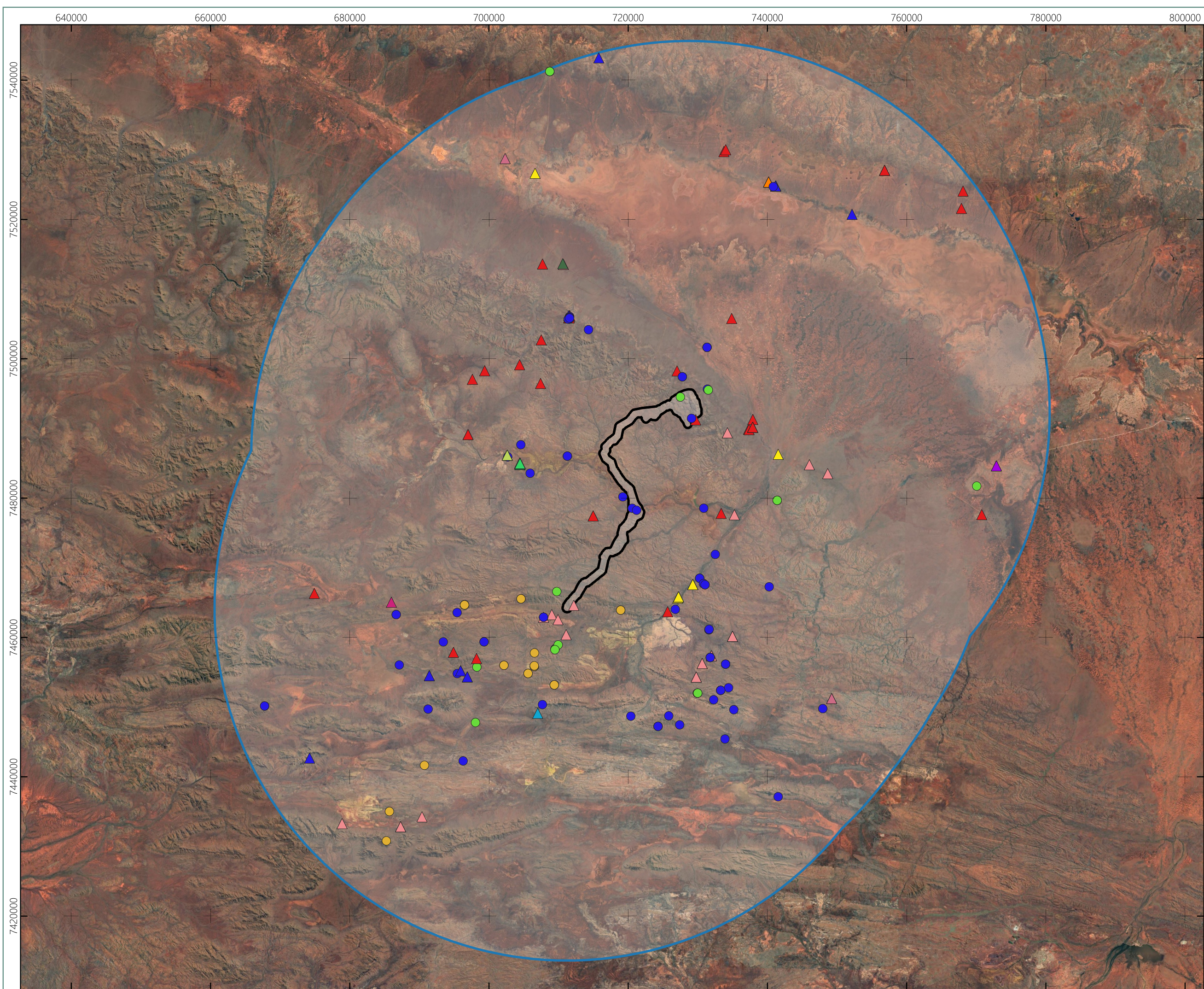
Significant Fauna
Identified in the Study
Area - Mammals

Marillana Power 2030 Fauna

MAP

Prepared for
BHP WAIO

3.1



Legend

Survey Area

Study Area

Significant Avifauna & Herpetofauna Species (DBCA Database Only)

Avifauna

- Australian Painted-snipe (*Rostratula australis*)
- Common Greenshank (*Tringa nebularia*)
- Grey Falcon (*Falco hypoleucos*)
- Fork-tailed Swift (*Apus pacificus*)
- Oriental Plover (*Anarhynchus veredus*)
- Common Sandpiper (*Actitis hypoleucos*)
- Wood Sandpiper (*Tringa glareola*)
- Gull-billed Tern (*Gelochelidon nilotica*)
- Caspian Tern (*Hydroprogne caspia*)
- Glossy Ibis (*Plegadis falcinellus*)
- Osprey (*Pandion haliaetus*)
- Peregrine Falcon (*Falco peregrinus*)

Herpetofauna

- Pilbara Olive Python (*Liasis olivaceus barroni*)
- Pilbara Barking Gecko (*Underwoodisaurus seorsus*)
- Gane's Blind Snake (*Anilius ganei*)

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

Author: JW Date: 01-12-2025

Significant Fauna Identified in the Study Area - Avifauna & Herpetofauna

Marillana Power 2030 Fauna

MAP

Prepared for
BHP WAIO

3.2

3.2. Fauna Habitat Types

Five broad fauna habitats were characterised within the Survey Area (Table 3.2 and Map 3.3). The most common fauna habitat in the Survey Area is Hillcrest/Hillslope (73.5% of the Survey Area). Cleared/Disturbed areas accounted for 12.2% of the Survey Area. Descriptions and representative photographs are presented in Sections 3.2.1 – 3.2.6. Cleared/Disturbed areas do not provide fauna values and are not described in detail.

Table 3.2: Broad Fauna Habitats of the Survey Area

Fauna Habitat	Extent in Survey Area (ha)	Percentage of Survey Area (%)	Land Systems
Hillcrest/Hillslope	5,389.6	73.5	Newman, McKay, Platform, Robe, and Rocklea
Gorge/Gully	425.3	5.8	Newman, Platform, and Robe
Minor Drainage Line	289.1	3.9	Newman, McKay, Platform, Robe, Boolgeeda, and Rocklea
Breakaway/Cliff	235.9	3.2	Newman
Major Drainage Line	99.3	1.4	Robe and River
Cleared/Disturbed	890.9	12.2	Newman, McKay, Platform, Robe, Boolgeeda, Rocklea, and River
Total	7,330		

3.2.1. Hillcrest/Hillslope

The Hillcrest/Hillslope habitat covered 5,389.6 ha (73.5%) of the Survey Area (Map 3.3, Table 3.2). The slopes and hills varied in degree based on elevation, from large, banded ironstone hill slopes and breakaways to rolling hills on plain. The vegetation associated with mid hill crests and slopes included *Eucalyptus leucophloia*, *Corymbia hamersleyana* low open woodland, over *Hakea chordophylla*, *Grevillea wickhamii* mid sparse shrubland, over *Acacia hilliana*, *Acacia adoxa* low sparse shrubland over *Triodia vanleeuwenii* or *Triodia wiseana* low open hummock grassland on soils of red to brown sandy or silty loam with continuous ironstone gravel. Wood and leaf litter was limited to small, shallow, pockets beneath areas of denser vegetation. The continuous layer of pebbles and/or rock slabs is typical for this habitat type (Plate 3.1). Fauna microhabitats that occur within this habitat type include cracks and crevices, small overhangs and underneath exposed rocks, and *Triodia* hummocks.

Typically, amphibians are mostly absent from this habitat type or are lacking diversity due to the lack of soft substrate and moisture (for burrowing species) and cool, moist refugia to shelter in during dry periods.

The avifauna of this habitat type is typically comprised of generalist species that can also be found in a variety of other habitats. Zebra Finch (*Taeniopygia castanotis*), Spinifex Pigeon (*Geophaps plumifera*), and Crested Pigeon (*Ocyphaps lophotes*) can be found foraging for seeds amongst the *Triodia*. Other species include Wedge-tailed Eagle (*Aquila audax*), Whistling Kite (*Haliastur sphenurus*), Black-faced Woodswallow (*Artamus cyanopterus*), and Grey Shrike-thrush (*Colluricincla harmonica*).

Some examples of mammals found in the Hillcrest/Hillslope habitat are the Euro (*Osphranter robustus*), Rothschild's Rock Wallaby (*Petrogale rothschildi*), and Pilbara Ningau (Ningau *timealeyi*). These and other similar species will all utilise the cracks, crevices, and caves typically found in this habitat for shelter.

An assortment of rock inhabiting reptile species such as the Ring-tailed Dragon (*Ctenophorus caudicinctus*), Rock Ctenotus (*Ctenotus saxatilis*), and Spiny-tailed Goanna (*Varanus acanthurus*) can be found in the Hillcrest/Hillslope habitat.

Significant fauna species potentially occurring in this habitat type include the Northern Quoll (*Dasyurus hallucatus*), Western Pebble-mound Mouse (*Pseudomys chapmani*), Ghost Bat (*Macroderma gigas*), Pilbara Leaf-nosed Bat (*Rhinioncteris aurantia*, Pilbara form), Peregrine Falcon (*Falco peregrinus*), and Grey Falcon (*Falco hypoleucos*). More information is provided in Table 3.5.



Plate 3.1: Hillcrest/Hillslope Habitat

3.2.2. Gorge/Gully

The Gorge/Gully habitat covered 425.3 ha (5.8%) of the Survey Area (Map 3.3, Table 3.2). It was mostly recorded in the north of the Survey Area. The habitat was characterised by medium to minor drainage gullies of banded ironstone with brown silty clay loam to sandy loam. The vegetation is comprised of low open woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia*, over a tall sparse shrubland of *Acacia tumida*, *Petalostylis labicheoides*, and *Acacia monticola*, over a low sparse tussock grassland with *Themeda triandra*, *Eriachne mucronata*, and *Triodia pungens* mid sparse hummock grassland. This habitat is defined by a dominant understorey of *Eriachne mucronata* and *Triodia pungens*, with either a presence or absence of *Themeda triandra* or **Cenchrus ciliaris* (Plate 3.2).

Fauna microhabitats that occur within this habitat type include caves, cracks and crevices, large ironstone boulders, overhangs, pools of surface water, and leaf litter beds. Documented Ghost Bat and Pilbara Leaf-nosed Bat roosts are found within the Survey Area in this habitat type including one Category 2 and one Category 3 Ghost Bat roost.

The avifauna of this habitat type is typically comprised of species such as Western Bowerbird (*Chlamydera guttata*), Grey Shrike-thrush (*Colluricincla harmonica*), and Australian Owlet Nightjar (*Aegotheles cristatus*).

Some examples of mammals found in the Gorge/Gully habitat include the Common Rock Rat (*Zyzomys argurus*), Rothschild's Rock Wallaby (*Petrogale rothschildi*), and Gould's Wattled Bat (*Chalinolobus gouldii*).

An assortment of specialised herpetofauna species such as the Western Marbled Velvet Gecko (*Oedura fimbria*), Pygmy Python (*Antaresia perthensis*), Goldfields Crevice Skink (*Egernia formosa*), Russet Snake-eyed Skink (*Cryptoblepharus ustulatus*), Pilbara Rock Monitor (*Varanus pilbarensis*), and Pilbara Toadlet (*Uperoleia saxatilis*) inhabit Gorge/Gully habitat.

Significant fauna species potentially occurring in this habitat type include Northern Quoll (*Dasycercus hallucatus*), Long-tailed Dunnart (*Sminthopsis longicaudata*), Ghost Bat (*Macroderma gigas*), Pilbara Leaf-nosed Bat (*Rhinioncteris aurantia*, Pilbara form), Pilbara Olive Python (*Liasis olivaceus barroni*), Gane's Blind Snake (*Anilius ganei*), and Pilbara Barking Gecko (*Underwoodisaurus seorsus*). More information is provided in Table 3.5.



Plate 3.2: Gorge/Gully Habitat

3.2.3. Minor Drainage Line

The Minor Drainage Line habitat covered 289.1 ha (3.9%) of the Survey Area (Map 3.3, Table 3.2). The habitat was characterised by floodplain or minor drainage channels with open low woodland of *Eucalyptus xerothermica* or *Corymbia hamersleyana* in drainage lines which are lined with mid-dense shrubland of *Acacia* species (*A. ancistrocarpa* and *A. bivenosa*), occurring over a mid-sparse tussock grassland of

Themeda triandra over low open hummock grassland of *Triodia pungens* and *T. vanleeuwenii* on red or brown silty clay loam to sandy loam (Plate 3.3). Wood litter was sparse, and leaf litter accumulated underneath thickets of shrubs where the soil was typically softer. Minor Drainage Line habitat was recorded throughout the Survey Area (Map 3.3).

Fauna microhabitats that occurred within this habitat type include trees (flowers, leaf litter, bark, tree hollows), woody debris, leaf litter in shrub thickets, and pools of shallow surface water which increase soil moisture levels.

The avifauna of this habitat type is typically comprised of tree dwelling or nectar feeding species such as Willie Wagtail (*Rhipidura leucophrys*), Weebill (*Smicrornis brevirostris*), Diamond Dove (*Geopelia cuneata*), Grey-headed Honeyeater (*Ptilotula keartlandi*), Singing Honeyeater (*Gavicalis virescens*), and Rufous Whistler (*Pachycephala rufiventris*).

Some examples of mammals found in the Minor Drainage Line habitat are the Desert Mouse (*Pseudomys desertor*) and Pilbara Ningau (*Ningau timealeyi*).

An assortment of skinks such as the Leopard Skink (*Ctenotus pantherinus*), Eastern Pilbara Lined Ctenotus (*Ctenotus duricola*), Northern Shovel-nosed Snake (*Brachyuophis approximans*), *Lerista bipes*, and *Lerista muelleri* occur in this habitat. Numerous commonly occurring geckos can be found such as Variegated Gehyra (*Gehyra variegata*), Bynoe's Gecko (*Heteronotia binoei*), Pilbara Ground Gecko (*Lucasium woodwardi*), *Lucasium wombeyi*, *Strophurus wellingtonae*, and Pilbara Clawless Gecko (*Crenadactylus pilbarensis*).

Significant fauna species potentially occurring in this habitat type include the Bilby (*Macrotis lagotis*), Ghost Bat (*Macroderma gigas*), Pilbara Leaf-nosed Bat (*Rhinonictis aurantia* Pilbara form), Grey Falcon (*Falco hypoleucos*), Peregrine Falcon (*Falco peregrinus*), and Pilbara Olive Python (*Liasis olivaceus barroni*). More information is provided in Table 3.5.



