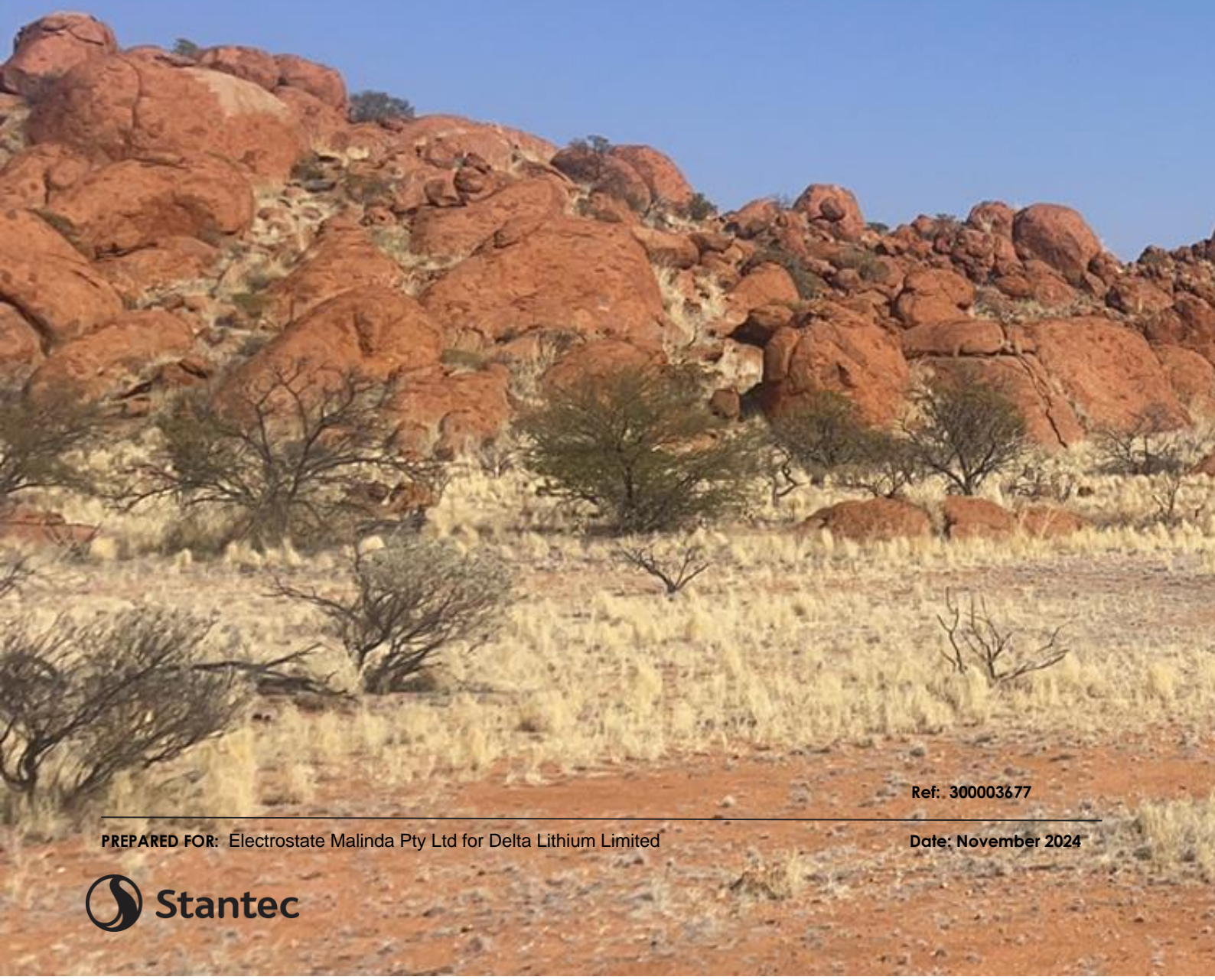


Yinnetharra Detailed Terrestrial Vertebrate Fauna and Short-range Endemic Invertebrate Fauna Survey



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4.0	12/12/2025	Final Report	Paul Bolton	Paul Bolton	Paul Bolton	Paul Bolton

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Executive Summary

Background and Objective

Electrostate Malinda Pty Ltd (Electrostate) is a lithium exploration company currently seeking to develop the Yinnetharra Lithium Project (the Project) in the Gascoyne bioregion of Western Australia. Stantec Australia Pty Ltd (Stantec) was commissioned to undertake a dual phase Detailed Terrestrial Vertebrate Fauna and Short-range Endemic (SRE) Invertebrate Fauna Survey (the Detailed Survey) of three tenements held by Electrostate: E09/2169, E09/2170 and E09/2283 (the Survey Area). The Survey Area, totalling 11,215.3 ha, is located 110 kilometres (km) north-east of Gascoyne Junction.

This work within the report has been conducted in accordance with the EPA guidelines and will be used to support the submission of the necessary regulatory approvals required to commence operations.

The objective was addressed by conducting a comprehensive desktop assessment and Reconnaissance Survey prior to undertaking the following surveys: Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Fauna Survey and the Targeted Yinnetharra Rock-dragon Survey.

The survey work consolidated within this report was conducted over multiple surveys, including:

- Reconnaissance Survey: 6 – 11 June 2023;
- Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Survey Phase 1: 8 – 19 September 2023;
- Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Survey Phase 2 (Trip 1): 4 – 11 April 2024;
- Targeted Yinnetharra Rock-dragon Survey: 30 April – 3 May 2024.
- Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Survey Phase 2 (Trip 2): 21 – 27 May 2024; and

The objective of the Detailed Survey was to understand the vertebrate and SRE invertebrate fauna values of the Survey Area to inform an environmental assessment for the Project, with a specific focus on the following significant vertebrate fauna species (their conservation status under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Biodiversity Conservation Act 2016* (BC Act), respectively, with a summary of the listings used to describe conservation status provided in Appendix A:

- Yinnetharra Rock-dragon (*Ctenophorus yinnetharra*; EPBC Act: Vu, BC Act: Vu)
- Long-tailed Dunnart (*Antechinomys longicaudata*; BC Act: P4)
- Southern Whiteface (*Aphelocephala leucopsis*; EPBC Act: Vu)
- Grey Falcon (*Falco hypoleucos*; EPBC Act: Vu, BC Act: Vu)
- Peregrine Falcon (*Falco peregrinus*, BC Act: OS)
- Night Parrot (*Pezoporus occidentalis*) (EPBC Act: En, BC Act: Cr).

Significant Species

The desktop assessment comprised nine database searches and the review of two fauna surveys previously undertaken within the surrounding regions of the Survey Area. Twenty-eight significant vertebrate fauna species listed under the EPBC Act 1999 or the BC Act 2016 were identified as having potential to occur within the Survey Area. One significant species was recorded within the Survey Area during the Detailed Survey: the Southern Whiteface (*Aphelocephala leucopsis*; Vu). Based on the desktop assessment and habitats identified within the Survey Area, one additional significant fauna species was assessed as likely to occur, four as possible, and 11 as unlikely to occur. In addition, 11 species were excluded from the likelihood of occurrence assessment as the Survey Area is outside their known distribution.



Survey Effort

Survey methods for the Detailed Vertebrate Fauna and SRE Invertebrate Fauna Survey consisted of eight systematic trapping sites, for a duration of seven nights each, equating to a survey effort of 2,912 trapping nights per phase, with a combined total of 5,824 trap nights conducted for the Detailed Survey. Systematic sites comprised pitfall, small Elliot, funnel and cage trapping, as well as avifauna census, motion-sensor camera, echolocation recorder and systematic searching methods. Targeted methods used during the Detailed Survey comprised targeted searching (vertebrate and SRE invertebrate fauna), funnel traps (72 trap nights), motion-camera deployment (181 recording nights), opportunistic recording, acoustic bird call recording (54 recording nights), and bat echolocation recording (60 recording nights).

A total of 126 species of vertebrate fauna were recorded during the Detailed Survey representing 43.6% of the total number of species identified from the database searches and literature review (n=289). Vertebrate species recorded during Detailed Survey comprised 18 native mammals, four non-native mammals, 74 native birds, 29 reptiles and one amphibian. Additionally, 13 taxa (70 specimens) from Short Range Endemic (SRE) Invertebrate fauna target groups were collected from systematic pitfall traps, and targeted searches during the Survey, representing 30% of the total number of taxa identified from the database searches and literature review (n=43). Of these, 11 taxa were assessed as potential SREs due to insufficient geographical context.

Survey methods for the Targeted Yinnietharra Rock-dragon Survey consisted of 15 targeted searches (15 person hours) conducted within in the Survey Area and the surrounding areas within the region where the species has been historically recorded. Additionally, 17 habitat assessments were undertaken at targeted search locations and opportunistically where Yinnietharra Rock-dragon were recorded to gain a better understanding of the species' habitat preferences. The data were then used to create criteria for assessing the suitability of habitat for the Yinnietharra Rock-dragon. Data from the field survey were used to create a species distribution model (SDM) to map the probability of the species occurring in the Survey Area.

Fauna Habitats

Nine broad fauna habitat types were identified within the Survey Area: Stony Plain, Minor Drainage, Low Hills, Alluvial Plain, Major Drainage, Rocky Outcropping, Rocky Hill, Mulga Woodland and Sandy Plain. Of these, Major Drainage, Minor Drainage, Low Hills, Rocky Hill and Mulga Woodland were considered significant habitats due to the potential for breeding and/or foraging habitat for Matter of National Environmental Significance (MNES) species. One MNES species, the Southern Whiteface was recorded within the Study Area and Major Drainage, Minor Drainage and Mulga Woodlands habitat are considered critical habitat for the Southern Whiteface and contain suitable vegetation for foraging and nesting. Major Drainage habitat provides suitable nesting habitat for the Peregrine Falcon, a species which is considered likely to occur in the Survey Area. No suitable habitat for the Yinnietharra Rock-dragon was recorded within the Survey Area.

Three habitats were classified as having high SRE potential as they contained multiple microhabitat features and were of limited extent. These comprise Rocky Outcropping, Major Drainage and Rocky Hill.

Assemblages

The fauna assemblages within the Survey Area were sampled at systematic trapping sites. Species accumulation curves of reptiles, birds and mammals indicated that between 73% to 100% of these fauna assemblages were captured during the Detailed Survey. All accumulation curves of each group began to reach an asymptote, indicating that systematic sampling was largely sufficient, capturing most or all of the detectable species at the locations sampled. The species accumulation curves suggest that additional systematic survey effort would not significantly increase the number of species recorded in the Survey Area, however it is possible that additional systematic survey effort may result in additional species being detected. Additional mammal, avifauna and herpetofauna species were recorded within the Survey Area via targeted and opportunistic survey methods that were not captured in the species accumulation curves.

In summary, the species assemblages recorded during the Detailed Survey were comparable to those of a previous survey undertaken in the vicinity of the Survey Area. One significant terrestrial vertebrate fauna species, the Southern Whiteface, was recorded from four locations within the Survey Area within Minor Drainage, Sandy Plain, and Stony Plain habitat. Suitable habitat for the Southern Whiteface occurs within Major Drainage (nesting habitat), Minor Drainage (scattered isolated trees suitable for nesting and areas with suitable understorey for foraging) and Mulga Woodlands (Shrublands dominated by acacia with suitable understorey for foraging). One significant species is considered likely to occur, the Peregrine Falcon.



1. Introduction

1.1 Project Background

Electrostate Malinda Pty Ltd (Electrostate) is a lithium exploration company currently seeking to develop the Yinnetharra Lithium Project (the Project) in the Gascoyne bioregion of Western Australia. Stantec Australia Pty Ltd (Stantec) was commissioned to undertake a dual-phase Detailed Terrestrial Vertebrate Fauna and Short Range Endemic (SRE) Invertebrate Fauna Survey (the Detailed Survey) of three tenements held by Electrostate: E09/2169, E09/2170, and E09/2283 (the Survey Area). The Survey Area, totalling 11,215.3 ha, is located 110 kilometres (km) north-east of Gascoyne Junction (Figure 1-1).

A dual-phase Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Fauna Survey was undertaken within the Survey Area to understand the key environmental factors that may be impacted by proposed mining activities. The intent of this survey is to determine the assemblage of fauna species and the occurrence of significant species within the Survey Area, and to map the fauna habitats present. This will indicate the size and scale of any potential impacts to terrestrial vertebrate and SRE invertebrate fauna and inform the environmental impact assessment for the Project. No previous fauna surveys have been completed in the Survey Area.

1.2 Scope and Objectives

The overarching objective of the Detailed Survey was to define the fauna values of the Survey Area to inform future environmental assessments for the Project. The specific objectives included the following:

- Complete a comprehensive desktop assessment of the Survey Area;
- Conduct a dual-phase Detailed Terrestrial Vertebrate Fauna Survey to assess the occurrence and likely distribution of fauna assemblages within the Survey Area;
- Conduct targeted searches for vertebrate fauna of significance and SRE invertebrate fauna in prospective habitats to ascertain their occurrence and distribution;
- Identify, describe and map fauna habitats within the Survey Area; and
- Assess the Detailed Survey findings in a local and regional context providing comparison with available data within the bioregion.

The objectives and methods adopted for these surveys are aligned with the following relevant regulatory guidelines:

- Environmental Factor Guideline: Terrestrial Fauna (EPA 2016b);
- Technical Guidance Sampling of Short-range Endemic Invertebrate Fauna (EPA 2016a);
- Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020);
- Survey Guidelines for Australia's Threatened Bats (DEWHA 2010a);
- Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b);
- Survey Guidelines for Australia's Threatened Reptiles (DEWHA 2011);
- Interim Guideline for Preliminary Surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia (DPaW 2017a);
- Guidelines for Determining the Likely Presence and Habitat Usage of Night Parrot (*Pezoporus occidentalis*) in Western Australia (DBCA 2024b); and
- Department of the Environment Matters of National Environmental Significance – significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (DoE 2013).



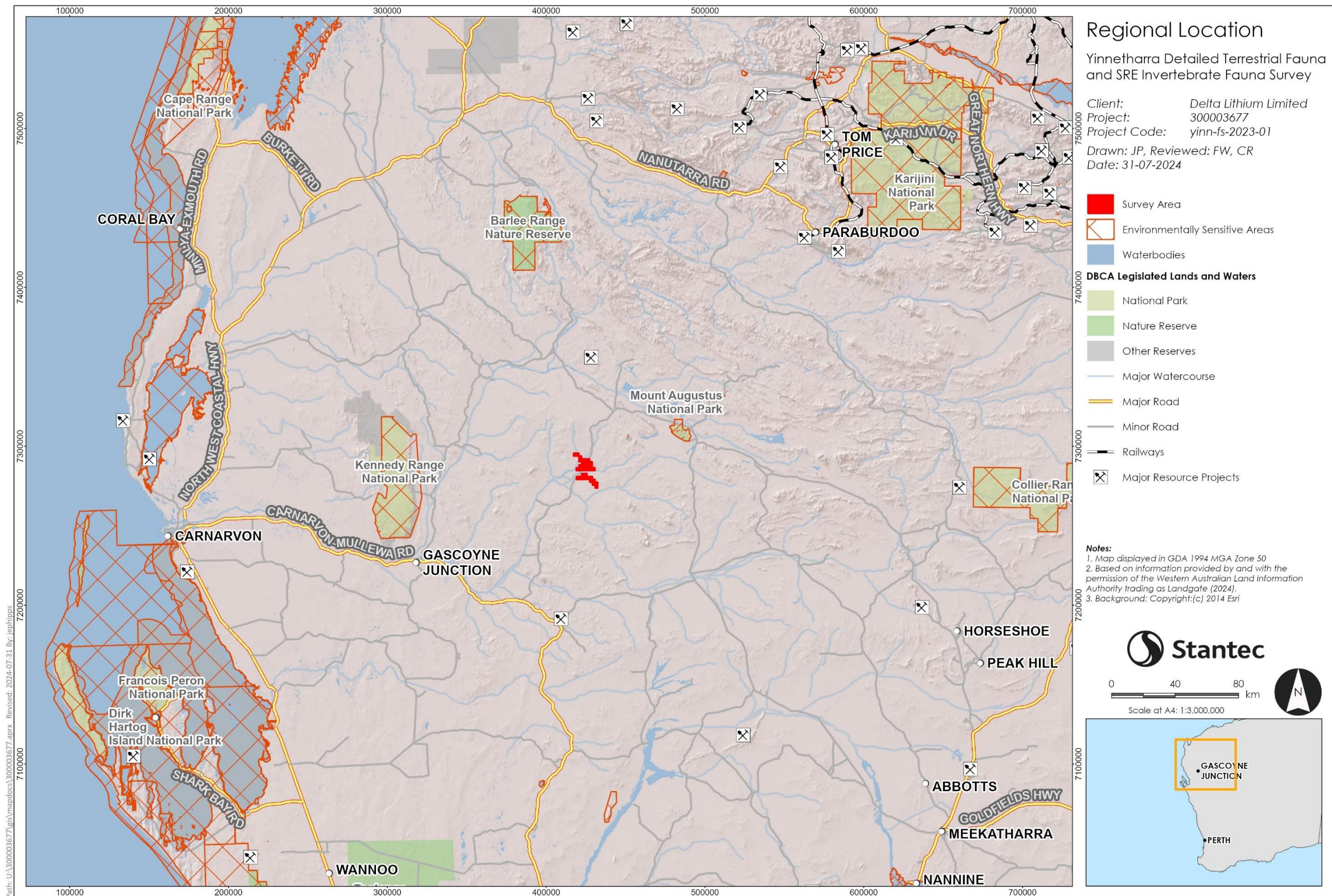


Figure 1-1: Regional location of the Survey Area.

2. Existing Environment

2.1 Biophysical Environment

2.1.1 Biogeographical Location

The Interim Biogeographic Regionalisation for Australia (IBRA) is a bioregional framework that divides Australia into 89 biogeographic regions and 419 subregions on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell 1995). It was developed through collaboration between state and territory conservation agencies with coordination by the Department of the Environment, Water, Heritage and the Arts (now the Department of Climate Change, Energy, the Environment and Water). The bioregions and subregions are the reporting unit for the systematic development of a comprehensive, adequate and representative National Reserve System.

The Survey Area occurs within the Augustus (GAS3) subregion of the Gascoyne bioregion (Figure 2-1). The Gascoyne bioregion encompasses approximately 180,752 km² of land in northern Western Australia (DoAWE 2022a), with the GAS3 subregion comprising approximately 53% of the Gascoyne bioregion (10,687,739 ha) (Desmond *et al.* 2001). The GAS3 subregion sits on the northern margin of the Yilgarn Craton and consists of low, rugged areas of Proterozoic sedimentary and granite ranges, partitioned by broad flat valleys (Desmond *et al.* 2001). The Gascoyne River provides the main drainage of the subregion; however, the subregion is also the headwaters of both the Ashburton and Fortescue Rivers. The vegetation of the subregion includes Mulga (*Acacia aneura* complex and its close relatives) woodland over *Triodia* grasses on shallow stony loams found on rises, and Mulga woodland on the earthy loams of the hardpan plains (Desmond *et al.* 2001).

2.1.2 Land Systems

Land systems are defined as an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation (Tille 2006). An understanding of land systems provides an indication of the occurrence and distribution of vegetation types and fauna habitats within and surrounding the Survey Area.

A rangeland survey was undertaken in the Gascoyne River catchment in 1969, by the then Department of Agriculture (now the Department of Agriculture and Food) and the then Department of Land Administration (now Landgate). The objective of the survey was to develop a comprehensive description of biophysical resources and assess the vegetation composition and soil condition within the region (from an agricultural perspective) (Wilcox and McKinnon 1972). This information was used to classify and map the land systems of the Gascoyne River catchment according to landform, soil, vegetation, geology and geomorphology (Wilcox and McKinnon 1972).

The Survey Area intersects eight land systems (Table 2-1; Figure 2-2). The Durlacher land system occupies most of the Survey Area (44.25%), and is defined by stony plains, lower tributary drainage plains and low stony rises, supporting tall shrublands of mulga, other acacias and low chenopod shrubs.