Plate 3.3: Minor Drainage Line Habitat

3.2.4. Breakaway/Cliff

The Breakaway/Cliff habitat covered 235.9 ha (3.2%) of the Survey Area (Map 3.3, Table 3.2). The habitat was characterised by red loam soils on mid to upper banded ironstone hill slopes and breakaways.

The vegetation associated with mid to upper banded ironstone hill slopes and breakaways consisted of *Eucalyptus leucophloia* low open woodland, over *Grevillea wickhamii*, *Acacia pruinocarpa*, *Senna glutinosa* open shrubland, over *Triodia vanleeuwenii*, *T. pungens*, or *T. wiseana* hummock grassland on red loam soil.

This habitat type mostly lacked wood litter and leaf litter and was dominated by exposed rock faces, in particular the vertically orientated cliffs (Plate 3.4).

Fauna microhabitats that occur within this habitat type includes caves, cracks and crevices, small overhangs underneath exposed rocks, and *Triodia* hummocks. Within the Survey Area, several Ghost Bat and Pilbara Leaf-nosed Bat roosts are present in this habitat type.

The typical avifauna of this habitat type includes Little Woodswallow (*Artamus minor*), Grey Shrike-thrush (*Colluricincla harmonica*), and Pied Butcherbird (*Cracticus nigrogularis*) with birds of prey circling above such as Whistling Kite (*Haliastur sphenurus*), Kestrel (*Falco cenchroides*), and Black Kite (*Milvus migrans*).

Examples of mammals that may occur in the Breakaway/Cliff habitat are Euro (*Osphranter robustus*), Rothschild's Rock Wallaby (*Petrogale rothschildi*), and Common Rock rat (*Zyzomys argurus*). Volant species (bats) can include Gould's Wattled Bat (*Chalinolobus gouldii*), Northern Free-tailed Bat (*Ozimops lumsdenae*),

Common Sheath-tailed Bat (*Taphozous georgianus*), and Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*).

Specialised reptile species such as the Western Ring-tailed Dragon (*Ctenophorus caudicinctus*), Spiny-tailed Goanna (*Varanus acanthurus*), Western Marbled Velvet Gecko (*Oedura fimbria*), Pygmy Python (*Antaresia perthensis*), Pilbara Rock Monitor (*Varanus pilbarensis*), and Goldfields Crevice Skink (*Egernia formosa*) inhabit the Breakaway/Cliff habitat. Amphibians are typically absent due to the exposed nature of the Breakaway/Cliff.

Significant fauna species potentially occurring along breakaways include the Long-tailed Dunnart (*Sminthopsis longicaudata*), Western Pebble-mound Mouse (*Pseudomys chapmani*), and Northern Quoll (*Dasyurus hallucatus*). Along the cliffs there is potential for Ghost Bat (*Macroderma gigas*), Pilbara Leaf-nosed Bat (*Rhinonictis aurantia*, Pilbara form), Pilbara Olive Python (*Liasis olivaceus barroni*), Grey Falcon (*Falco hypoleucos*), and Peregrine Falcon (*Falco peregrinus*) to occur, the latter may use the cliff faces for nesting and roosting. More information is provided in Table 3.5.



Plate 3.4: Breakaway/Cliff Habitat

3.2.5. Major Drainage Line

The Major Drainage Line habitat covered 99.3 ha (1.4%) of the Survey Area (Map 3.3, Table 3.2). The habitat was characterised by major drainage lines and gorges with red or brown sand and mixed creek stones. The vegetation of this habitat comprised of open woodland of *Eucalyptus camaldulensis*, *Eucalyptus victrix*, and *Acacia coriacea* over *Acacia tumida*, *Melaleuca glomerata*, *Gossypium robinsonii* high open to dense shrubland over open tussock grassland of *Eulalia aurea*, *Themeda triandra* with *Cyperus vaginatus* open sedges on red or brown sand and gravel and creek stones (Plate 3.5). Wood can accumulate in smaller piles, with leaf litter typically limited to wood litter debris.

This habitat provided fauna microhabitats such as flowers, tree hollows, bark, leaf litter in larger trees, sandy substrate for foraging and construction of burrows, woody debris with leaf litter accumulation, pools of surface water and increased moisture levels for species such as amphibians (in particular during wet season), and sandbanks for construction of burrows and tunnels.

Amphibians are likely to occur in this habitat type when water is available (in the wet season). Soft substrate for burrowing species, and cool, moist refugia may occur all year round.

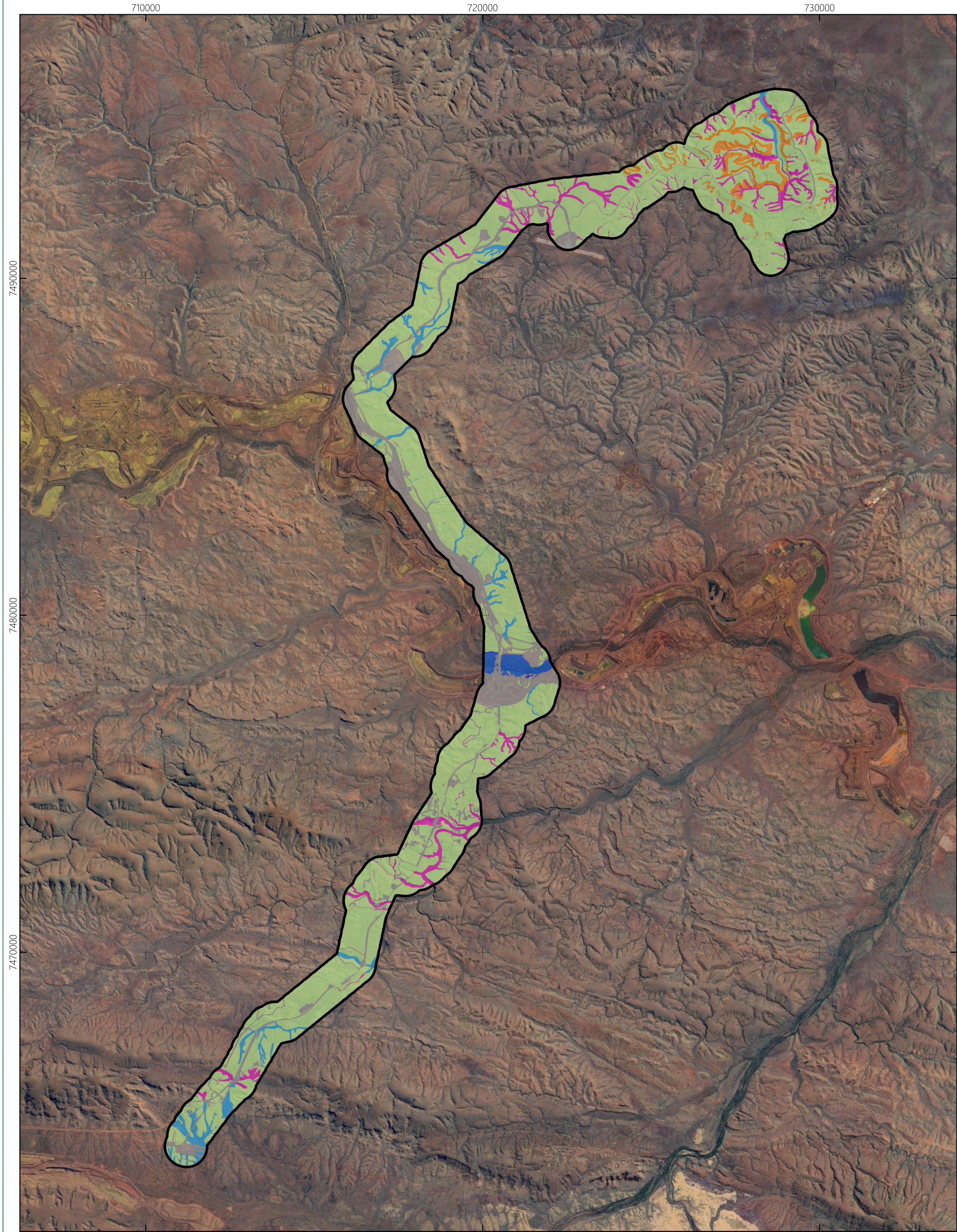
The avifauna of this habitat type is typically comprised of Blue-winged Kookaburra (*Dacelo leachii*), Sacred Kingfisher (*Todiramphus sanctus*), White-plumed Honeyeaters (*Ptilotula penicillata*), Rufous Songlark (*Cincloramphus mathewsi*), Rainbow Bee-eater (*Merops ornatus*), Little Corella (*Cacatua sanguinea*), and Collared Sparrowhawk (*Accipiter cirrocephalus*).

Typical mammal assemblage for the Major Drainage Line habitat includes Red Kangaroo (*Osphranter rufus*), Sandy Inland Mouse (*Pseudomys hermannsburgensis*), and Brushtail Possum (*Trichosurus vulpecula*).

Significant fauna species potentially occurring in this habitat type include the Northern Quoll (*Dasyercus hallucatus*), Ghost Bat (*Macroderma gigas*), Pilbara Leaf-nosed Bat (*Rhinonictis aurantia*, Pilbara form), Grey Falcon (*Falco hypoleucos*), Peregrine Falcon (*Falco peregrinus*), and Pilbara Olive Python (*Liasis olivaceus barroni*). More information is provided in Table 3.5.



Plate 3.5: Major Drainage Line



Legend

Survey Area

Fauna Habitat Types

Breakaway/Cliff

Gorge/Gully

Hillcrest/Hillslope

Major Drainage Line

Minor Drainage Line

Cleared/Disturbed

N

01234 km

Scale 1:100,000 @ A3

Coordinate System: GDA 1994 MGA Zone 50

Projection: Universal Transverse Mercator

Units: Metre

Author: JW

Date: 21-11-2025

Fauna Habitat Types

Marillana Power 2030 Fauna

Prepared for BHP WAIO

MAP

3.3

3.2.6. Habitat Analysis

Fauna habitats were analysed in terms of non-metric MDS scatter plots, for vertebrate fauna species caught in trapping grids and for systematically sampled bird species, as well as opportunistic records at these sites. To simplify interpretation, the data recorded at each site was combined into a single variable. In Figure 3.1 and Figure 3.2 below, Gorge/Gully habitat type is displayed in red, Hillcrest/Hillslope is displayed in orange, Major Drainage Line is shown in yellow, and green represents Minor Drainage Line. The Breakaway/Cliff habitat could not be included because no systematic trapping sites were installed here. The habitat type was sampled using opportunistic searches and ultrasonic bat recorders.

In non-metric MDS scatter plots, the distance of each point (habitat type) indicates the similarity of the fauna assemblages of each habitat type. The further away each point occurs from another indicates the differences between each site.

The non-metric MDS scatter plot indicates that the vertebrate fauna assemblage of sites MPS-02, MPS-03, MPS-04 and MPS-07 are the most closely related (Figure 3.1). While sites MPS-01 and MPS-06 are also similarly related to one another. Sites MPS-08 and MPS-05 differ from all other sites and to one another. This is to be expected as the substrate associated with sites MPS-02, MPS-03, MPS-04 and MPS-07 have many similarities. Gorge/Gully, Hillcrest/Hillslope, and Minor Drainage Line all share rocky ironstone substrates with clay/loam red brown soils. Tree species, either *Eucalyptus leucophloia* or *Corymbia hamersleyana*, form open woodland with an understory of *Triodia* hummocks prevalent throughout. Site MPS-07 differs slightly in floral array with a mid story of dominant *Acacia* species. This however did not affect the reptilian assemblage to a large degree with the most commonly recorded species across these sites being the Rock Ctenotus (*Ctenotus saxatilis*).

Sites MPS-06 and MPS-01 recorded no mammals which is indicated by their separate position in the MDS plot. Reptiles recorded across the six sites included five species, three of which were also recorded at sites within the main cluster. Site MPS-08 recorded only three species, all of which were reptiles, potentially due to the site having been recently burnt. Site MPS-05 (Major Drainage Line) is the most distinct fauna habitat in all aspects including substrate, landform and vegetation. The substrate was sandy with large *Eucalyptus* trees (*E. camaldulensis* and *E. victrix*) over open grasses and sedges. This was the only site to record *Lerista amicum*, *Lerista bipes*, and House Mouse.

The non-metric MDS scatter plot indicates that the avifauna assemblage of sites MPS-01, MPS-02 and MPS-03 are similarly related. Again, due to similar substrates and landform the Gorge/Gully and Hillcrest/Hillslope habitats have the most similar assemblage to one another. Common species within these habitats include generalist species that can occur across all habitats such as Australian Zebra Finch (*Taeniopygia castanotis*), Diamond Dove, Grey-headed Honeyeater, and Torresian Crow (*Corvus orru*). Sites MPS-04 and MPS-08 have a similar species array to the clustered sites as they are also Hillcrest/Hillslope habitats with overlapping species. There is a little more variation in the species recorded at these sites with the addition of Weebill, Galah (*Eolophus roseicapilla*), Australian Magpie (*Gymnorhina tibicen*), Grey-crowned Babbler (*Pomatostomus temporalis*), and Western Bowerbird (*Chlamydera guttata*).

Sites MPS-07 and MPS-05 are the most distinct in avifauna array (Figure 3.2), which is to be expected as these two habitat types, Minor Drainage Line and Major Drainage Line, are the most distinct in terms of substrate, landform and vegetation. An increased abundance of flowering species (seasonally) occurs in Minor Drainage Lines attracting nectar eating species such as Weebill, Grey-headed Honeyeater, and Singing Honeyeater. Major Drainage Lines support moisture as well as larger trees with hollows. Many species flock to water holes, when present, to drink in the mornings and late afternoons, such as Little

Corella, Budgerigar (*Melopsittacus undulatus*), and Cockatiel (*Nymphicus hollandicus*), also providing greater food resources for larger species such as birds of prey, Collared Sparrowhawk, Whistling Kite, and Barking Owl (*Ninox connivens*).