Table 2-1 Description of land systems associated with the Survey Area (van Vreeswyk *et al.* 2004)

Land System	Description	Extent in the bioregion		Extent in the Survey Area	
		Ha	%	Ha	%
Durlacher System	Stony plains, lower tributary drainage plains and low stony rises, supporting scattered tall shrublands of mulga, other acacias and chenopod low shrubs.	644,119.43	3.56%	4,963.08	44.25%
Phillips System	Low hills and undulating uplands on gneiss and quartz supporting mulga and other acacia tall shrublands	812,073.73	4.49%	3,904.28	34.81%
Yinnietharra System	Scattered granite tors and domes above stony slopes, broad sandy plains with groved vegetation and wide drainage tracts; supporting tall	141,295.87	0.78%	759.01	6.77%



Land System	Description	Extent in the bioregion		Extent in the Survey Area	
		Ha	%	Ha	%
	shrublands of mulga and other acacias.				
James System	Low hills, ridges and tors of granite and quartz, with stony lower plains, rises and drainage floors, supporting scattered tall shrublands of mulga and other acacias.	20,2841.64	1.12%	745.60	6.65%
Gascoyne System	River channels and associated narrow alluvial plains and inclusions, supporting river redgum fringing woodlands, also mulga and other acacias, <i>Senna</i> spp. and buffel grass.	215,174.88	1.19%	613.15	5.47%
Augustus System	Rugged ranges, hills, ridges and plateaux with skeletal soils supporting mulga and other acacia shrublands in southern parts or hard spinifex grasslands in northern parts	1,918,236.55	10.61%	175.10	1.56%
Agamemnon System	Low hills and undulating uplands and gneiss and quartz supporting mulga and other acacia tall shrublands.	425,827.23	2.36%	28.53	0.25%
Nadarra System	Plains and calcrete rises with chenopod shrublands and hard spinifex grasslands.	115,605.35	0.64%	26.51	0.24%
Total		4,475,174.68	24.76%	11,215.26	100.00%



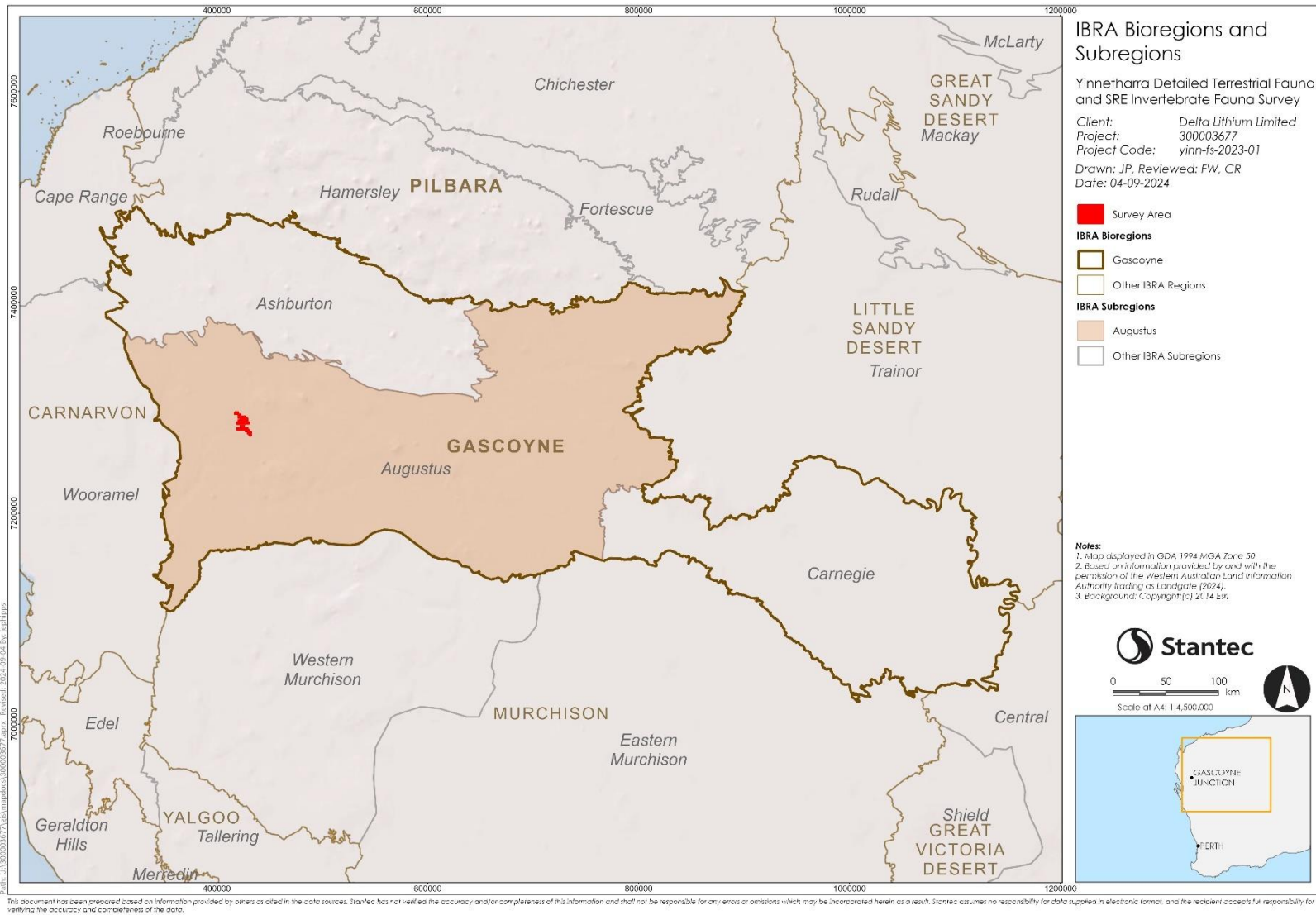


Figure 2-1: IBRA regions in relation to the Survey Area.

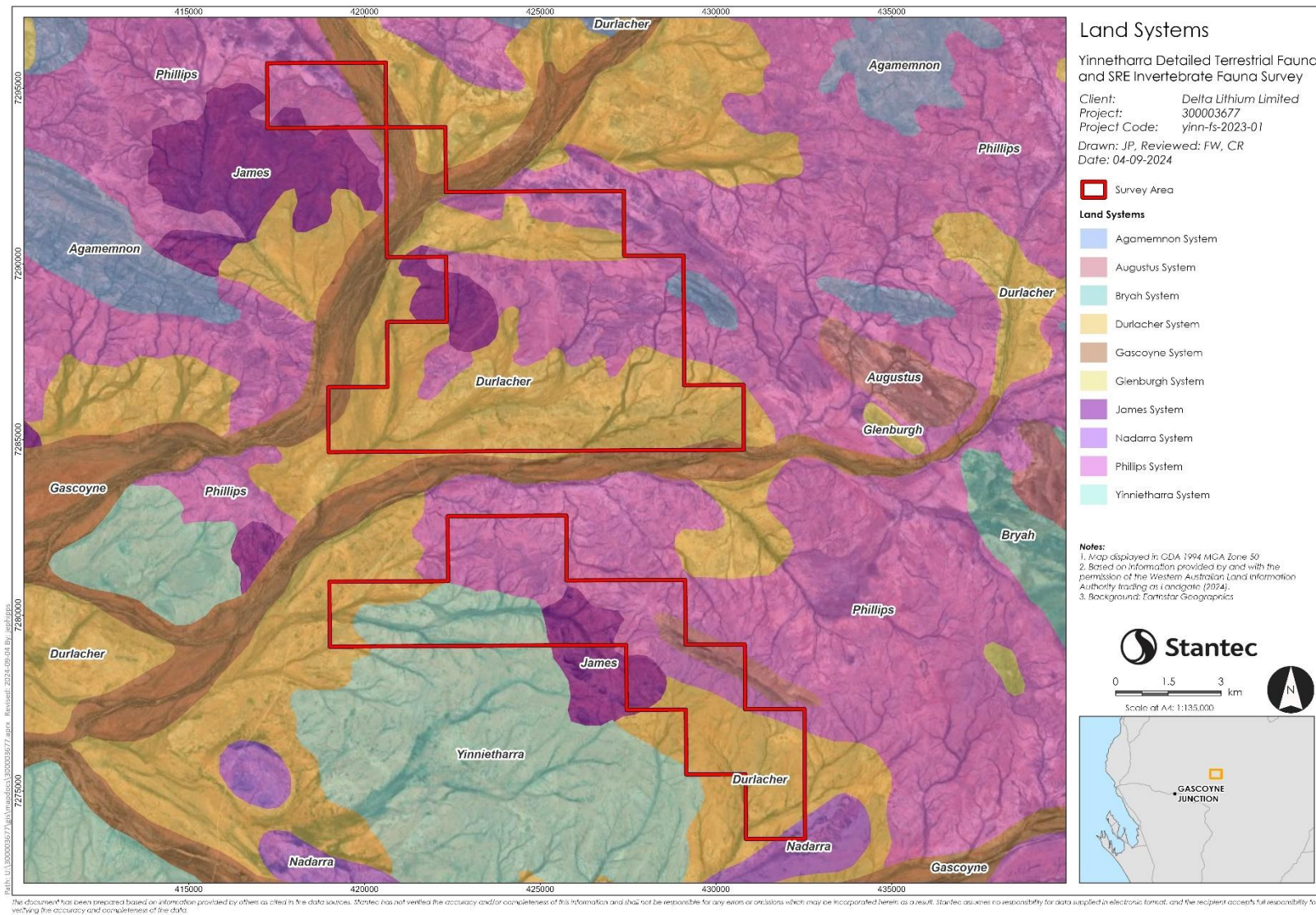


Figure 2-2: Land systems of the Survey Area.

2.1.3 Flora And Vegetation

The Survey Area occurs in the Ashburton Botanical District of the Eremaean Botanical Province (Beard 1990). The Ashburton Botanical District is described as predominantly mulga (*Acacia aneura*) often with snake wood (*Acacia xiphophylla*) and other *Acacia* spp. as scrub on the hills and as low woodland on the plains. It also contains some areas of dwarf scrub of *Eremophila* and *Senna* (Beard 1990).

2.1.3.1 Pre-European Vegetation

Vegetation mapping of Western Australia (WA) was completed on a broad scale (1:1,000,000 and 1:250,000) by Beard (1975), defining broad vegetation associations. These vegetation associations were re-assessed by Shepherd *et al.* (2002), to account for clearing in the intensive land use zone of WA, and to divide some of the larger vegetation units. In addition, Shepherd *et al.* (2002) also developed a series of systems to assist in the removal of mosaics, although some mosaics still occur.

The Survey Area intersects five vegetation units mapped by Beard (Figure 2-3), mainly comprising the Yinnietharra Hills 163.1 system (62.47%), Yinnietharra Hills 166 system (14.29%), and Yinnietharra Hills 181 system (11.61%) (Table 2-2) (Beard 1975). The significance of clearing a vegetation association can be determined by comparing current extents (ha) with pre-European extents. Table 2-3 summarises the current and pre-European extent of these five vegetation associations across three scales: state, bioregion and subregion. The current extents suggest that minimal land clearing has occurred across the four scales of assessment (state, bioregion, subregion and Local Government Area (LGA)), with close to 100% of vegetation remaining.