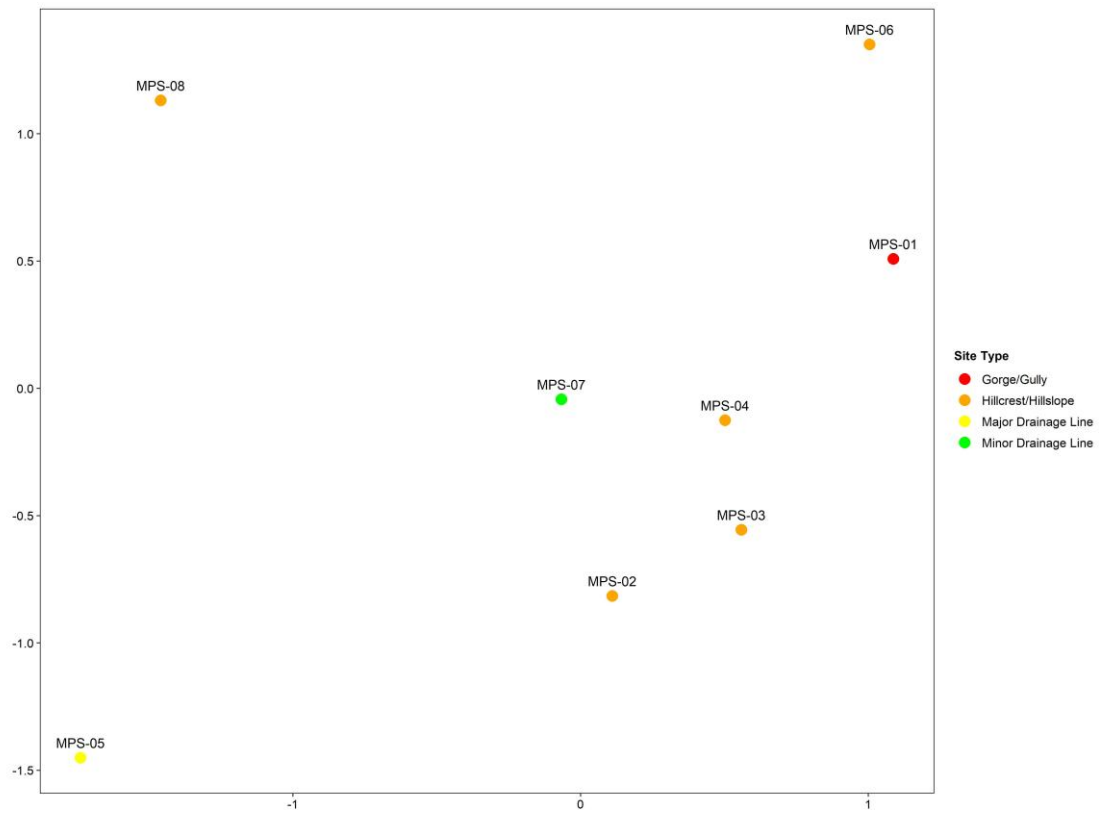


Figure 3.1: Non-metric MDS Scatter Plot of Trapping Grid Vertebrate Fauna Data

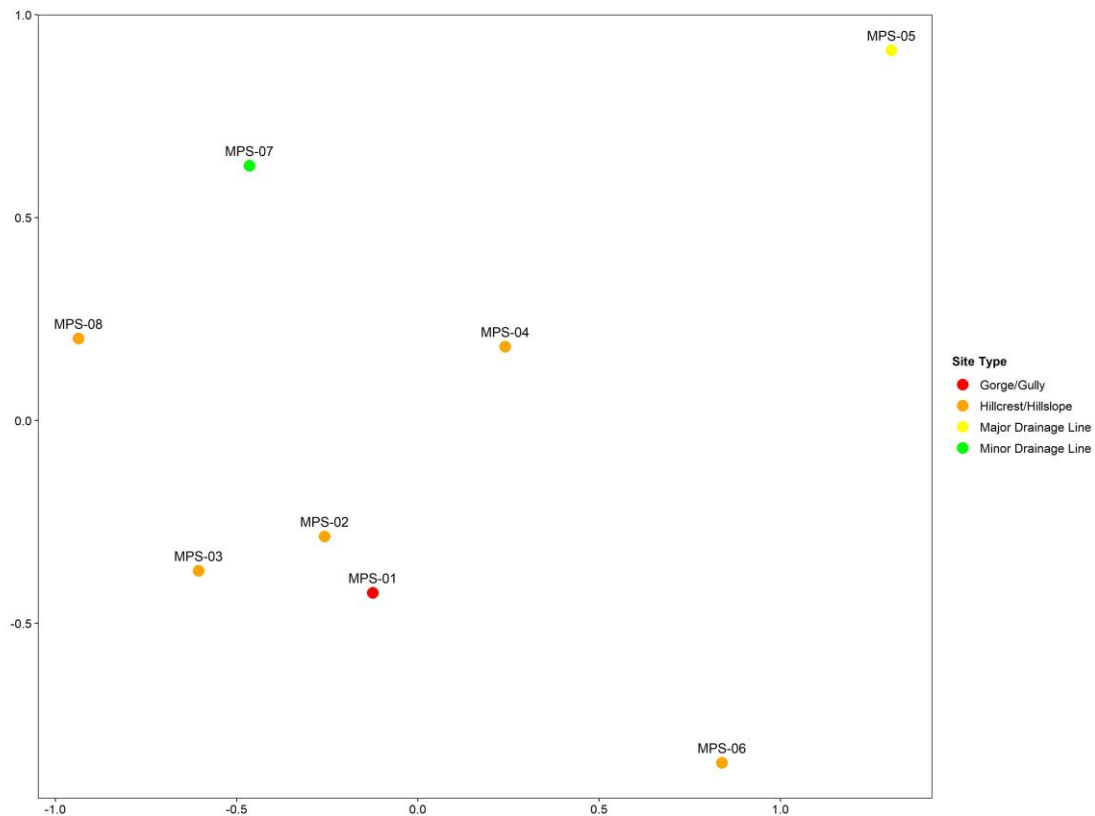


Figure 3.2: Non-metric MDS Scatter Plot of Systematic Bird Survey Data

3.3. Vertebrate Fauna

A total of 106 vertebrate species were recorded during the single-phase survey: 16 mammals, 60 birds, and 30 reptiles (Table 3.3). The fauna species recorded during the survey represents 29% of the total of 360 species potentially occurring at the Survey Area (Section 3.1, Appendix B).

The single-season survey was completed in October 2024 (dry season) in an area that was heavily impacted by fire nine months prior to surveying (Section 1.11). This may have in turn reduced the number of vertebrate fauna species recorded from Survey Area.

Table 3.3: Summary of Vertebrate Fauna Recorded During the Survey

Faunal Group	Sub-group	Number of Species Recorded	Number of Species Potentially Occurring
Mammals	Ground dwelling - native	5	26
	Ground dwelling - introduced	3	9
	Bats	8	16
Birds		60	180
Reptiles		30	120
Amphibians		0	9
Total		106	360

3.3.1. Mammals

Eight ground-dwelling mammal species were recorded from the Survey Area (Appendix C), three of which are introduced. Native ground dwelling mammals included one carnivorous marsupial species (Dasyuridae), and two macropod species (Macropodidae), and two native rodent species (Muridae). Introduced species were House Mouse (*Mus musculus*), European Cattle (*Bos primigenius*), and the naturalised Dingo (*Canis familiaris*). Eight bat species were recorded, comprising two species of sheath-tailed bat (Emballonuridae), three species of free-tailed bat (Molossidae), and three species of vesper bat (Vespertilionidae; Appendix C). Combined, the mammals recorded during the survey represent 31% of all mammal species identified as potentially occurring in the desktop study (Appendix B).

3.3.2. Avifauna

A total of 60 bird species from 27 families were recorded during the survey (Appendix C). These represent 33% of all bird species identified as potentially occurring in the desktop study (Appendix B).

The majority of records comprised of generalists, granivorous species, insectivores, and birds of prey: Spinifex Pigeon, Australian Ringneck, Purple-backed Fairywren, Torresian Crow, Australian Magpie, Australian Zebra Finch, and Painted Finch were the most commonly recorded species during the survey. Nectivorous avifauna was limited to few species of the honeyeater family that typically occur all year around such as the Singing Honeyeater, Grey-headed Honeyeater, and White-plumed Honeyeater. Boom and bust or irruptive species such as the Budgerigar were recorded in very low numbers (n=8).

3.3.3. Herpetofauna

A total of 30 reptile species was recorded during the survey (Appendix C). These represent 25% of herpetofauna species returned from the desktop study (Appendix B). Reptile records comprised one dragon species (Agamidae), nine gecko species (Diplodactylidae and Gekkonidae), 14 skink species (Scincidae), three goanna species (Varanidae), and three snake species (Elapidae). No amphibians were recorded likely due to the lack of rainfall experienced during the survey. The majority of species recorded comprised of skink and gecko species which is expected as they make up the majority of the herpetofauna assemblage in the Study Area.

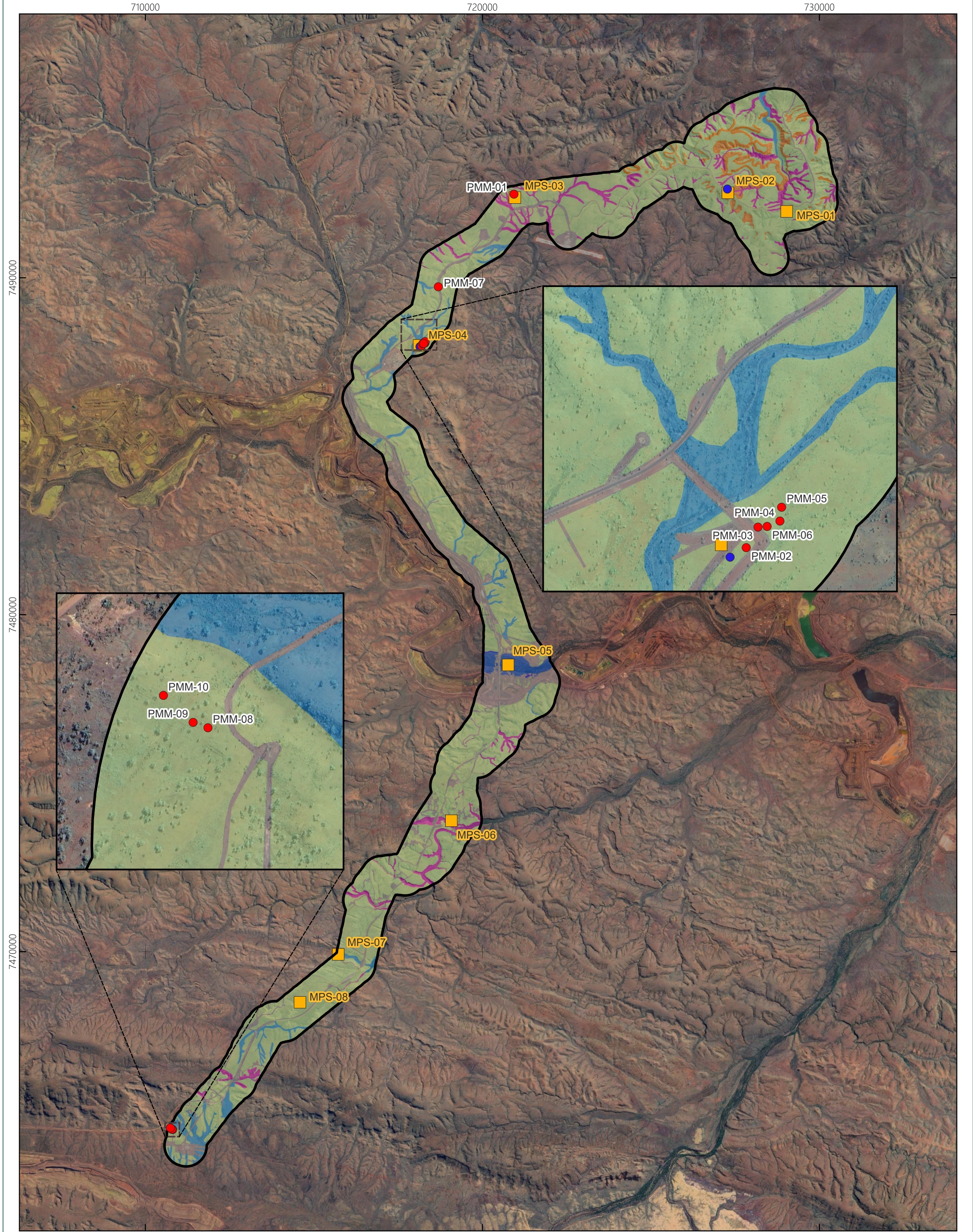
3.4. Significant Fauna

The desktop study identified 29 significant fauna species that have the potential to occur, or have been recorded previously, within the Survey Area. Of these, one species was recorded during the current survey: Western Pebble-mound Mouse (*Pseudomys chapmani*, Priority 4). Individuals were trapped during the systematic trapping and secondary evidence (mounds) were recorded. Details of the records are listed in Table 3.4 and their locations are mapped in Map 3.4. No Night Parrot calls were detected by this survey (Appendix D). The four eDNA samples analysed for Pilbara Olive Python were returned as negative with the full report available in Appendix E.

All 29 significant species are listed in Table 3.5, with three species having been recorded from the Survey Area within the last 10 years, six species assessed as having a high likelihood to occur and the remaining 20 species have a very low to low likelihood to occur. Their habitat requirements, previous records and occurrence within the Survey Area are detailed in Table 3.5. The nine species that have been recorded, or have a high likelihood to occur, within the Survey Area are described in more detail in Sections 3.4.1.1 - 3.4.3.2.