At a scale of 1:1,000,000 to 1:250,000, Beard's (1975) mapping only provides a broad overview of expected vegetation units within the Survey Area.

Table 2-2: Pre-European vegetation system associations and extent within the Survey Area

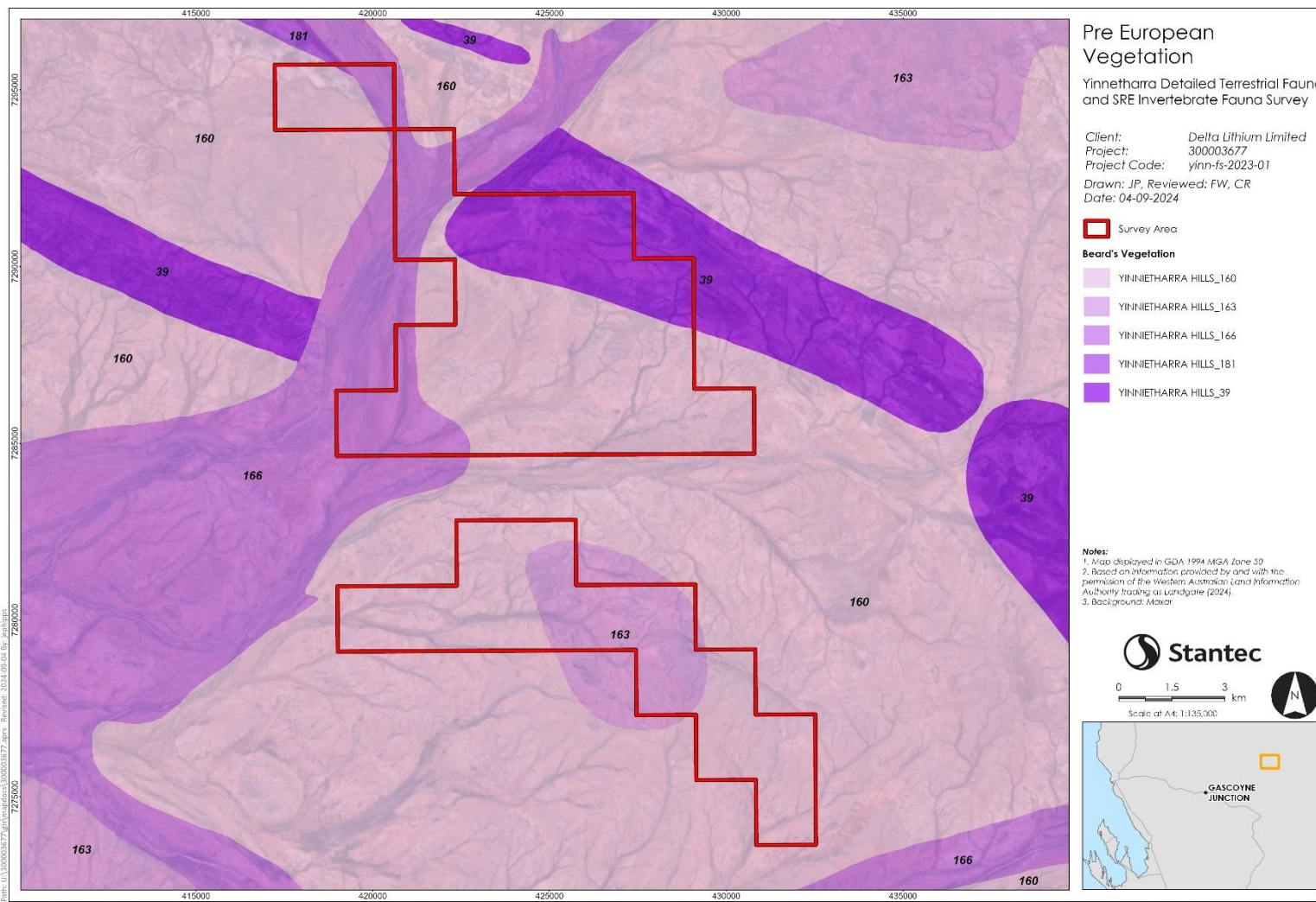
System Association	System Code	Description	Extent in the Survey Area	
			Ha	%
Yinnietharra Hills 163	163.1	Shrublands; <i>Eremophila</i> and <i>Cassia</i> dwarf scrub.	7,006.01	62.47%
Yinnietharra Hills 166	166	Low woodland; mulga and <i>Acacia victoriae</i> .	1,602.24	14.29%
Yinnietharra Hills 181	181	Shrublands; mulga and snakewood scrub.	1,301.98	11.61%
Yinnietharra Hills 160	160.1	Shrublands; snakewood and <i>Acacia victoriae</i> scrub.	1,298.40	11.58%
Yinnietharra Hills 39	39	Shrublands; mulga scrub.	6.64	0.06%
Total			11,215.27	100.00



Table 2-3 Extent of pre-European vegetation system associations for the Survey Area remaining across three scales (state, bioregion and subregion)

System	Scale	Pre-European extent (ha)	Current extent (ha)	Proportion remaining (%)	Current extent within the IUCN Class I-IV Reserves (ha)	Proportion of extent protected within IUCN Class I-IV Reserves (%)
Yinnietharra Hills 160	State-wide	789,353.06	789,338.63	100.00	0	0
	Bioregion	789,078.22	789,063.79	100.00		
	Subregion	789,078.22	789,063.79	100.00		
Yinnietharra Hills 163	State-wide	251,835.95	251,833.75	100.00		
	Bioregion	251,774.61	251,772.41	100.00		
	Subregion	251,774.61	251,772.41	100.00		
Yinnietharra Hills 166	State-wide	87,059.47	87,054.76	99.99		
	Bioregion	86,833.89	86,829.17	99.99		
	Subregion	86,833.89	86,829.17	99.99		
Yinnietharra Hills 181	State-wide	5,416.00	5,416.00	100.00		
	Bioregion	5,416.00	5,416.00	100.00		
	Subregion	5,416.00	5,416.00	100.00		
Yinnietharra Hills 39	State-wide	33,707.06	33,707.06	100.00		
	Bioregion	33,707.06	33,707.06	100.00		
	Subregion	33,707.06	33,707.06	100.00		

¹Include existing National Parks, Nature Reserves, Conservation Parks, 5(g) Reserves (Conservation Reserves managed by the Department of Biodiversity, Conservation and Attractions (DBCA)), DBCA conservation estate.



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Figure 2-3: Pre-European vegetation within the Survey Area

2.2 Physical Environment

2.2.1 Climate

The Survey Area occurs within the Augustus subregion of the Gascoyne Bioregion of Western Australia (Section 2.1), which is characterised by a desert climate with bimodal rainfall (Desmond *et al.* 2001). The nearest Bureau of Meteorology (BoM) weather station with long term rainfall data is Mount Phillip Station (Station no. 007058), approximately 9 km north of the Survey Area. Based on long-term rainfall data from Mount Phillip Station, the mean annual rainfall between 1902 to 2020 was 226.3 mm (BoM 2024) (Figure 2-4). The Survey Area receives higher rainfall during two periods, January to March and May to July. Rainfall is erratic and associated with several climatic influences including cyclonic activity (Wilcox and McKinnon 1972).

The nearest Bureau of Meteorology (BoM) weather station with long-term temperature data is Gascoyne Junction Station (Station no. 006022), approximately 110 km southwest of the Survey Area. Based on the long-term temperature data from Gascoyne Junction Station, the warmest months of the year are between November and March, with daily maximum temperatures averaging above 35°C. The coolest months occur from June to August, with minimum temperatures averaging around 10°C (Figure 2-4).

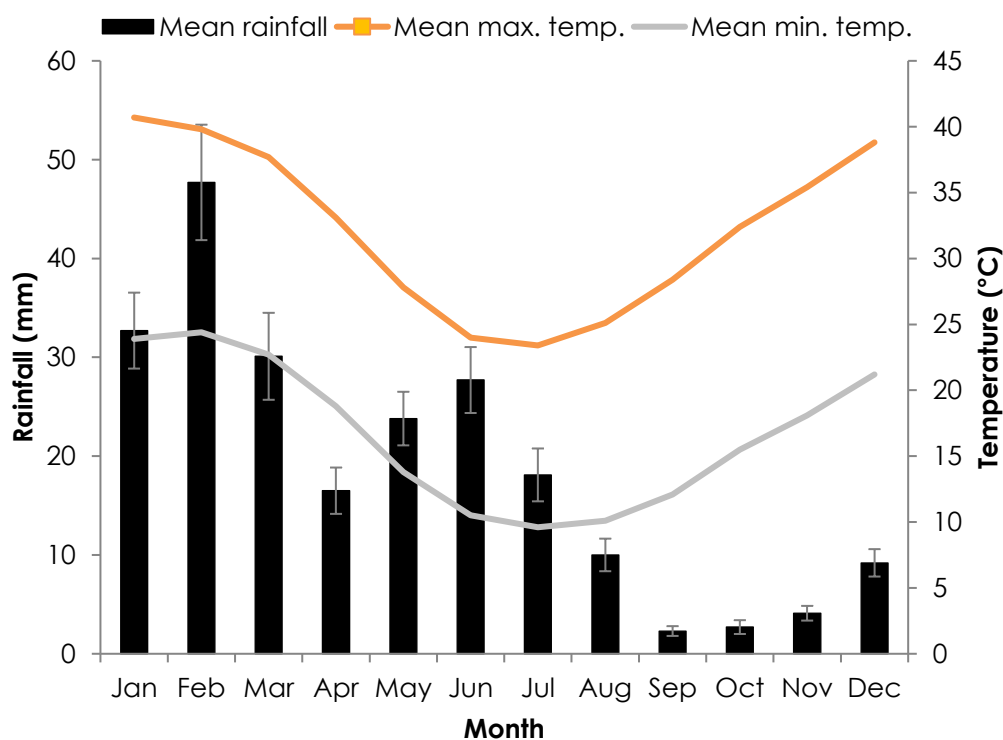


Figure 2-4: Long-term (1902 to 2020) rainfall data from Mount Phillip Station (Station no. 007058) and long-term temperature data (1940-2022) from Gascoyne Junction Station (Station no. 006022) (BoM 2024).