Table 3.4: Significant Fauna Recorded During the Survey

Species	Conservation Status			Location				Details
	EPBC Act	BC Act	DBCA	Easting	Northing	Site	Mound ID	
Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>)	-	-	P4	718148	7487958	MPS-04	-	Captured individual
				720936	7492482	MPS-03	PMM-01	Active mound
				727269	7492634	MPS-02	-	Captured individual
				718196	7487986	-	PMM-02	Very old mound
				718231	7488047	-	PMM-03	Active mound, open entrance
				718296	7488065	-	PMM-04	Old mound
				718301	7488106	-	PMM-05	Recently active mound
				718258	7488049	-	PMM-06	Old mound
				718692	7489733	-	PMM-07	Old mound
				710809	7464721	-	PMM-08	Possible active mound
				710787	7464729	-	PMM-09	Old mound
				710743	7464769	-	PMM-10	Recently active mound



Legend

 Survey Area

 Systematic Site Location

Significant Fauna Recorded

 Captured Individual

 Mound

Fauna Habitat Types

 Breakaway/Cliff

 Cleared/Disturbed

 Gorge/Gully

 Hillcrest/Hillslope

 Major Drainage Line

 Minor Drainage Line



01234 km

Scale 1:100,000 @ A3

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



Author: EM

Date: 01-12-2025

Significant Fauna Recorded
During the Survey

Marillana Power 2030 Fauna

Prepared for BHP WAIO

MAP

3.4

Table 3.5: Matters of National Environmental Significance Listed Fauna Species Likely to Occur

Species	Conservation Status			Preferred Habitats	Previous and Current Records	Habitat Present		Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			Critical Habitat (DotE, 2013)	Supporting Habitat (BHP WAIO, 2023b)	
Mammals								
Northern Quoll <i>Dasyurus hallucatus</i>	EN	EN	-	Most common on dissected rocky escarpments, gorges, and boulder piles. Typically, rocky areas with suitable denning sites and access to surface water, utilising major drainage lines and treed creek lines for dispersal (DCCEEW, 2023).	Two records occur within Survey Area. Three occur within ~2 km of Survey Area, in Newman, Robe, and McKay land systems. Over 500 records are within the Study Area, predominantly in the Newman land system.	- Breakaway/Cliff - Gorge/Gully	- Hillcrest/Hillslope - Major Drainage Line	Recorded Previous records and suitable habitat present within the Survey Area.
Bilby <i>Macrotis lagotis</i>	VU	VU	-	A variety of habitats with loam, clay loam or sandy soil substrates and plant species that are fed on directly, or host insect larvae. It has been recorded from mulga shrubland on clay loam, salt lakes, and sandplain habitat that is dominated by grassland and/or shrubland (DEC 2012). Habitats can also include <i>Triodia</i> hummock grassland, <i>Acacia</i> shrubland, open woodland, and cracking clays (Dziminski and Carpenter, 2017, 2018).	Recorded on 37 occasions within Study Area, concentrated on the fringes of the Fortescue Marsh. The closest record is approximately 25 km N of the Survey Area, from 2013.	None present	None present	Low Some previous records from the Fortescue Marsh. Suitable soil substrate is only present in drainage habitat. Critical habitat is not present within the Survey Area.
Pilbara Leaf-nosed Bat <i>Rhinioncteris aurantia</i> (Pilbara form)	VU	VU	-	Dissected rocky escarpments with suitable roost caves with high humidity (85 – 100% RH) and stable temperatures (28 – 32°C). Forages in a variety of habitats, particularly along water bodies and riparian vegetation (Armstrong, 2001; Cramer <i>et al.</i> , 2016).	Over 1,500 records within Study Area, recorded between 2006-2023. The closest of these records is ~5 km NW from the Survey Area. Records are predominantly within Newman and Platform land systems. The closest documented roost site is approximately 20 km NW of the Survey Area.	None present due to no known Category 1, 2 or 3 roosts within 10 km of the Survey Area, as per BHP Guidelines ((BHP WAIO, 2023b)).	- Breakaway/Cliff - Gorge/Gully - Hillcrest/Hillslope - Major Drainage Line - Minor Drainage Line	High Numerous previous records surrounding the Survey Area. Critical and supporting foraging habitat is present within the Survey Area.
Ghost Bat <i>Macroderma gigas</i>	VU	VU	-	A variety of habitats including caves, rock piles and abandoned mines may be utilised as transient roosts. Maternity/breeding roosts require dark, warm, and humid (>80% RH) microclimates (Armstrong and Anstee, 2000). Will travel up to 2 km from a roost to hunt and will utilise other structures such as culverts, rock overhangs and trees for feeding roosts (Tidemann <i>et al.</i> , 1985).	Over 350 records within Study Area, with the majority recorded in rocky habitat in Newman land system, between 1998-2023. Two records within the Survey Area in 2023.	- Gorge/Gully^{◊*} - Hillcrest/Hillslope* - Major Drainage Line* - Minor Drainage Line*	- Gorge/Gully - Breakaway/Cliff - Hillcrest/Hillslope - Major Drainage Line - Minor Drainage Line	Recorded Numerous previous records, also recorded from within the Survey Area. Critical roosting habitat and critical and supporting foraging habitat is present within the Survey Area.

Species	Conservation Status			Preferred Habitats	Previous and Current Records	Habitat Present		Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			Critical Habitat (DotE, 2013)	Supporting Habitat (BHP WAIO, 2023b)	
Birds								
Night Parrot <i>Pezoporus occidentalis</i>	CR	CR	-	At the site level, birds appear to require mature (>40 cm), long unburnt and structurally complex ring forming <i>Triodia</i> grasslands in association with nearby low lying saline lakes and drainages, hosting chenopods/samphire (Jackett <i>et al.</i> , 2017). At the landscape level, both roosting and foraging habitat is typically on flat or gently sloping ground, and is very open, with few trees or shrubs (DBCA, 2024). Often the vegetation in areas of suitable habitat will be naturally fragmented and therefore well-protected from fire (DBCA, 2024).	No records in the Study Area. Included in the PMST as habitat likely to occur.	None present	None present	Low No previous records in the Study Area. No suitable habitat present within the Survey Area. Detection methods of this cryptic species have been improved only recently. Lack of records may not indicate absence.
Australian Painted-snipe <i>Rostratula australis</i>	EN	EN	-	Shallow terrestrial freshwater wetlands, lakes, and swamps, typically with low, dense fringing vegetation. Favours sites with shallow water and exposed mud (Menkhorst <i>et al.</i> , 2019).	Two records in 2012 ~40km E of the Survey Area.	None present	None present	Very Low Two recorded within the Study Area. No suitable habitat present. Species requires very specific habitat.
Common Greenshank <i>Tringa nebularia</i>	EN, MI	MI	-	Inhabits wetlands and sheltered coastal habitats. Mudflats, saltmarsh, and mangroves within bays, harbours and estuaries. Inland habitats include permanent and ephemeral waterbodies such as swamps, floodplains, waterholes, artificial wetlands, clay pans, and lakes (BirdLife Australia, 2023).	Two records ~15 km W of the Survey Area on consecutive days in 2011. Only three records in the Study Area.	None present	None present	Low Few previous records in the Study Area. No suitable habitat present within the Survey Area.
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	VU, MI	MI	-	Intertidal mudflats and freshwater wetlands with muddy margins. Wetlands with emergent low vegetation that offer cover. Found in ephemeral waterbodies but will leave once dry (BirdLife Australia, 2023).	No records in the Study Area. Included in the PMST as habitat may occur.	None present	None present	Very Low No previous records in the Study Area. No suitable habitat present within the Survey Area.

Species	Conservation Status			Preferred Habitats	Previous and Current Records	Habitat Present		Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			Critical Habitat (DotE, 2013)	Supporting Habitat (BHP WAIO, 2023b)	
Grey Falcon <i>Falco hypoleucos</i>	VU	VU	-	Arid and semi-arid grasslands, plains, and timbered watercourses, forages in open landscapes such as rocky plains with hummock grasslands, lower shrublands, and small drainage lines where they predominantly prey on birds (Olson and Olson, 1986; Schoenjahn, 2013).	One record from 2014, ~15 km NW of the Survey Area in the DBCA database. Three records from 2008, ~20 km SW of the Survey Area. A total of eight records within the Study Area.	Major Drainage Line	- Breakaway/Cliff - Hillcrest/Hillslope - Minor Drainage Line	High Few previous records in the Study Area. Critical habitat present within the Survey Area.
Southern Whiteface <i>Aphelocephala leucopsis</i>	VU	VU	-	Distributed throughout the drier regions of southern mainland Australia (Pizzey and Knight, 2012). This species favours dry open forest/woodland and inland scrubs such as mallee, mulga, cypress pine and saltbush (BirdLife Australia, 2023).	One record in 2007 from ALA in the Study Area ~20 km SE of the Survey Area (ALA records are generalised to 10 km for significant species).	None present	None present	Low One previous record in the Study Area. No suitable habitat present within the Survey Area.
Reptiles								
Pilbara Olive Python <i>Liasis olivaceus barroni</i>	VU	VU	-	Inhabits gorges, gullies, stony ranges, rock piles and along watercourses. Often associated with permanent and temporary water bodies though is not restricted to them (DSEWPac, 2011a).	Three records between 2010-2011 within Survey Area. Over 40 records in the BHP database within 30 km of the Survey Area.	- Breakaway/Cliff - Gorge/Gully	- Major Drainage Line - Minor Drainage Line	High (previously recorded) Previously recorded from within the Survey Area but not in the last 10 years. Critical and supporting habitat present within the Survey Area.

* Within foraging distance of Category 1 or 2 Ghost Bat roosts (12 km radius). There are no known Category 1 roosts within the Survey Area. There is one known Category 2 roost within the Survey Area; CMIN-03, which is located in the southern end of the Survey Area (Map 3.5).

◊ = habitat type contains Category 2 roost cave (BHP WAIO, 2023b).

Table 3.6: Migratory and Priority Listed Fauna Species Likely to Occur

Species	Conservation Status			Preferred Habitats	Previous and Current Records	Habitat Present	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			Important Habitat	
Mammals							
Brush-tailed Mulgara <i>Dasycercus blythi</i>	-	-	P4	Preferred habitats include sandy and loamy flats vegetated with hummock and/ or tussock grasses. They have also been recorded from stony gibber plains where wind-blown soil or sand has accumulated and allowed burrowing (Pavey <i>et al.</i> , 2011).	Seventy records within the Study Area but no records from within the Survey Area. The closest records are ~10 km N on the edge of the Fortescue Marsh. Records are generally centred around the Sand Plain and Dune habitats identified by Biologic (2013), within the Study Area.	None present	Low Previous records from near the Fortescue Marsh. No suitable habitat present within the Survey Area.
Spectacled Hare-wallaby <i>Lagorchestes conspicillatus leichardti</i>	-	-	P4	Sand and gravelly plains, dunes, stony rises and hills with spinifex or tussock-grass, sometimes also with mulga. Builds a nest in a scrape under grass tussocks or shrubs for shelter from predators and hot daytime temperatures (NESP Threatened Species Recovery Hub, 2021).	Known from a single record of scats on ALA on the southern edge of the Fortescue Marsh.	None present	Low One previous record from near the Fortescue Marsh. No suitable habitat present within the Survey Area.
Short-tailed Mouse <i>Leggadina lakedownensis</i>	-	-	P4	Most records in Western Australia are from seasonally inundated sandy clay or cracking clay soils in which it constructs simple, single chambered burrows (Kutt and Kemp, 2005). Also found in spinifex and tussock grasslands, samphire shrublands, sedgelands and open woodlands on suitable substrate.	Four records in the Study Area in 1997, the closest being ~35 km W of the Survey Area. Associated with the Boolgeeda land system.	None present	Low Few previous records in the Study Area. No suitable habitat present within the Survey Area.
Western Pebble-mound Mouse <i>Pseudomys chapmani</i>	-	-	P4	Endemic to the Pilbara region. They are found on pebbled soil in arid tussock grassland and <i>Acacia</i> woodland on gentle slopes of rocky ranges, with hard spinifex and scattered shrubs (Baker and Gynther, 2023).	Recorded on 12 occasions during this single-phase survey (individuals and mounds). Previously recorded within the Survey Area on over 100 occasions. Over 750 records within the Study Area, and numerous records within 20 km of Survey Area.	Hillcrest/Hillslope	Recorded Previous and current records within the Survey Area and important habitat is present.
Birds							
Pacific Swift <i>Apus pacificus</i>	MI	MI	-	The Pacific Swift has an almost entirely aerial lifestyle and is somewhat generalist in habitat preferences, often observed over a variety of habitats (DCCEEW, 2025c). It is highly nomadic and associated with storm fronts, often flying at significant heights (>200m; Menkhorst <i>et al.</i> , 2019).	Recorded at seven locations in Study Area since 2011. Four of these records were from a single day in 2013. The closest record is 13 km E in 2014.	NA	Low Few previous records within the Study Area. The species has an almost entirely aerial lifestyle and is not expected to use habitats of the Survey Area.
Oriental Plover <i>Anarhynchus veredus</i>	MI	MI	-	Open grassland habitat including claypans and areas of hard bare ground. Also known to utilise modified habitats such as lawns, playing fields and paddocks. More common inland in arid and semi-arid regions (BirdLife Australia, 2023).	One record from ~15 km S of the Survey Area in 2019.	None present	Low One previous record within the Study Area. No suitable habitat present.

Species	Conservation Status			Preferred Habitats	Previous and Current Records	Habitat Present	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			Important Habitat	
Red-necked Stint <i>Calidris ruficollis</i>	MI	MI		Sheltered coastal waters and estuaries. Inland inhabits saltmarshes, shallow wetlands, riverbanks, sewerage farms and dams. Foraging occurs predominantly on wet mud or very shallow water (BirdLife Australia, 2023).	Known from a single record on ALA sourced from tracking data (Lisovski <i>et al.</i> , 2021).	None present	Low One previous record within the Study Area. No suitable habitat present.
Pectoral Sandpiper <i>Calidris melanotos</i>	MI	MI	-	Coastal wetland, both fresh and saline but also inland on permanent and temporary wetlands. Prefers sites with mudflats, fringing vegetation or swamps with heavy vegetation (Morcombe, 2003).	No records in the Study Area. Included in the PMST as habitat may occur.	None present	Very Low No previous records within the Study Area. No suitable habitat present.
Common Sandpiper <i>Actitis hypoleucos</i>	MI	MI	-	Typically occupies freshwater river and pool habitats though rarely associated with brackish, salt lake and estuary environments (Pizzey and Knight, 2012).	Eight records over three days in 2022 ~12 km W of the Survey Area.	None present	Low Few previous records within the Study Area. No suitable habitat present.
Wood Sandpiper <i>Tringa glareola</i>	MI	MI	-	Typically occupies freshwater river and pool habitats though rarely associated with brackish, salt lake and estuary environments (Pizzey and Knight, 2012).	A single record on the northern edge of the Fortescue Marsh in 2009. No other records in the Study Area.	None present	Low One previous record within the Study Area. No suitable habitat present.
Oriental Pratincole <i>Glareola maldivarum</i>	MI	MI		Often found at wetlands with an abundance of insects or in open areas near tidal flats and beach lands (Morcombe, 2003). Known to congregate in large flocks (Menkhorst <i>et al.</i> , 2019).	Known only from a single ALA record on the Fortescue Marsh in 2017, ~45 km E of the Survey Area.	None present	Low One previous record within the Study Area. No suitable habitat present.
Gull-billed Tern <i>Gelochelidon nilotica</i>	MI	MI		Most common on coastlines with tidal mudflats but is also found inland on ephemeral lakes and wetlands (Menkhorst <i>et al.</i> , 2019).	Three records in the Study Area on the Fortescue Marsh. The closest record is ~25 km N of the Survey Area in 2016.	None present	Low Few previous records within the Study Area. No suitable habitat present.
Caspian Tern <i>Hydroprogne caspia</i>	MI	MI	-	Sheltered coastal areas and inland wetlands such as salt lakes, ephemeral wetlands and waterholes. Roosting occurs at beaches, lakes estuaries and lagoons (BirdLife Australia, 2023).	Two records ~40 km SE of Survey Area, in 2022. Total of three records in the Study Area.	None present	Low Few previous records within the Study Area. No suitable habitat present.
Glossy Ibis <i>Plegadis falcinellus</i>	MI	MI	-	Shallow freshwater, occasionally observed in estuaries. Roosts in trees near water. Breed in well vegetated fresh or brackish wetlands (BirdLife Australia, 2023).	Recorded on the northern edge of the Fortescue Marsh ~30 km N of the Survey Area, in 2017.	None present	Low Few previous records within the Study Area. No suitable habitat present.
Osprey <i>Pandion haliaetus</i>	MI	MI	-	Coastal and terrestrial wetlands of tropical and temperate Australia and offshore islands, occasionally ranging inland along rivers. The species is known to almost exclusively predate on marine or freshwater fish, indicating their preference for coastal waters and tidal reaches of large streams (Pizzey and Knight, 2012; DAWE, 2021).	One record from 2011, ~12 km E of the Survey Area. A second record from 2012, ~35 km N of the Survey Area.	None present	Low Few previous records within the Study Area. No suitable habitat present.