2.2.2 Surface Geology and Soils

The GAS3 subregion is characterised by rugged, low Proterozoic sedimentary and granite ranges divided by broad flat valleys. It includes the Narryera Complex and Bryah Basin of the Proterozoic Capricorn Orogen (on the northern margin of the Yilgarn Craton), as well as the Archaean Marymia and Sylvania Inliers (Desmond *et al.* 2001).

The surface geology of the Survey Area is comprised of eight geological units (Table 2-4; Figure 2-5). These units were mapped at a scale of 1:1,000,000 by Geoscience Australia (2012). The dominant geological unit in the Survey Area is Colluvium 38491, which accounts for 34.97% of the Survey Area.

The Survey Area occurs within the Yaragner Hills and Plains Soil-landscape Zone of Western Australia (Tille 2006). The soil of the region is described as stony with red shallow loamy duplexes, red deep sandy duplexes, red shallow loams, some red shallow sandy duplexes, and some red/brown non-cracking clays.

Table 2-4 Geological units occurring within the Survey Area.

Name (code)	Geological Description	Extent in the Survey Area	
		Ha	%
Colluvium 38491 (Qrc)	Colluvium and/or residual deposits, sheetwash, talus, scree; boulder, gravel, sand; may include minor alluvial or sand plain deposits, local calcrete and reworked laterite	3,921.61	34.97%
Alluvium 38485 (Qa)	Channel and flood plain alluvium; gravel, sand, silt, clay; may be locally calcreted.	2,074.28	18.50%
Perseverance Supersuite (Ngp)	Leucocratic medium-grained muscovite-tourmaline (-biotite) monzogranite; equigranular to porphyritic.	1,446.61	12.90%
Morrissey Metamorphics (Lym)	Comprise pelitic schist with numerous thin layers and lenses of amphibolite and psammitic schists (after feldspathic sandstone) interlayered with calc-silicate rock.	1,435.61	12.80%
Durlacher Supersuite (Lgdr)	Monzogranite and granodiorite, minor tonalite, syenogranite, gabbro.	1,035.74	9.24%
Moorarie Supersuite (Lgmo)	Monzogranite, granodiorite and tonalite, diorite, gneissic to schistose granodiorite to monzogranite; local schist, amphibolite, calc-silicate and quartzite.	949.47	8.47%
Pooranoo Metamorphics (Lnpo)	Pelitic schist, gneiss and granofels, and metamorphosed feldspathic sandstone and conglomerate	296.00	2.64%
Muntarra Formation, Kiangi Creek Formation (Msd3)	Siltstone and mudstone; sandstone, dolostone, minor conglomerate	55.98	0.50%
Total		11,215.27	100.00



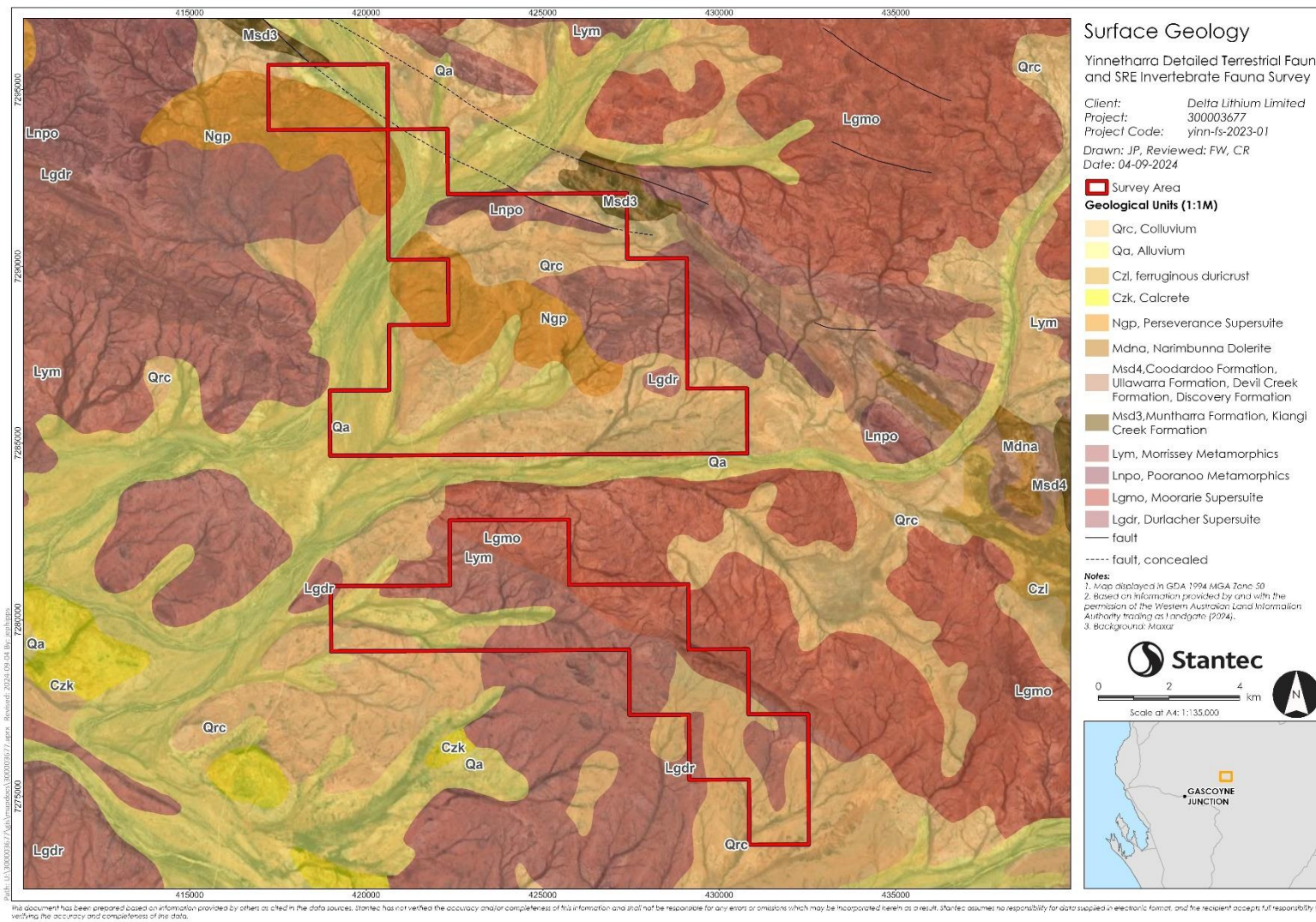


Figure 2-5: Surface geology of the Survey Area.

2.2.3 Surface Hydrology and Drainage

The Survey Area is located within the northern portion of Gascoyne River catchment which is drained primarily by the Gascoyne River System. (Figure 2-6). The Survey Area is located 12 km north of the Gascoyne River and is intersected by Thirty Three River in the south and Morrissey Creek to the north west. Both watercourses are ephemeral and only flow after substantial rainfall.

2.2.4 Land Tenure and Use

Land tenure in the Gascoyne is dominated by pastoral leases (84%) (DPIRD 2018) with the Survey Area lying within the Yinnetharra and Mount Phillips Pastoral Stations (Figure 2-7). Within the GAS 3 subregion, land use is dominated by grazing (84.2%), unallocated crown land/reserves (9.76%), and Aboriginal reserves (3.37%) (Desmond *et al.* 2001). The Survey Area spans two separate native title determination areas: Wajarri Yamatji (Part A), and Gnulli, Gnulli #2 and Gulli # 3 – Yinggarda Baiyungu and Thalanyji People (National Native Title Tribunal 2024).

2.2.5 Conservation Reserves and Environmentally Sensitive Areas

There are two conservation reserves within ~100 km of the Survey Area: Kennedy Range National Park (100 km to the west), and Mount Augustus National Park (53 km to the east; Figure 2-7). Mount Augustus National Park is the closest conservation reserve to the Survey Area and is also considered an Environmentally Sensitive Area (ESA). Mount Augustus National Park is 9,168 ha and features Mount Augustus, a large granite formation 8 km length and 715 m in height. The park encompasses a range of habitats and supports a diversity of flora including *Acacia.*, *Cassia.*, *Eremophila* and *Triodia*. Additionally, Mount Augustus National Park contains one permanent water pool which supports a variety of waterbird species (DBCA 2024a).

The Survey Area does not intersect any ESAs declared under Section 51B of the *Environmental Protection Act (1986)* (Government of Western Australia 2005). No wetlands of international importance (i.e., Ramsar wetlands) or nationally important wetlands occur within the Survey Area (DoAWE 2022b).



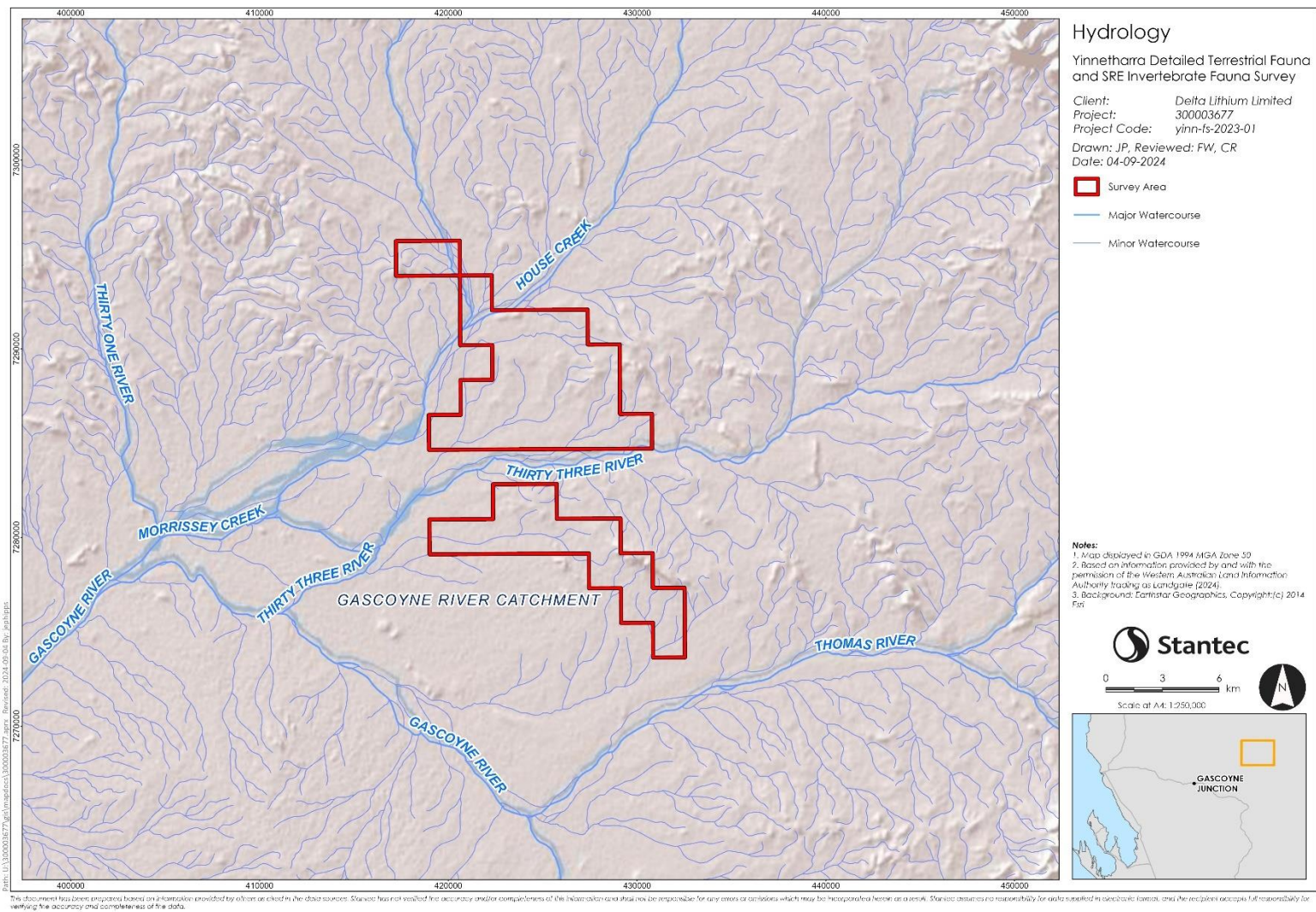


Figure 2-6: Surface hydrology and drainage in relation to the Survey Area.

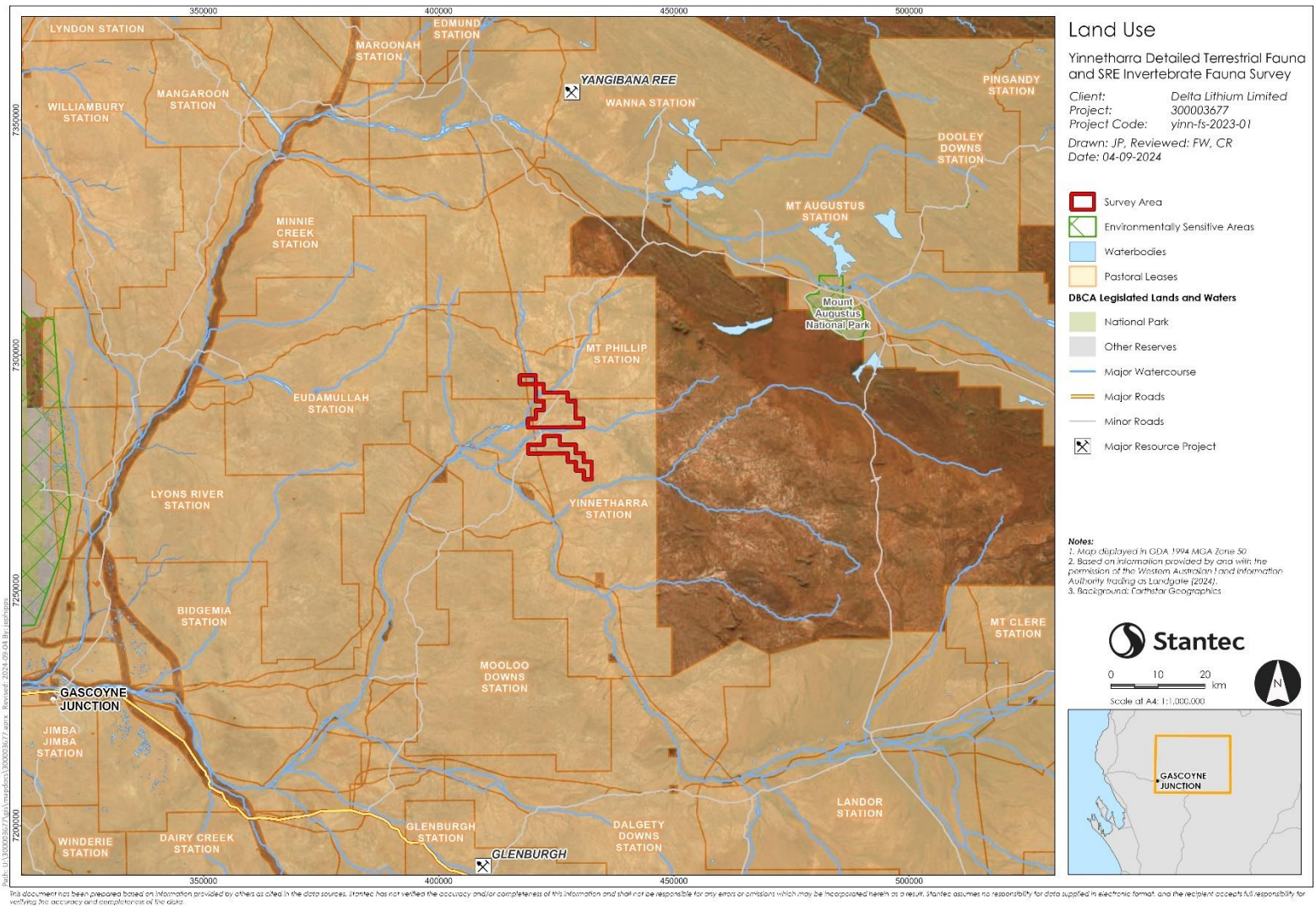


Figure 2-7: Land use in relation to the Survey Area.

3. Desktop Assessment

3.1 Approach

A desktop assessment, comprising database searches and a literature review, was undertaken to gather contextual information on the Survey Area. The purpose of the desktop assessment was to identify terrestrial fauna potentially occurring within and in the vicinity of the Survey Area, particularly species of significance.

Conservation significance and rankings used under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Biodiversity Conservation Act 2016* (BC Act), as well as the Department of Biodiversity, Conservation and Attractions (DBCAs) Priority List, are defined in Appendix A.

3.2 Desktop Methods

3.2.1 Database Searches

Nine database searches were conducted to identify and collate existing information on the potential fauna assemblage of the environment within the Survey Area and surrounding landscape. Appropriate search buffers were applied depending on the technical capabilities (maximum buffer, accuracy of data) of the databases, and the ecological features of the Survey Area (Table 3-1). This was undertaken to provide context about potential presence of significant fauna species (including SRE invertebrates) that are known to occur in similar habitat within the region. Results are presented in Appendix B and Section 5.3.

Table 3-1: Database searches conducted for the desktop assessment.

Custodian	Database Name	Buffer (km)	Date of Receipt
Department of Biodiversity, Conservation and Attractions (DBCAs) (DBCAs 2023c)	NatureMap	50	19-04-23
Department of Agriculture, Water and the Environment (DoAWE) (DoAWE 2023)	Protected Matters Search Tool (PMST)	50	18-04-23
DBCAs (DBCAs 2022)	Threatened and Priority Fauna	100	31-08-22
Birdlife Australia (Birdlife Australia 2023a)	Birdlife Bird Data	100	26-04-23
Atlas of Living Australia (AoLA) (ALA 2023b)	Custom Fauna Database Search	100	18-04-23
Western Australia Museum (WAM) (WAM 2023a)	Arachnid and Diplopod Collection Database	100	12-04-23
WAM (WAM 2023b)	Mollusc Collection Database	100	12-04-23
WAM (WAM 2023c)	Crustacea Collection Database	100	12-04-23
Department of Water and Environmental Regulation (DWER) (DWER 2023)	Index of Biodiversity Surveys for Assessments (IBSA) Project Finder	N/A	N/A

3.2.2 Literature Review

Background information relating to the Survey Area and surrounding landscape was compiled, focusing on the occurrence of significant fauna species, SRE invertebrates, fauna habitat types, and fauna assemblages. A search of the Index of Biodiversity Surveys for Assessments (IBSA) revealed a lack of surveys previously undertaken within or in close proximity to the Survey Area and lodged on IBSA. Consequently, additional searches were undertaken for mine sites to identify potential historical survey data. This work included a search for operating mines within a 50 km buffer of the Survey Area using Mineral Titles Online (Mining tenements). Reports/data pertaining to several mine sites were investigated to determine if any relevant biological surveys were publicly available for inclusion in the desktop assessment. The literature review considered two publicly available terrestrial fauna reports within the Gascoyne bioregion that were considered most relevant to the desktop assessment (Table 3-2).



Table 3-2: Summary of reports considered in the literature review.

Reference	Survey Details	Proximity to Survey Area	Survey Effort	Fauna Habitats/ Vegetation Types	Fauna Assemblages Recorded	Significant Species Recorded
ecoscape (2016)	<p><u>Project:</u> Yangibana Project Biological Assessment: Terrestrial Fauna</p> <p><u>Client:</u> Hastings Technology Metals Ltd.</p> <p><u>Survey Type:</u> Detailed dual phase with SRE</p> <p><u>Survey Dates:</u> 12 – 23 May 2015 22 September – 2 October 2015</p>	48 km north	<ul style="list-style-type: none"> • 8 pitfall sites (1,120 trap nights) • 8 funnel sites (2,240 trap nights) • 8 Elliot sites (1,120 trap nights) • 8 cage sites (224 trap nights) • 18 avifauna census sites (49 hours of birding) • 15 targeted searches (15 hours) • 10 motion-sensor cameras (511 days) • 15 echolocation units (276 hours of recording) • 10 wet pitfall sites (total of 40 traps open for 8 weeks) • 14 leaf litter collection sites 	<p>Fauna habitats:</p> <ul style="list-style-type: none"> • Rocky Plain • Sandy Plain • Granite Outcrop • Major River • Minor Creepline 	<p>134 fauna species recorded:</p> <ul style="list-style-type: none"> • 20 mammals • 85 birds • 25 reptiles • 4 amphibians 	<ul style="list-style-type: none"> • Grey Falcon (<i>Falco hypoleuca</i>) (Vu, VU) • Long-tailed Dunnart (<i>Sminthopsis longicaudata</i>) (P4) • Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>) (P4) – historic mound records only • 13 potential SRE invertebrates
Eco Logical (2018)	<p><u>Project:</u> Yangibana Rare Earths Project Flora and Fauna Survey</p> <p><u>Client:</u> Hastings Technology Metals Ltd.</p> <p><u>Survey Type:</u> Basic Flora and Fauna</p> <p><u>Survey Dates:</u> 28 April – 3 May 2017</p>	39 km north	<ul style="list-style-type: none"> • Targeted searches for significant species and habitats • Fauna habitat mapping 	<p>Fauna habitats:</p> <ul style="list-style-type: none"> • Rocky Plain • Granite Outcrop • Minor Creepline • Rocky Slopes and Foothills • Claypan 	Species list not provided	<ul style="list-style-type: none"> • Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>) (P4) - possibly active mound



3.2.3 Likelihood Of Occurrence of Significant Fauna

Significant fauna identified from the database searches and literature review were assessed for their likelihood of occurrence within the Survey Area. This assessment was based on the interpretation of habitat types within the Survey Area, the presence of suitable the species, as well as the proximity and time since the most recent records of each significant species. Each species was categorised according to the criteria presented in Table 3-3 below.