Species	Conservation Status			Preferred Habitats	Previous and Current Records	Habitat Present	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			Important Habitat	
Peregrine Falcon <i>Falco peregrinus</i>	-	OS	-	Widespread but uncommon; variety of habitats ranging from urban areas, coastal cliffs, riverine gorges, wooded watercourses, or margins of cleared lands (Menkhorst <i>et al.</i> , 2019).	Twenty-nine records in Study Area. One record in 2018 within ~4 km W of Survey Area.	• Breakaway/Cliff • Gorge/Gully • Major Drainage Line • Minor Drainage Line	High Several records within the Study Area. Important habitat present within the Survey Area.
Reptiles							
Gane’s Blind Snake <i>Anilios ganei</i>	-	-	P1	Variety of habitats, often associated with moist gorges, areas of loose soil, leaf litter, and debris where they burrow (Aplin, 1998).	One record from within the Survey Area in 2011. Additionally, 12 records between 2007 and 2011 within ~20 km of the Survey Area.	• Gorge/Gully • Hillcrest/Hillslope • Minor Drainage Line	High (previously recorded) Previously recorded from within the Survey Area but not in the last 10 years. Important habitat present within the Survey Area.
Pilbara Barking Gecko <i>Underwoodisaurus seorsus</i>	-	-	P2	Found in elevated rocky areas with <i>Triodia</i> spp. and low tree cover (Doughty and Oliver, 2011).	Fifteen records between 1997-2022 in the Study Area. Seven records within 15 km of the Survey Area. All records occur within the Newman land system.	• Gorge/Gully • Hillcrest/Hillslope	High Several records within the Study Area. Important habitat present within the Survey Area.

3.4.1. Mammals

3.4.1.1. Northern Quoll (*Dasyurus hallucatus*)

Conservation Status: EPBC Act & BC Act: Endangered.

Distribution, Habitat and Ecology: The Northern Quoll is an omnivorous, opportunistic feeder that mostly consumes insects, fruits, vegetation, molluscs and vertebrate species, including mammals, birds, reptiles and frogs (Dunlop, Rayner and Doherty, 2017).

The Northern Quoll formerly occurred across northern Australia, but its distribution has been reduced due to the impact of feral Cats and Cane Toads (Hernandez Santin *et al.*, 2018; DCCEE, 2023). In the Pilbara, individuals typically find refuge in rocky habitats, resting and denning in crevices, cracks and small caves during the day. Specifically, habitats include rocky gorges, basalt hills, escarpments, mesas, plateaus, granite boulder piles, caves, breakaways and free faces (Baker and Gynther, 2023). Foraging occurs across adjacent habitat that provides suitable cover and food resources, particularly drainage lines, which are also used for dispersal (Baker and Gynther, 2023).

Northern Quolls often occur in disjunct populations that are readily subject to fluctuations, due partly to their life history, where males typically live for only a year (Oakwood, 2000). Population fluctuations are also influenced by stochastic factors such as precipitation, fire and availability of prey (Hernandez Santin, Fisher and Goldizen, 2018).

Occurrence in the Survey Area: Previously recorded in the Survey Area. Two records occur within Survey Area, both in 2018, of an individual recorded on a motion camera and one collected scat from the same gully (Biologic, 2019). Three records occur within ~2 km of Survey Area, in Newman, Robe and McKay land systems. Over 500 records within the Study Area, predominantly in the Newman land system. Critical denning habitat is present within the Survey Area in Breakaway/Ciffs and Gorge/Gully habitats with supporting/dispersal habitat present along Major Drainage Line and Hillcrest/Hillslope.

3.4.1.2. Pilbara Leaf-nosed Bat (*Rhinonictis aurantia*, Pilbara form)

Conservation Status: EPBC Act & BC Act: Vulnerable.

Distribution, Habitat and Ecology: The Pilbara Leaf-nosed Bat is the Pilbara form of the Orange Leaf-nosed Bat, a small orange coloured bat that occurs across northern Australia (Armstrong, 2006). There are two populations of Orange Leaf-nosed Bat, one in the Pilbara and the other in the Kimberley region. They differ genetically, morphologically and in the frequency of their echolocation calls (Armstrong, 2001, 2003, 2006).

The Pilbara Leaf-nosed Bat requires two different habitats, suitable caves or mine adits for roosting during the day, and an external habitat for foraging at night. These habitats are defined in the Conservation Advice for this species (TSSC, 2016b). Roosting occurs in deep, warm and humid caves and adits (horizontal tunnels). Some caves are used all year around, whereas others are visited for a variety of purposes including specific maternity roost caves (Churchill, 2009; Department of the Environment, 2015; TSSC, 2016b). A standardised nomenclature for the different roost types has been established and includes four types of roosts (Bat Call WA, 2021b):

- Permanent diurnal roost with proven breeding (Category 1).
- Permanent diurnal roost with no proven breeding (Category 2).
- Semi-permanent diurnal roosts (Category 3).
- Nocturnal refuge (Category 4).

Permanent diurnal roosts for this species are occupied all year and are utilised for breeding and rearing of young. Non-permanent breeding roosts are also used for mating and transitory diurnal roosts facilitate long-distance dispersal. These roost types are considered critical habitat for the survival of the species. Nocturnal refuge roosts are used for shelter and feeding, and while not classified as critical habitat, they are important for the species persistence in the local area (Churchill, 2009; Department of the Environment, 2015).

Foraging habitat is only considered critical when in foraging proximity to a permanent diurnal roost (Category 1, 2 and 3; BHP WAIO, 2023b). Supporting foraging habitat consists of plains, low hills, gullies, ridgelines, mesas, and gorges (Bat Call WA, 2021b).

Pilbara Leaf-nosed Bats are insectivorous, with a large proportion of their diet consisting of moths, termites and beetles. The bats emerge from their diurnal roost after dusk and forage along rock faces, rocky gullies, gorges, creek lines and water holes (Churchill, 2009; Department of the Environment, 2015). The Pilbara Leaf-nosed Bat is vulnerable to the loss of body heat and moisture and therefore requires a stable warm microclimate. Their breeding cycle stretches over a 9-month period, with mating taking place in July and the dispersal of independent young in February/March (Churchill, 2009; Department of the Environment, 2015).

Likelihood of occurrence: High likelihood of occurring in the Survey Area. Over 1,500 records within Study Area, recorded between 2006-2023. The closest of these records is ~5 km NW of the Survey Area identified by bat recorder in 2011 (Biota, 2013). Records are predominantly within Newman and Platform land systems. The closest documented roost site is approximately 20 km NW of the Survey Area (Bullen, 2013).

Previous surveys detected three Category 4 Pilbara Leaf-nosed Bat roosts from within the Survey Area (Map 3.5). No known Category 1, 2 or 3 roosts within proximity of the Survey Area and therefore no habitat has been identified as critical (Bat Call WA, 2021b; BHP WAIO, 2023b). The closest Category 2 roost is 20 km from the Survey Area and therefore the Breakaway/Cliff, Gorge/Gully, Hillcrest/Hillslope, Major Drainage Line, and Minor Drainage Line habitats within the Survey Area are classified as supporting foraging habitat. Given the high number of records from the Study Area, some of which are less than 20 km, the species is considered likely to be present within the Survey Area for foraging and dispersal activities in the supporting foraging habitats.

3.4.1.3. Ghost Bat (*Macroderma gigas*)

Conservation Status: EPBC Act & BC Act: Vulnerable.

Distribution, Habitat and Ecology: Ghost Bats once occurred across much of Australia but are now only known from isolated locations in northern Australia (Armstrong and Anstee, 2000; Churchill, 2009). The Ghost Bat is a carnivore, feeding on other bats, rodents, invertebrates, and birds. They detect prey via a combination of passive listening, vision, and echolocation. Detection through movement is thought to be the primary stimulus with echolocation being rarely used active hunting, meaning standard survey techniques such as ultrasonic bat recorders are unreliable for detecting foraging individuals (Tidemann *et al.*, 1985; Pettigrew *et al.*, 1986; Boles, 1999; Ruykys, Hanrahan and Stokeld, 2023).

Ghost Bats use a range of cave structures for short-term transient feeding roosts, long-term roosts and maternity roots (DCCEEW, 2025d). Short-term transient roosts can include overhangs, small shallow caves, granite boulders, and rail culverts. Maternity roosts are usually deep, complex large domed caves or mine adits, characterised by warm, stable temperatures and humid microclimate (TSSC, 2016a). They forage over

a broad range of habitats including *Triodia* slopes, open savanna woodland, and *Acacia/Eucalyptus* open woodland, including mulga (Churchill, 1995; Bullen, Reiffer and Trainer, 2023).

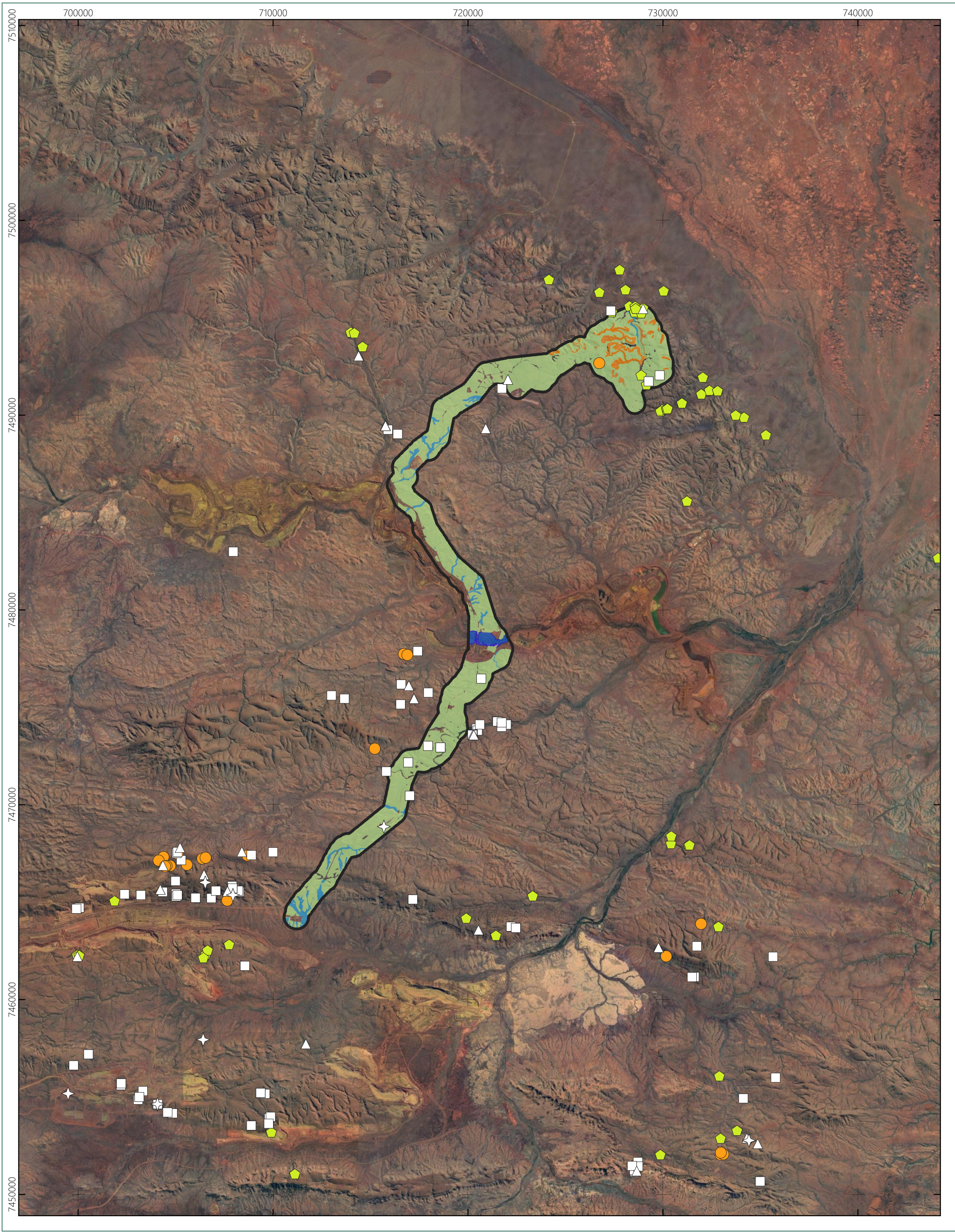
Tracking studies have shown that up to 75% of the population disperse in winter with the remaining individuals (possibly pregnant females) occupying the warm caves over winter (Toop, 1985). Females and males aggregate for breeding purposes at the end of the wet season (Pettigrew *et al.*, 1986) and females give birth to young between late August and October. The young are nursed in large maternity caves over the wet season (Toop, 1985).

Ghost Bat roosts are categorised based on how frequently the cave is occupied and whether this roosting occurs diurnally or nocturnally. The four categories are as outlined below (Bat Call WA, 2021a):

- Permanent maternity or diurnal roost (Category 1).
- Regularly occupied maternity or diurnal roost (Category 2).
- Occasionally occupied diurnal roosts (Category 3).
- Nocturnal refuge only (Category 4).

Likelihood of occurrence: Previously recorded within the Survey Area in 2023, in the DBCA database, with one sighting of an individual in a cave and an observation of feeding residue. Over 350 records within the Study Area, with the majority recorded in rocky habitat in Newman land system, between 1998-2023. Given the previous records from within the Survey Area in 2023, the species is considered likely to be present within the Survey Area.

Previous surveys to date identified one Category 2 Ghost Bat roost (CMIN-03) within the Survey Area in Gorge/Gully habitat type (BHP Internal Database). Two additional Category 2 caves are also known from within 4.5 km south of the Survey Area (BHP Internal Database, Map 3.5). Given the presence of the roosts, critical roosting habitat is present in the southern section of the Survey Area in the form of Gorge/Gully habitat (BHP WAIO, 2023b). Additionally, Gorge/Gully, Hillcrest/Hillslope, Major Drainage Line and Minor Drainage Line habitat types are present within foraging distance (12 km) of the Category 2 Ghost Bat roost and are therefore considered critical foraging habitat for the species (BHP WAIO, 2023b). Supporting habitat is present in the form of Gorge/Gully, Breakaway/Cliff, Hillcrest/Hillslope, Major Drainage Line and Minor Drainage Line habitat types outside the 12 km of the known Category 2 roost caves. To date, one Category 3 (CMAR-26) and eight Category 4 caves have been detected during previous surveys from these habitat types within the Survey Area.