Table 3-3: Criteria used for assessing the occurrence of significant fauna species in the Survey Area.

Likelihood Levels and Criteria
Likelihood: Confirmed
The species has been recorded unambiguously within the Survey Area from: <ul style="list-style-type: none">• Recent surveys of the Survey Area,• Reliable records obtained via database searches or• From current vouchered specimen at WA Museum.
Likelihood: Likely
There is a medium to high likelihood that the species occurs in the Survey Area, as: <ul style="list-style-type: none">• The Survey Area occurs within the known distribution of the species,• Contains suitable habitat (either year-round or intermittently, such as temporary water sources or features that are only relied upon during certain times of the year e.g. breeding caves) and• The species has been recorded recently nearby.
Likelihood: Possible
There is potential for the species to occur in the Survey Area, as: <ul style="list-style-type: none">• The species has not been recorded recently nearby, however;<ul style="list-style-type: none">– The species may not have been detectable during current or previous surveys (e.g. rare, patchily distributed, highly mobile or has an extensive foraging range, or non-optimal survey timing).– The species is known to be cryptic and may not have been detectable despite extensive surveys.• The species has been recorded recently nearby and species presence cannot be ruled out due to factors such as species ecology or distribution, however;<ul style="list-style-type: none">– Doubt remains over taxonomic identification.– The majority of habitat does not appear suitable.– Coordinates are doubtful.
Likelihood: Unlikely
The species is unlikely to occur in the Survey Area as: <ul style="list-style-type: none">• The Survey Area lacks critical habitat, having at best marginally suitable habitat, and/or being severely degraded;• Only recorded from a few historic record/s and no other collections in the area; and• The species has not been recorded in the survey area despite adequate survey efforts, such as a standardized methodology or targeted searching within potentially suitable habitat.

3.2.4 Short-range Endemic Invertebrate Fauna

Endemism refers to the restriction of a species to a particular area at a continental, national or local scale (Allen *et al.* 2002). Harvey (2002) defines a restricted range as a species with a maximum range of 10,000 km². Comprehensive systematic reviews of different faunal groups often reveal the presence of SRE invertebrate species (Harvey *et al.* 2011). Some better known SRE species have been listed under State or Commonwealth legislation. However, the majority of SRE species have not been listed under legislation, often due to lack of taxonomic knowledge (EPA 2016c). SRE invertebrates in general are



considered relevant to environmental impact assessment as habitat loss and degradation can decrease their prospects for persistence (EPA 2016c).

The SRE invertebrate fauna of WA is typically associated with sheltered and mesic microhabitats, such as the southeast aspect of slopes, trees, boulders and rock piles, outcrops, mesas, drainage systems, deep gorges, natural springs and fire refuges (EPA 2016c). In WA, many terrestrial SRE invertebrate species have Gondwanan origins and are relics of previously widespread species common to the continents of the southern hemisphere during the mesic climates of the Miocene (Harvey 2002). The subsequent aridification of Australia during the Miocene through to the Pleistocene resulted in the fragmentation and contraction of once common mesic habitats. Consequently, populations dependent on these mesic habitats were also fragmented, resulting in the evolution of SRE invertebrate fauna (Harvey 2002).

A combination of intrinsic and extrinsic factors, such as dispersal capabilities or opportunities, habitat preferences, life history attributes, physiological attributes, habitat availability, biotic and abiotic interactions, and historical factors, determine not only the geographic distribution of a taxon, but its propensity for population differentiation and speciation (Ponder and Colgan 2002). Taxa prone to short-range endemism tend to share several ecological and life-history characteristics, such as poor powers of dispersal, confinement to discontinuous habitats, highly seasonal activity patterns, and low fecundity (Harvey 2002).

Invertebrate groups prone to short-range endemism that have potential to occur within the Survey Area and that are regularly targeted during SRE surveys across the state include: mygalomorph spiders, selenopid spiders, scorpions, pseudoscorpions, millipedes, slaters and terrestrial snails (EPA 2016a; Harvey 2002). Taxonomists have developed criteria for explaining the degree of certainty surrounding the SRE status of a specimen where specific knowledge gaps exist, such as:

- Unknown geographic distribution of a species due to patchy/limited sampling;
- Limited taxonomic resolution due to limited knowledge of a particular group or a lack of specialist skills; and
- Specimens are of an inappropriate life stage or sex to allow for accurate identification to species level.

These categories were used to provide context to specimens collected during this Survey (Table 3-4).

Table 3-4: Categories for status with respect to short-range-endemism.

SRE category	Criteria
Confirmed	<ul style="list-style-type: none"> • This category applies when the identity of the taxon is unambiguous, and its distribution is less than 10,000 km² based on publicly available vouchered records. Supporting data can be either genomic (from DNA sequences) or morphological, ideally both.
Potential	<ul style="list-style-type: none"> • Data Deficient (DD): This category covers taxa for which there is insufficient data available to determine SRE status. Factors that fall under this category includes insufficient geographic and taxonomic information, and/or inappropriate life stages prevent identification to species level. • Habitat Indicators (H): This category employs habitat characteristics to evaluate SRE status when habitats are known to support SRE taxa. For example, many species sampled from subterranean habitats are known to be range restricted; a new species discovered from such habitat therefore has greater potential to be range restricted (i.e. an SRE) than widespread. • Morphological Evidence (M): This category uses one or more morphological characters that are characteristic of SRE taxa inhabiting restricted environments, e.g. the specialised morphological features of animals adapted to subterranean habitats, including body markings that are absent or significantly paler than surface dwelling relatives, eyes that are absent or significantly reduced, and/or longer appendages (legs and antennae) than surface relatives. • Unpublished Research & Expertise (U): This category relies on unpublished research or expertise to develop SRE status.
Widespread	<ul style="list-style-type: none"> • This category applies when vouchered evidence demonstrates a distribution greater than 10,000 km² (not an SRE species).



3.3 Desktop Assessment Results

3.3.1 Vertebrate Fauna

The desktop assessment identified 289 vertebrate fauna species that have been previously recorded and/or have the potential to occur within the Survey Area (Table 3-5; Appendix B). These comprised the following:

- 25 native mammals;
- 7 non-native mammals;
- 171 birds;
- 75 reptiles; and
- 11 amphibians.

Table 3-5: Summary of vertebrate fauna recorded from the desktop assessment*

Faunal group	Relevant Regional Reports	Relevant Database Searches					Total*
	ecoscape (2016)	DBCA (2023b)	(DoAWE 2023)	DBCA (2022)	Birdlife Australia (2023b)	ALA (2023a)	
Mammals	15	7	3	5	-	15	25
Mammals (non-native)	5	4	-	-	-	5	7
Birds	85	95	14	5	145	155	171
Reptiles	25	35	2	1	-	66	75
Amphibians	4	2	0	0	-	11	11
Total	134	143	19	11	145	252	289

* excludes Eco Logical (2018) as a complete species list was not provided.

3.3.2 Significant Fauna

Of the 289 species of vertebrate fauna identified in the desktop assessment, 28 are listed as significant species under the EPBC Act and/or BC Act, comprising eight mammals, 17 birds and three reptiles (Table 3-6). Based on the desktop assessment, no significant fauna species have been previously recorded within the Survey Area (Figure 3-1).

Table 3-6: Significant vertebrate fauna species identified during the desktop assessment.

Scientific Name	Common Name	Listing	
		EPBC Act	BC Act
Mammals			
<i>Dasyurus hallucatus</i>	Northern Quoll	En	En
<i>Petrogale lateralis lateralis</i>	Black-footed Rock-Wallaby	En	En
<i>Phascogale calura</i>	Red-tailed Phascogale	Vu	CD
<i>Macrotis lagotis</i>	Bilby	Vu	Vu
<i>Macroderma gigas</i>	Ghost Bat	Vu	Vu

Scientific Name	Common Name	Listing	
		EPBC Act	BC Act
<i>Rhinonictoris aurantia</i> (Pilbara form)	Pilbara Leaf-nosed Bat	Vu	Vu
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse		P4
<i>Antechinomys longicaudata</i>	Long-tailed Dunnart		P4
Birds			
<i>Pezoporus occidentalis</i>	Night Parrot	En	Cr
<i>Rostratula australis</i>	Australian Painted Snipe	En	En
<i>Erythrotriorchis radiatus</i>	Red Goshawk	En	Vu
<i>Leipoa ocellata</i>	Malleefowl	Vu	Vu
<i>Falco hypoleucos</i>	Grey Falcon	Vu	Vu
<i>Calidris ferruginea</i>	Curlew Sandpiper	Mi & Cr	Cr
<i>Aphelocephala leucopsis</i>	Southern Whiteface	Vu	
<i>Apus pacificus</i>	Fork-tailed Swift	Mi	IA
<i>Hirundo rustica</i>	Barn Swallow	Mi	IA
<i>Motacilla cinerea</i>	Grey Wagtail	Mi	IA
<i>Motacilla flava</i>	Yellow Wagtail	Mi	IA
<i>Calidris melanotos</i>	Pectoral Sandpiper	Mi	IA
<i>Charadrius veredus</i>	Oriental Plover	Mi	IA
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mi	IA
<i>Actitis hypoleucos</i>	Common Sandpiper	Mi	IA
<i>Tringa nebularia</i>	Common Greenshank	Mi	IA
<i>Falco peregrinus</i>	Peregrine Falcon		OS
Reptiles			
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	En	Vu
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	Vu	Vu
<i>Ctenophorus yinnietharra</i>	Yinnietharra Rock-dragon	Vu	Vu