Legend

Survey Area

Fauna Habitat Types

- Breakaway/Climb
- Gorge/Gully
- Hillcrest/Hillslope
- Major Drainage Line
- Minor Drainage Line
- Cleared

Ghost Bat & Pilbara Leaf-nosed Bat

- GB Category 2
- GB Category 3
- GB Category 4
- PLNB Category 4
- Unclassified



0 1 2 3 4 km
Scale 1:170,000

@ A3

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



Author: JW

Date: 15-01-2026

Known Bat Caves

Marillana Power 2030 Fauna

Prepared for BHP WAIO

3.4.1.4. Western Pebble-mound Mouse (*Pseudomys chapmani*)

Conservation Status: DBCA: Priority 4.

Distribution, Habitat and Ecology: The Western Pebble-mound Mouse is endemic to the Pilbara region. Their distribution extends from southern and central Pilbara to the Little Sandy Desert (Baker and Gynther, 2023). They are typically found on stony plains or gentle slopes with pebbled soil in arid hummock grassland and *Acacia* woodland. They have a complex social structure and are known to occur in groups of up to 25 individuals, utilising multiple mounds constructed with pebbles (Baker and Gynther, 2023). Male home ranges are considerably larger than those of females, particularly during breeding (Anstee, Roberts and Shea, 1997).

Occurrence in the Survey Area: The species was recorded during the current survey (on 12 occasions) from individuals and mounds (both active and inactive; Table 3.4), and previous surveys (over 100 occasions). Over 750 records within Study Area, and numerous records within 20 km of Survey Area. Important habitat for this species is present within the Survey Area in the Hillcrest/Hillslope habitat.

3.4.2. Avifauna

3.4.2.1. Grey Falcon (*Falco hypoleucos*)

Conservation Status: EPBC Act & BC Act: Vulnerable.

Distribution, Habitat and Ecology: The Grey Falcon is the rarest falcon in Australia with an estimated population size of <1,000 individuals (Schoenjahn, 2013). They occur sparsely in a wide variety of arid and semi-arid zones across an area of about 5 million km² (Schoenjahn, Pavey and Walter, 2020). They are not associated with any particular vegetation types; however, climate characteristics such as temperature and rainfall appear to strongly influence the distribution of the species (Schoenjahn, Pavey and Walter, 2020).

Grey Falcons breed from June to November, with a clutch size varying between 1-4 eggs (Schoenjahn, 2013; Garnett *et al.*, 2019; Schoenjahn, Pavey and Walter, 2020). Breeding habitat appears to be localised in zones with the highest annual average temperatures, and areas with persistently dry and winter drought climatic conditions (Schoenjahn, 2013). They typically use the nests of other large birds (corvids and raptors), generally in tall trees such as River Red Gums (*Eucalyptus camaldulensis*) along drainage lines or on man-made infrastructure such as repeater towers or power-line pylons (Olson and Olson, 1986).

The Grey Falcon forages in open landscapes such as rocky plains with hummock grasslands, lower shrublands, open woodland and small drainage lines where they predominantly prey on birds, mainly pigeons and parrots (Olsen and Olsen, 1986; Schoenjahn, 2013).

Occurrence in the Survey Area: One record in 2014 from ~15 km NW of the Survey Area in the DBCA database. Three records ~20 km SW of the Survey Area all in 2008. A total of eight records within the Study Area from previous surveys. Critical habitat is present within the Survey Area along Major Drainage Line (mature large trees), whereas supporting habitat is present at Breakaway/Cliff, Hillcrest/Hillslope and Minor Drainage Line.

3.4.2.2. Peregrine Falcon (*Falco peregrinus*)

Conservation Status: BC Act: Other Specially Protected.

Distribution, Habitat and Ecology: The Peregrine Falcon occurs across most of Australia, although it is an uncommon species (Birdlife Australia, 2017). They inhabit cliffs, coastal habitats, rivers, wooded water courses and lakes, as well as urban environments. Peregrine Falcons usually nest by making a scrape on a

high cliff-edge but will also use stick nests of other large birds and tree hollows in some areas (Olsen *et al.*, 2006). Hunting occurs predominantly during the day, and feeding is primarily on small- to medium-sized birds caught in flight, often above drainage lines and rivers with favoured species reflecting the local prey profile (Birdlife Australia, 2017; Palmer, Rose and Debus, 2019).

Occurrence in the Survey Area: The species has a high likelihood to occur within the Survey Area. Twenty-nine records occur in Study Area, of which one record in 2018 was within ~4 km of Survey Area. Important habitat for this species is present in the Breakaway/Cliff and Gorge/Gully habitats. Major Drainage Line and Minor Drainage Line habitats represent suitable supporting habitat within the Survey Area.

3.4.3. Herpetofauna

3.4.3.1. Pilbara Olive Python (*Liasis olivaceus barroni*)

Conservation Status: EPBC Act & BC Act: Vulnerable.

Distribution, Habitat and Ecology: The Pilbara Olive Python is a subspecies of Olive Python which is geographically separated from populations in the Kimberley, Northern Territory and Queensland (Wilson and Swan, 2025). They are one of the largest python species in Australia, growing up to 4.5 m in length (Wilson and Swan, 2025) and are often seen near water or in pools where they ambush prey such as birds, rodents, bats and wallabies (Pearson, 2007; Ellis, 2010; Wilson and Swan, 2025). Male Pilbara Olive Pythons travel up to 4 km during the winter months in search of females to mate with, with home ranges thought to be up to 450 ha (Pearson, 2013). Habitat requirements of the Pilbara Olive Python are thought to vary throughout the year due to changes in temperature and breeding activities. Dispersal during the wet season occurs across rocky habitats supporting water sources and drainage lines (Pearson, 2001). Pools of surface water are utilised for hunting whilst nearby caves, crevices and sometimes debris or tree hollows are used for shelter. During the cooler months, the pythons will shelter in caves and rock crevices, away from water (DEWHA, 2008).

Reproduction is dependent upon environmental factors attributing to body condition. Where conditions are optimal, eggs are laid in Spring with young hatching at the start of the wet season (Dec-Jan). Once hatched, the young will disperse whilst foraging conditions for reptiles are ideal (Pearson, 2003).

Occurrence in the Survey Area: High likelihood of occurring in the Survey Area with three previous, but no recent, records (2010-2011) from within the Survey Area. The records from 2010 were of sloughed skin and scat found in Marillana Creek (Biologic, 2011d). The single 2011 record was of an opportunistic sighting of an individual in the northern portion of the Survey Area. Over 40 records in the BHP database within 30 km of the Survey Area. Critical habitat is present within the Survey Area in Breakaway/Cliff and Gorge/Gully habitats. Major Drainage Line and Minor Drainage Line habitats represent suitable supporting habitat for this species within the Survey Area.

3.4.3.2. Gane's Blind Snake (*Anilius ganei*)

Conservation Status: DBCA: Priority 1.

Distribution, Habitat and Ecology: The Gane's Blind Snake is an elusive, moderately robust blind snake that lives primarily underground. Due to its subterranean lifestyle, the species is rarely recorded, and relatively little is known of its ecology. The Gane's Blind Snake has a rounded snout that is greyish on the upper side and cream on the underside (Wilson and Swan, 2025). Its distribution is limited to the Pilbara region between Newman and Pannawonica (DBCA, 2025; Wilson and Swan, 2025). The species is likely to enter social insect nests to feed on termites and ants, as well as their eggs and pupae. The Gane's Blind Snake is thought to be associated with moist gullies and gorges, though little published information exists (Aplin, 1998). A

specimen was recorded in the Hamersley Range from a stony clay-loam valley floor vegetated with *Triodia*, suggesting that the species may utilise moist gullies and gorges, although it is likely not restricted to this habitat (Ecoscape, 2011).

Occurrence in the Survey Area: High likelihood of occurring in the Survey Area with one previous record (2011) from within the Survey Area (BHP Internal Database). Another 12 records from 2007-2011 occur within ~20 km of the Survey Area. Important habitat for this species is present in the Hillcrest/Hillslope and Gorge/Gully habitats. Minor Drainage Line habitat also represents suitable habitat for this species within the Survey Area.

3.4.3.3. Pilbara Barking Gecko (*Underwoodisaurus seorsus*)

Conservation Status: DBCA: Priority 2.

Distribution, Habitat and Ecology: The Pilbara Barking Gecko is one of the largest geckos in the Pilbara at up to 100 mm in length. It is pale red brown in colour with small, scattered spots across its body and limbs. These correspond with small scattered dorsal tubercles forming irregular bands across its back, with no patterns on the top and side of the head. Its limbs are long and slender, and the original tail has five distinct white bands (Wilson and Swan, 2025). The species is generally found in elevated rocky areas with spinifex and low tree cover and is restricted to the Hamersley Range in the Pilbara region, from Tom Price to near Newman (Wilson and Swan, 2025).

Occurrence in the Survey Area: High likelihood of occurring in the Survey Area. Fifteen records were returned between 1997-2022 within the Study Area. Seven records are located within 15 km of the Survey Area. Important habitat for this species is present in the Hillcrest/Hillslope and Gorge/Gully habitats.

3.5. Statistical Analysis

3.5.1. Species Accumulation Curves

Species accumulation curves for mammals, avifauna and herpetofauna species recorded via systematic sampling, are presented in Figure 3.3, Figure 3.4 and Figure 3.5. None of the SACs approached asymptote indicating that additional species are likely to be recorded with additional sampling effort.

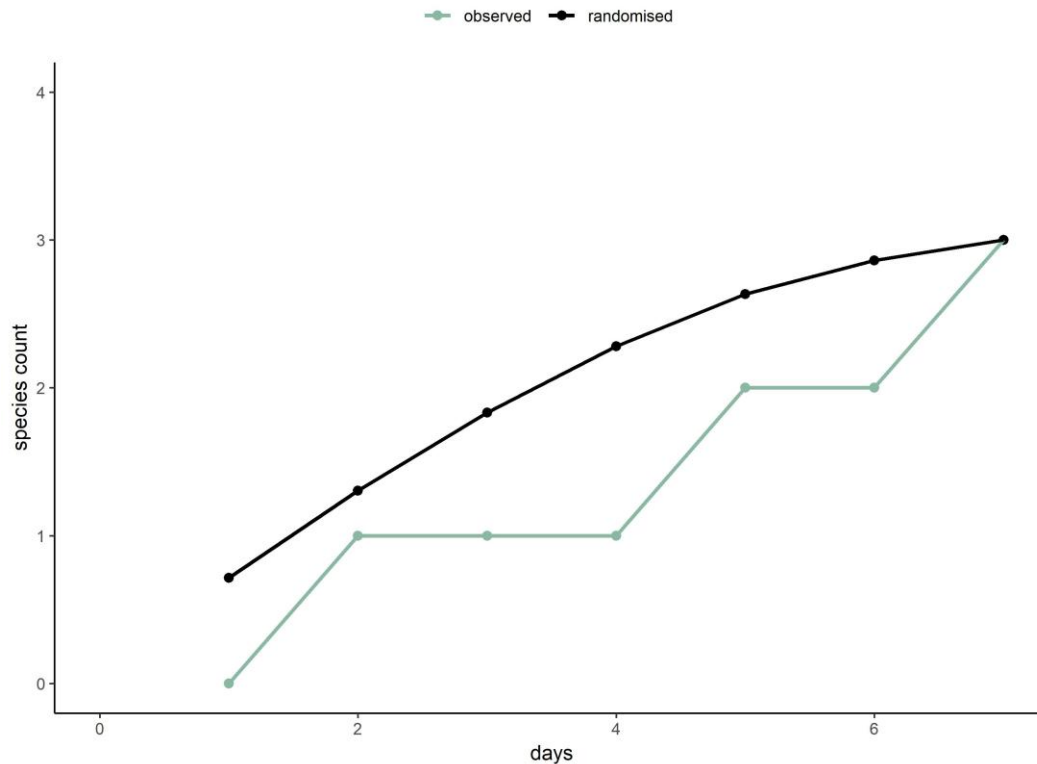


Figure 3.3: Mammal SAC

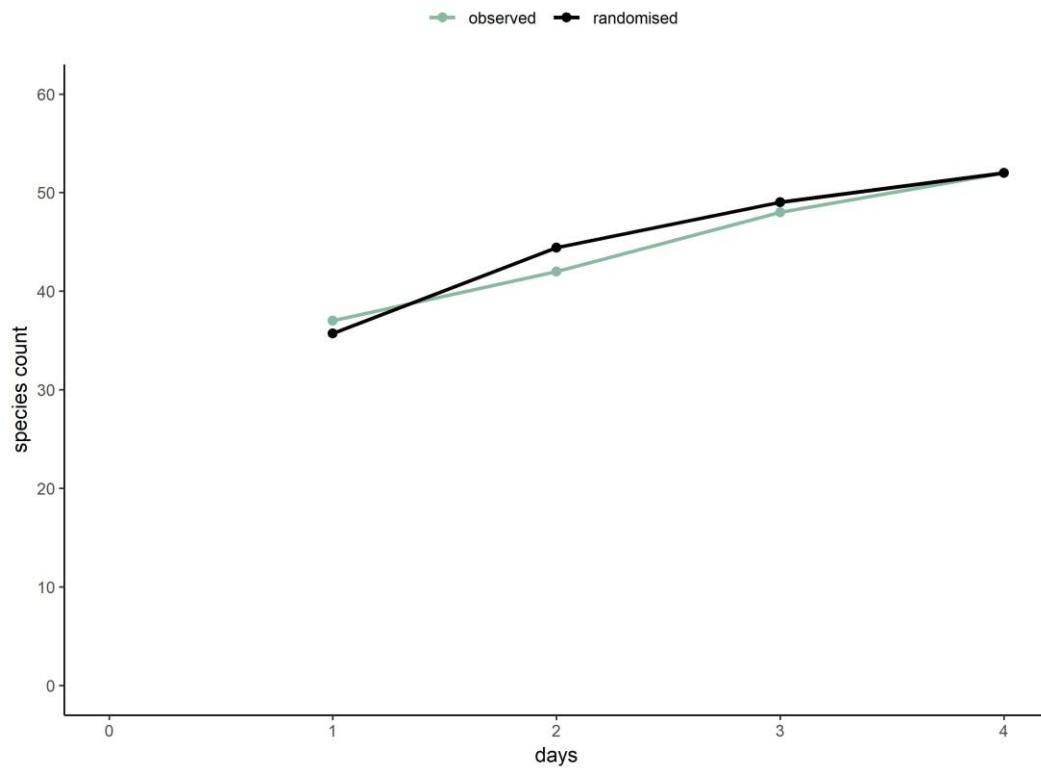


Figure 3.4: Avifauna SAC

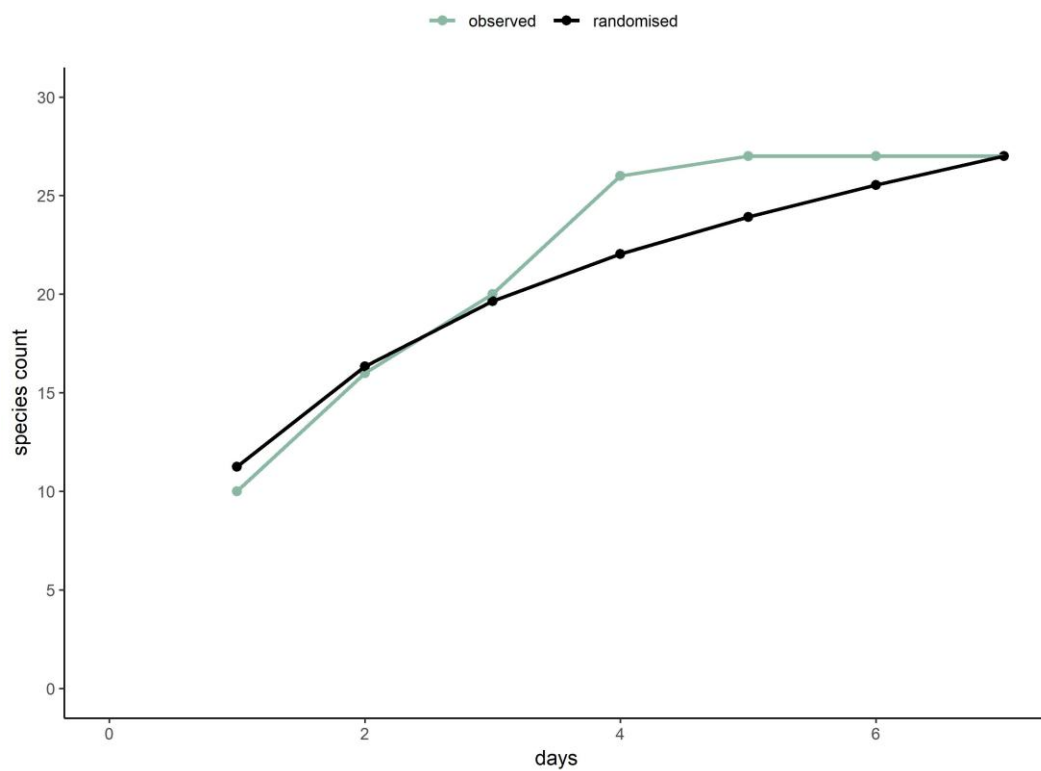


Figure 3.5: Herpetofauna SAC

Chao1 richness estimates obtained from systematic trapping data, are presented in Table 3.7. Richness estimates indicate that 94.0%, 91.0% and 71.6% of the trappable fauna assemblage were recorded during the survey for mammals, avifauna and herpetofauna, respectively (Table 3.7). However, standard errors are large and therefore, species estimates should be considered cautiously. The standard error is excessively high for the herpetofauna richness estimate, implying the estimate is especially inaccurate.

Table 3.7: Observed and Estimated Species Richness for Systematic Data

Fauna Group	Observed Number of Species	Chao1 Species Estimator	Standard Error	Percentage of Estimated Assemblage Recorded
Mammals	3	3.2	0.6	94.0
Avifauna	52	57.4	4.2	91.0
Herpetofauna	27	37.7	9.2	71.6
Total	82	98.3		

4. CONCLUSION

A total of 106 vertebrate species were recorded during the single-phase survey: 16 mammals (including three introduced), 60 birds, and 30 reptiles. These represent 31% of all mammal species identified, 33% of all bird species identified, and 25% of herpetofauna species identified from the desktop study as potentially occurring in the Survey Area.

Species accumulation curves for mammals, avifauna and herpetofauna species recorded via systematic sampling were conducted. However, they did not approach asymptote indicating that additional species are likely to be recorded with additional sampling effort. Richness estimates indicate that 94.0%, 91.0% and 71.6% of the trappable fauna assemblage were recorded during the survey for mammals, avifauna and herpetofauna, respectively. The Survey Area was extensively burnt in January 2024, nine months prior to the field survey. This burn covered approximately 41% of the Survey Area (2,999 ha) and covered most of the northern portion. While this fire did not impact on the collection of data it may have impacted on the faunal assemblage present at the time of the survey.

Five broad fauna habitats were characterised within the Survey Area, including:

- Hillcrest/Hillslope
- Gorge/Gully
- Minor Drainage Line
- Breakaway/Cliff
- Major Drainage Line.

Hillcrest/Hillslope was the dominant fauna habitat type within the Survey Area (73.5%), followed by Gorge/Gully (5.8%). Cleared/Disturbed areas accounted for 12.2% of the Survey Area but do not provide fauna values.

One significant species was recorded during the survey: the Western Pebble-mound Mouse (*Pseudomys chapmani*, Priority 4). Two individuals were trapped during the systematic trapping, and 10 mounds were recorded, five of which were active or recently active. The individuals were captured in Hillcrest/Hillslope habitat type, and the mounds were also in this habitat type or in close proximity to roads within Cleared/Disturbed areas.

Nine species of significant fauna have been recorded (previously or currently) or have a high likelihood to occur in the Survey Area. Critical, supporting and important habitats for these species are:

- Breakaway/Cliff:
 - Critical habitat for the Northern Quoll and Pilbara Olive Python.
 - Supporting habitat for Pilbara Leaf-nosed Bat, Ghost Bat and Grey Falcon.
 - Important habitat for Peregrine Falcon.
- Gorge/Gully:
 - Critical habitat for the Northern Quoll, Ghost Bat, and Pilbara Olive Python.
 - Supporting habitat for Pilbara Leaf-nosed Bat.
 - Important habitat for Peregrine Falcon, Pilbara Barking Gecko, and Gane's Blind Snake.
- Major Drainage Line:
 - Critical habitat for Grey Falcon.

- Supporting habitat for Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat (within 12 km of Category 1 or 2 Ghost Bat roosts), and Pilbara Olive Python.
- Important habitat for Peregrine Falcon.
- Minor Drainage Line:
 - Supporting habitat for Pilbara Leaf-nosed Bat, Ghost Bat (within 12 km of Category 1 or 2 Ghost Bat roosts), Grey Falcon, and Pilbara Olive Python.
 - Important habitat for Peregrine Falcon and Gane's Blind Snake.
- Hillcrest/Hillslope:
 - Critical habitat for Ghost Bat within 12 km of Category 1 or 2 Ghost Bat roosts.
 - Supporting habitat for Northern Quoll, Ghost Bat, Ghost Bat, Pilbara Leaf-nosed Bat, and Grey Falcon.
 - Important habitat for Western Pebble-mound Mouse, Pilbara Barking Gecko and Gane's Blind Snake.

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APPENDIX A: CONSERVATION CODES



Appendix A1: Definitions of Conservation Categories under the EPBC Act

Category	Definition
Extinct	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	The species is known to survive only in cultivation or in captivity, or as a naturalised population well outside its past range.
Critically Endangered	The species is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	the species is not critically endangered, but it is facing a very high risk of extinction in the wild in the near future
Vulnerable	The species is not critically endangered or endangered, but it is facing a high risk of extinction in the wild in the medium-term future.
Conservation Dependent	The species is the focus of a specific conservation program without which the species would become vulnerable, endangered or critically endangered within five years.
Migratory	The EPBC Act provides for protection of migratory species as a matter of national environmental significance. Migratory species are those animals that migrate to Australia and its external territories or pass through or over Australian waters during their annual migrations (DotE 2013). Migratory species are listed under the following international conventions: • Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention); • China-Australia Migratory Bird Agreement (CAMBA); • Japan-Australia Migratory Bird Agreement (JAMBA); and, • Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Appendix A2: Definitions of Conservation Categories Under the BC Act

Code	Definition (BC Act)
Threatened Species (T) Published as Specially Protected under the Wildlife Conservation Act 1950, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora). • Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act. • Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act.	
Critically Endangered (CR)	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".
Endangered (EN)	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".
Vulnerable (VU)	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".
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.	
Extinct species (EX)	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).
Extinct in the wild species (EW)	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".
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.	
Migratory species (MI)	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.

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

APPENDIX B: REGIONAL FAUNA APPENDIX



[illegible]

[illegible]

[illegible]

[illegible]

APPENDIX C: VERTEBRATE FAUNA SPECIES RECORDED



[illegible]

Macropodidae																									
<i>Osphranter rufus</i>													1												
<i>Petrogale rothschildi</i>														2											1
Muridae																									
* <i>Mus musculus</i>								1																	
<i>Pseudomys chapmani</i>			P4		1	1^	1																		9^
<i>Pseudomys desertor</i>										1															
Emballonuridae																									
<i>Saccolaimus flaviventris</i>																	R	R	R	R	R	R	R	R	
<i>Taphozous georgianus</i>																	R	R	R	R		R	R	R	
Molossidae																									
<i>Austronomus australis</i>																	R		R	R		R			
<i>Chaerephon jobensis</i>																	R	R	R			R	R		
<i>Ozimops lumsdenae</i>																	R	R	R	R	R	R	R	R	
Vespertilionidae																									
<i>Chalinolobus gouldii</i>																	R	R	R	R	R	R	R	R	
<i>Nyctophilus daedalus</i>																	R	R		R		R	R	R	
<i>Scotorepens greyii</i>																	R	R	R	R		R	R	R	
Canidae																									
* <i>Canis familiaris</i>															2										1
Bovidae																									
* <i>Bos primigenius</i>								2																	2

R - Ultrasonic recording, ^ - Mound record only, * - Introduced or naturalised species

APPENDIX D: NIGHT PARROT CALL ANALYSIS REPORT



Results of acoustic surveys conducted for Night Parrot (*Pezoporus occidentalis*)

Project 2430
Marillana Power
October 2024

Report to:
Spectrum Ecology

Prepared by:
Nick Leseberg
Adaptive NRM
19th September 2025



1. Summary

In October 2024, autonomous recording units (ARUs) were deployed to survey for Night Parrots (*Pezoporus occidentalis*) at four sites in the Marillana Power project area, located in the Hamersley sub-region of the Pilbara bioregion, in Western Australia. Resulting acoustic data was analysed using signal parameters optimised for detecting Night Parrot calls. No Night Parrots were detected.

2. Night Parrot distribution and ecology

Analysis of historical records suggest Night Parrots were formerly found throughout arid central Australia, before undergoing a significant decline and range contraction during the late-19th and early-20th centuries (Leseberg *et al.* 2021a). The species is now known from a small area in western Queensland, and the central and northern inland of Western Australia (Leseberg *et al.* 2021a, Lindsay *et al.* 2024). There are several unconfirmed historical reports of Night Parrot from the Hamersley sub-region, and one 1975 record considered of high veracity from near Newman, 90 km southeast of the project area (Leseberg *et al.* 2021). There are several confirmed contemporary reports from the neighbouring Fortescue bioregion, the closest being around 45 km northeast of the project area. As Night Parrots are known from the surrounding region, it is feasible that if suitable habitat exists in the project area, Night Parrots could occur there.

Night Parrots in western Queensland, and central and northern Western Australia, establish long-term stable roost sites in long unburnt *Triodia* (Jackett *et al.* 2017, Murphy *et al.* 2017b, Ngururrpa Rangers *et al.* 2024), and may occupy these sites for extended periods of up to several years (S. Murphy, N. Leseberg unpubl. data). These long-term stable roost sites support both roosting and breeding. Although the total extent of *Triodia* at these sites does not appear critical, the size distribution of hummocks is important. The sites where Night Parrots occur all contain at least some patches of large, long unburnt *Triodia* hummocks, and are in open areas with few, if any, trees or shrubs (Jackett *et al.* 2017, Ngururrpa Rangers *et al.* 2024).

Unpublished DNA analyses of faecal samples show that Night Parrots in western Queensland eat a relatively broad array of food plants including grasses (e.g. *Triodia longiceps*, *Uranthoecium truncatum*, *Brachyachne ciliaris*, *Astrebla lappacea*, *Dactyloctenium radulans*) and forbs (e.g. *Trianthema triquetra*) (S. Murphy, N. Leseberg, unpubl. data). Tracking studies

show that while foraging at night, Night Parrots access these resources by visiting floristically diverse run-on zones in the landscape, which can be large (e.g. floodplains) or small (e.g. gilgai formations) (Murphy *et al.* 2017b). Like roosting areas, these foraging areas are typically very open, with few, if any, trees or shrubs (Murphy *et al.* 2017b). The birds are known to visit foraging areas and drinking sites up to 10 km from their roosting sites (Murphy *et al.* 2017b). The proximity of such areas to suitable roosting habitat is likely to be an important factor determining the ability of a landscape to support Night Parrots.

3. Survey methodology

Research in western Queensland has shown that Night Parrots have predictable year-round calling periods at dusk and dawn (Murphy *et al.* 2017a, Leseberg *et al.* 2019). This ensures that if Night Parrots are roosting at a particular site, the likelihood of detecting them using ARUs is high, provided the ARU is placed for a minimum of four nights in calm weather, and set to record during the peak calling periods. During breeding, and following large rain events, calling is more frequent, extends throughout the night, and the likelihood of detection is increased (Murphy *et al.* 2017a). Preliminary results from research in central Western Australia suggest patterns of behaviour in that region are similar (Jackett *et al.* 2017, Ngururrpa Rangers *et al.* 2024).

Night Parrots are also known to call during the night at feeding and drinking sites (Ngururrpa Rangers *et al.* 2024). Anecdotal evidence suggests they may call when moving between these sites (N. Leseberg, N. Jackett, S. Murphy unpubl. data). However, the detection of birds away from roosting sites is likely to be a chance event given the large area over which birds range at night (Murphy *et al.* 2017b).

Night Parrots are known to drink, and modelling suggests they may be reliant on free-standing water (or succulent food containing >55% water) during hot weather (Kearney *et al.* 2016). Birds have been detected in the Great Sandy Desert by focusing survey effort at water sources (Lindsay *et al.* 2024). It is likely this technique will be most effective during periods of water scarcity, when survey effort can focus on just a few possible locations.

The likelihood of detection is also influenced by the type of ARU being used. In calm conditions, a Song Meter 4 (Wildlife Acoustics, MA, USA), the ARU type used for most of

these surveys, is known to be capable of reliably detecting 95% of Night Parrot calls out to a range of around 205 m (Leseberg *et al.* 2022).

While Night Parrots are relatively easy to detect at their roosting sites using ARUs, at all locations where the birds are known to be present, they apparently occur at low densities within the landscape more broadly (Leseberg *et al.* 2021b). Further, there is emerging evidence that while Night Parrots may be resident within the landscape more broadly, they do move in and out of specific roost sites over time. Therefore, a survey program that focuses on short duration surveys in likely roosting habitat will only be able to determine whether Night Parrots are roosting in the immediate vicinity of the survey site at the time of sampling. More robust conclusions around the presence of Night Parrots within the landscape require longer duration surveys of likely roosting sites.

4. Survey effort

Sampling was conducted at four sites in the project area. Song Meter 4 ARUs were deployed at all sites and recorded a total of 22 nights of data (Table 1). Each ARU recorded the recommended recording period for Night Parrot surveys from 25 minutes after sunset until 25 minutes before sunrise (DBCA 2024). Two ARUs recorded seven nights of data, while two recorded only four nights of data. As recording conditions were generally good, with little wind, it is likely that if Night Parrots were roosting or foraging within 200 m of these sites during the survey period, they would have been detected.

Table 1. Bioacoustic recordings analysed for the October 2024 survey period.

Machine ID	Recording start date (PM)	Recording end date (AM)	Total recording nights
MPN-01	20-Oct-24	27-Oct-24	7
MPN-02	20-Oct-24	27-Oct-24	7
MPN-03	23-Oct-24	27-Oct-24	4
MPN-04	23-Oct-24	27-Oct-24	4
Total			22

5. Data analysis

ANRM received the raw acoustic data as '.wav' files. These were scanned using the software Kaleidoscope Pro, targeting the frequency range of 1500 – 3500 Hz, within which all known Night Parrot calls are distributed (Leseberg *et al.* 2019). Search parameters were optimised using a random selection of 250 Night Parrot call examples manually detected from both Great Sandy Desert and East Murchison datasets, of which 205 (82.0%) were automatically detected. Calls not detected were typically extremely faint. The probability of non-detection of a true-positive call was 18.0%; two true-positive calls was 3.2%; three true-positive calls was 0.6%; etc. Of the data tested, the median number of consecutive (spaced at < 5 minutes apart) calls in a sequence when Night Parrots were recorded was 5 (1–34, $n = 29$). The probability of at least one call being detected within a sequence of median length, assuming there was variation in the location of the source of the call, was > 99.9%.

Any detections outside of the 25-minute post-sunset to 25-minute pre-sunrise period were filtered out. Remaining detections were then compared to a reference library comprising several thousand Night Parrot calls from Western Australia. This library consists of calls recorded at sites where Night Parrots have been confirmed using visual means and is therefore considered of high reliability. The library also comprises multiple examples of all known call types from Western Australia (Leseberg *et al.* 2019).

6. Survey results

A total of 36,202 Kaleidoscope detections were manually assessed for Night Parrot vocalisations. No calls attributable to Night Parrots were detected during the analysis.

7. Conclusion

It is unlikely long-term stable Night Parrot roosts exist within approximately 200 m of the two sites sampled during this survey, at the time of sampling. Additionally, it is unlikely that Night Parrots were foraging in proximity to the two sites at the time of sampling.

It is important to reinforce that these results pertain specifically to that area immediately surrounding these survey points, and only for the period during which the survey was conducted. The results of these surveys do not enable robust conclusions about the presence or

absence of Night Parrots in the wider landscape. As Night Parrots are known from areas of suitable habitat in proximity to the project area, it is possible that if suitable Night Parrot habitat exists within the project area, Night Parrots may occur there.

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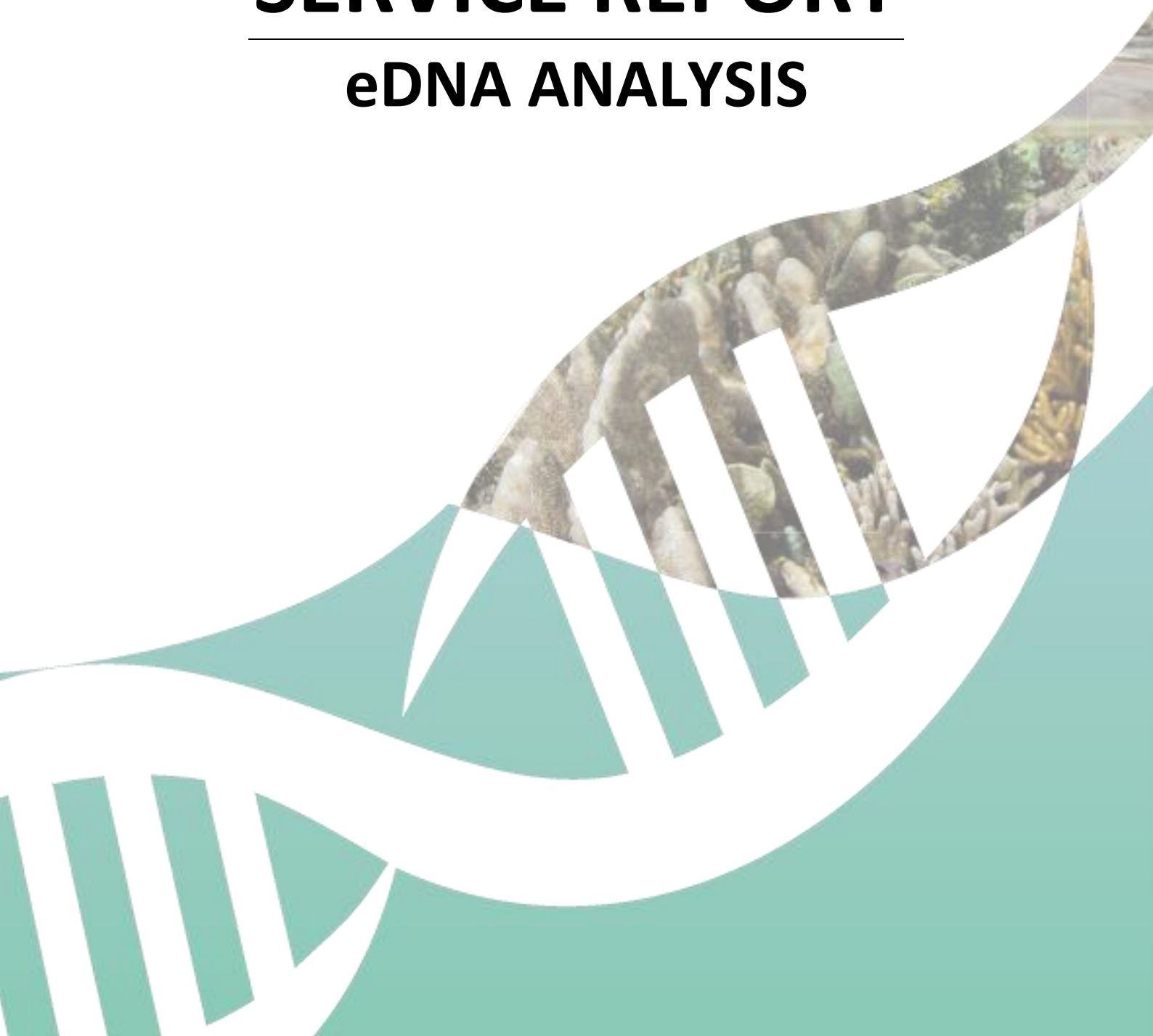
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APPENDIX E: PILBARA OLIVE PYTHON EDNA ANALYSIS REPORT



SERVICE REPORT

eDNA ANALYSIS



ASSAYS



Universal



Fish



Sharks &
Rays



Corals



Crustaceans



Bacteria



Plants &
Algae



Mammals



Insects



Vertebrates



Molluscs



Reptiles



Birds



Fungi

SAMPLES



Water



Plankton
tows



Sediment



Deposition
arrays



Biofoul



Bore water



Scats



Tissue



Plants



Fossils



Pollen



Stomach
contents

DNA	Deoxyribonucleic acid
eDNA	Environmental DNA
NCBI	National Centre for Biotechnology Information
OTU	Operational taxonomic unit
ZOTU	Zero-radius operational taxonomic unit
AIS	Alien Invasive Species
LULU	A post-clustering algorithm for curation of DNA amplicon data
PCR	Polymerase chain reaction
mtGenome	The full mitochondrial genome
fasta	A formatting type for sequence data
18S	The nuclear gene region, 18S
COI	The mitochondrial gene region, cytochrome c oxidase I
16S	The mitochondrial subunit ribosomal RNA gene region, 16S
12S	The mitochondrial gene region, 12S

DISCLAIMER

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Note: If this eDNA report has specific parts reproduced and cited within a wider report on field work, results displayed should be attributed to eDNA Frontiers (Curtin University) and the report included in an appendix in its entirety for referencing purposes.

Project Details

Scope of Work: EF514

Project Title: Pilbara olive python detection from filtered water samples taken in the Pilbara area using species specific eDNA analysis (qPCR).

Client Details

Client: Spectrum Ecology Pty Ltd (ABN: 68 615 115 243)
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Contact: Joel Wilson | Senior Zoologist
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Report Details

Report reference: EF514_Spectrum_Final Report

Report issue date: 03/12/2025

Laboratory start date: 01/10/2025 Laboratory end date: 22/10/2025

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Approvals

Dr Kathryn Dawkins
(Author)

1.0 OBJECTIVE

The objective of this study was to assess the presence of *Liasis olivaceus barroni* (Pilbara olive python) using species-specific qPCR applied to environmental DNA.

1.1 Study Scope

Using environmental DNA (eDNA) testing, eDNA Frontiers was tasked with analysing water samples for the presence of *Liasis olivaceus barroni* (Pilbara olive python). The client provided a total of four samples consisting of water filtrate suspended on 1.2µm filter membranes (Tables 1 and 2). Water was filtered using a hand-driven syringe system, with samples preserved in DNA Shield.

2.0 SAMPLE DETAILS

Table 1. Sample receipt details.

Date received:	29/08/2025
Transport temp:	Ambient (DNA Shield)
Number of samples:	4
Storage:	All samples were stored ambiently prior to analysis.

Table 2. Supplied sample details. * indicates samples that required additional DNA Shield to be passed through the filter as there was none present at the time of extraction.

eDNA Frontiers ID	Client Sample ID	Sample Type	Collection Date	Collection Location
E_514_001	MPEDNA-01 S1	Water - syringe	24/10/2024	Marillana
E_514_002	MPEDNA-01 S2	Water - syringe	25/10/2024	Marillana
E_514_003*	MPEDNA-01 S3	Water - syringe	26/10/2024	Marillana
E_514_004	MPEDNA-01 S4	Water - syringe	27/10/2024	Marillana

3.0 METHODS

3.1 Sample Collection

Water samples were collected at one location by Spectrum staff in October 2024. Samples were filtered using 1.2µm filters with a hand driven syringe system to capture eDNA present in the water. All filtering was carried out by Spectrum staff. All samples were transported at ambient temperature while preserved in DNA Shield to eDNA Frontiers' laboratories where they were stored until scheduled for DNA extraction.

3.2 eDNA Extraction and Analysis

The DNA Shield was removed from each cartridge unit and DNA was extracted using a custom protocol on the Kingfisher Flex system. One sample (E-514-003) did not have any preservative retrieved; a new aliquot of DNA Shield was pushed through the filter cartridge to use for extraction. Samples were analysed using a species-specific probe-based assay targeting the Pilbara olive python. Samples were analysed in triplicate at two dilutions (neat and 1/10), with positive and negative controls included for all analyses. Any sample that showed amplification had one replicate Sanger sequenced to verify the positive detection. For Sanger generated sequences, Geneious Prime (version 2025.1.3) was used to trim and align the forward and reverse amplicons, and from this generate a consensus sequence where amplicons were clean enough to do so. Consensus sequences were then aligned against a *Liasis olivaceus barroni* sequence to confirm positive identifications. Where amplicons were not clean enough to produce a consensus sequence, the forward and reverse sequence were blasted separately against a *L. olivaceus barroni* sequence to determine if there was enough overlap and similarity between them to verify a positive detection.

4.0 RESULTS

4.1 Species-specific qPCR analysis

Result criteria:

Positive:	Indication of exponential amplification with a C_T average of <45
Possible:	Indication of exponential amplification with a C_T average of 45-50
Negative:	Lack of amplification, C_T average 50 and above

Note: Any amplification in any number of replicates should be considered an indication of potential presence of the target DNA within the sample. The criteria above flag a threshold for where positive amplification may become less reliable, but these instances should still be considered as possible detections. Also, as there may be other closely related species that do not yet have reference sequences available, the qPCR does not necessarily rule out the possibility of cross-amplification of these species and thus a false-positive.

Amplification was observed in one environmental sample (E-514-003; Table 3). All positive controls amplified for all replicates, and no extraction or negative controls showed amplification for any replicate. The replicate that showed amplification was Sanger sequenced to confirm the species identity. When aligned with the positive control sequence it was found to be a match, which could be indicative of contamination. As such, this sample was re-amplified by qPCR without the positive control included; no amplification was observed. Therefore, the results from the first round of amplification were determined to be spurious, and no environmental sample was recorded as showing a positive detection.

Table 3. Cycle threshold (C_T) results for samples amplified using the species-specific probe-based assay targeting *Liasis olivaceus barroni*. Only environmental samples that showed amplification are reported. Only samples verified through Sanger sequencing are noted as positive detections.

Sample	Client Sample ID	Dilution	Replicate 1	Replicate 2	Replicate 3	Average C _T	Result
E-514-003	MPEDNA-01 S3	Neat	34.66	-	-	34.66	Negative
		1/10	-	-	-	-	
Extraction control		Neat	-	-	-	-	Negative
Negative control		Neat	-	-	-	-	Negative

5.0 SUMMARY

Of the four samples tested, one positive detection was made using the species-specific probe assay targeting *Liasis olivaceus barroni* with this verified through Sanger sequencing. This sample was recorded as being collected from MPEDNA-01 S3.

ARCHIVING OF STUDY DATA

The DNA extracts derived from this study will be stored within eDNA Frontiers' premises for a period of 12 months. If samples are required to be stored longer a sample archiving service can be provided.

All electronic data relating to the study is stored in an offsite secure server. This includes; all laboratory raw data; personnel records; and the study report. Hard copy documents are archived by study number into a locked area of the test facility located in eDNA Frontiers, Curtin University administration area.