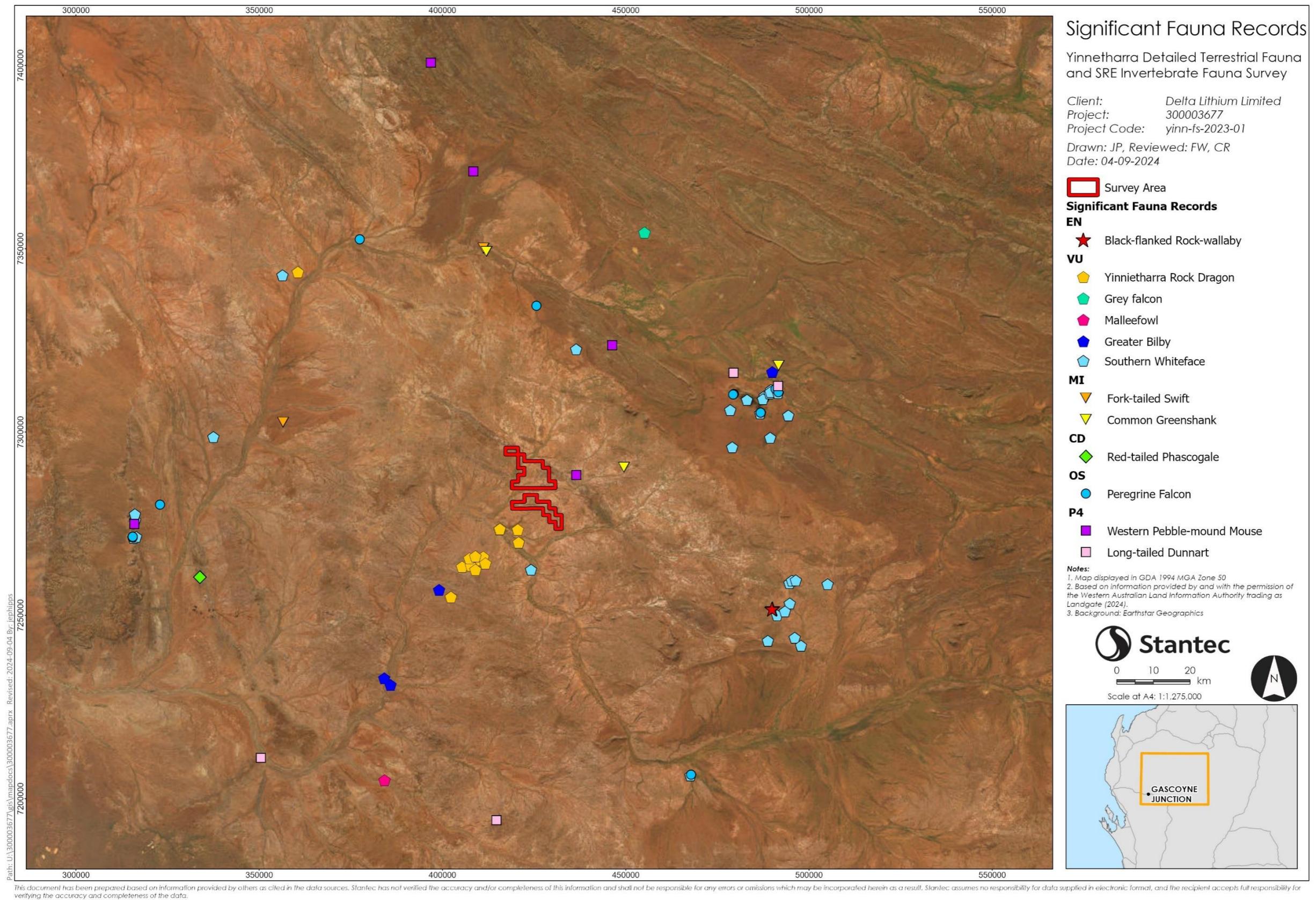


Figure 3-1: Significant species recorded in the vicinity of the Survey Area (Birdlife Australia 2023a; DBCA 2022).

3.3.3 SRE Invertebrate Taxa

Database searches and the literature review yielded 43 invertebrate taxa from SRE target groups (Appendix D). It should be noted that the WAM does not provide the SRE status of taxa recorded in the database search results. These taxa had been recorded within 100 km of the Survey Area as per the proposed maximum range of short-range endemism in Harvey (2002). Only specimens identified to species or morphospecies level are included, as it is not possible to determine species distribution when the identification can only be completed to genus level.

The 43 taxa from target groups comprised of the following:

- 11 mygalomorph spiders;
- 10 scorpions
- 9 pseudoscorpions;
- 2 millipedes;
- 6 slater;
- 4 snails; and
- 1 centipede

The 43 invertebrate taxa identified from the desktop assessment were assessed for their potential to occur (Appendix D), depending on the availability of habitat and proximity of the record:

- none of the taxa have been recorded within the Survey Area;
- 1 taxon had a high potential to occur within the Survey Area;
- 2 taxa had a moderate potential to occur within the Survey Area; and
- 40 taxa had a low potential to occur within the Survey Area.



4. Survey Methods

4.1 Survey Timing and Weather

Survey work for the Project was undertaken over five separate field trips:

- The Reconnaissance Survey was undertaken to ground-truth preliminary habitat mapping and select systematic trapping sites:
 - Reconnaissance Survey:
 - 6 – 11 June 2023.
- The Detailed Survey was undertaken over three separate field trips:
 - Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Fauna Survey Phase 1:
 - 8 – 19 September 2023.
 - Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Fauna Survey Phase 2:
 - Trip 1: 4 – 11 April 2024; and
 - Trip 2: 21 – 27 May 2024.
- The Targeted Yinnietharra Rock-dragon Survey was completed within the Survey Area and Regional surrounds:
 - Targeted Yinnietharra Rock-dragon Survey:
 - 30 April – 3 May 2024.

The Phase 2 survey work was completed over two separate trips due to rainfall during Trip 1 resulting in access roads being closed by the Shire of Upper Gascoyne. The methods applied during the Detailed Survey (Phase 1 and Phase 2) are presented within this section (Section 4). The approach and methods applied for the Targeted Yinnietharra Rock-dragon Survey are presented as a standalone memo within Appendix G. The results of all survey work completed for the project are consolidated within Section 5 of this report.

Fauna activity is closely linked to season, weather conditions and rainfall in the months prior to surveying (EPA 2020). Temporal differences in activity patterns of fauna means that repeat surveys are often required to yield more comprehensive species inventory (EPA 2020). The Survey Area occurs within the northern Eremaean botanical province, which is typically represented by warmer temperatures and summer influences rainfall events. Within this region, the EPA (2020) recommends different survey timing for different faunal groups as follows:

- Reptiles – most active in warmer months (September to April);
- Amphibians – immediately after significant rain events (summer and autumn), when they break aestivation to breed;
- Birds – immediately after rain events (summer and autumn), particularly for granivores which feed on prolific seed available post rain; and
- Mammals – no preferred time, however population cycles often relate to rainfall and for efficiency, it is considered appropriate to survey mammals concurrently with reptiles.

The EPA (2016a) Technical Guidance for sampling of SRE Invertebrate fauna recommends surveys in northern Western Australia are undertaken during periods of peak rainfall. Adult specimens are required for morphological identification for many SRE species, and taxa often reach maturity to coincide with seasonally wet conditions (EPA 2016a).



The Phase 1 Survey was conducted in spring (September) and was therefore within the optimal timing for reptiles and was also appropriate for mammals. The Phase 2 Trip 1 Survey was conducted in April following limited wet season rainfall and was therefore during optimal timing for reptiles and mammals. The Phase 2 Trip 2 Survey was conducted in late May after several rainfall events, and therefore appropriate timing for bird, mammals, and amphibians. The suitability of survey timing according to season, weather conditions and rainfall in the months prior to surveying (EPA 2020) for each faunal group is summarised in Table 4-1.

Table 4-1: Suitability of survey timing for each faunal group according to guidance in EPA (2020) and EPA (2016c).

Survey Phase	Survey Timing	Survey Conducted During Optimal Timing (Y/N)*				
		Reptiles	Amphibians	Birds	Mammals	SREs
Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Fauna Survey	September (spring - following limited rainfall)	Yes	No	No	Yes	No
Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Fauna Survey Phase 2: Trip 1	April (autumn - following limited rainfall)	Yes	No	No	Yes	No
Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Fauna Survey Phase 2: Trip 2	May (autumn - following several rainfall events)	No	Yes	Yes	Yes	Yes

*Limitations and constraints discussed in Section 7.

To understand the influence of weather conditions and rainfall leading up to the Detailed Surveys, weather data was considered and collated from active weather stations in the vicinity of the Survey Area (Figure 4-1; Table 4-2). Based on the availability of data and proximity to the Survey Area, rainfall data were collected from Cobra Airstrip weather station (station no. 7209), located 36.6 km northeast of the Survey Area. There was no weather station in the vicinity of the Survey Area which was collecting temperature data over the duration of the Surveys. Temperature data presented below are from the nearest weather station, Murchison (station no 6099), located 248 km south of the Survey Area.

Rainfall in the six months preceding the Phase 1 Survey in September 2023 (69.0 mm) was below the long-term average for the region (126.2 mm) (Figure 4-1). Weather conditions during Phase 1 of the Detailed Survey were hot and dry (Table 4-2), which is typical for the time of year. The maximum daily temperature ranged from 26.0°C to 34.5°C, whilst minimum daily temperatures ranged from 12.5°C to 16.0°C. There was no rainfall recorded during Phase 1 of the Detailed Survey.

Rainfall preceding the Phase 2 Surveys in April/May was also well below the long-term average (Figure 4-1). During Phase 2, Trip 1 of the Detailed Survey, the weather conditions were generally consistent with the long-term average. Maximum daily temperatures ranged from 26.5°C to 37.0°C, whilst minimum daily temperatures ranged from 14.0°C to 22.0°C. A reported 4.6 mm of rain fell on April 11th (BoM 2024), causing the Shire of Upper Gascoyne to close Cobra-Dairy Creek Road. Given this road is required to access all systematic trapping sites, field teams demobilised from site prior to the completion of the survey and returned in late May to complete the recommended seven nights of systematic trapping (Table 4-2). Weather conditions during Phase 2 Trip 2 were warm and generally consistent with the long-term average. Maximum daily temperatures ranged from 26.5°C to 30.0°C, whilst minimum daily temperatures ranged from 6.0°C to 10.5°C. There was no rainfall recorded during Phase 2 Trip 2, however several small rainfall events in the preceding weeks had created more favourable conditions for recording bird species.



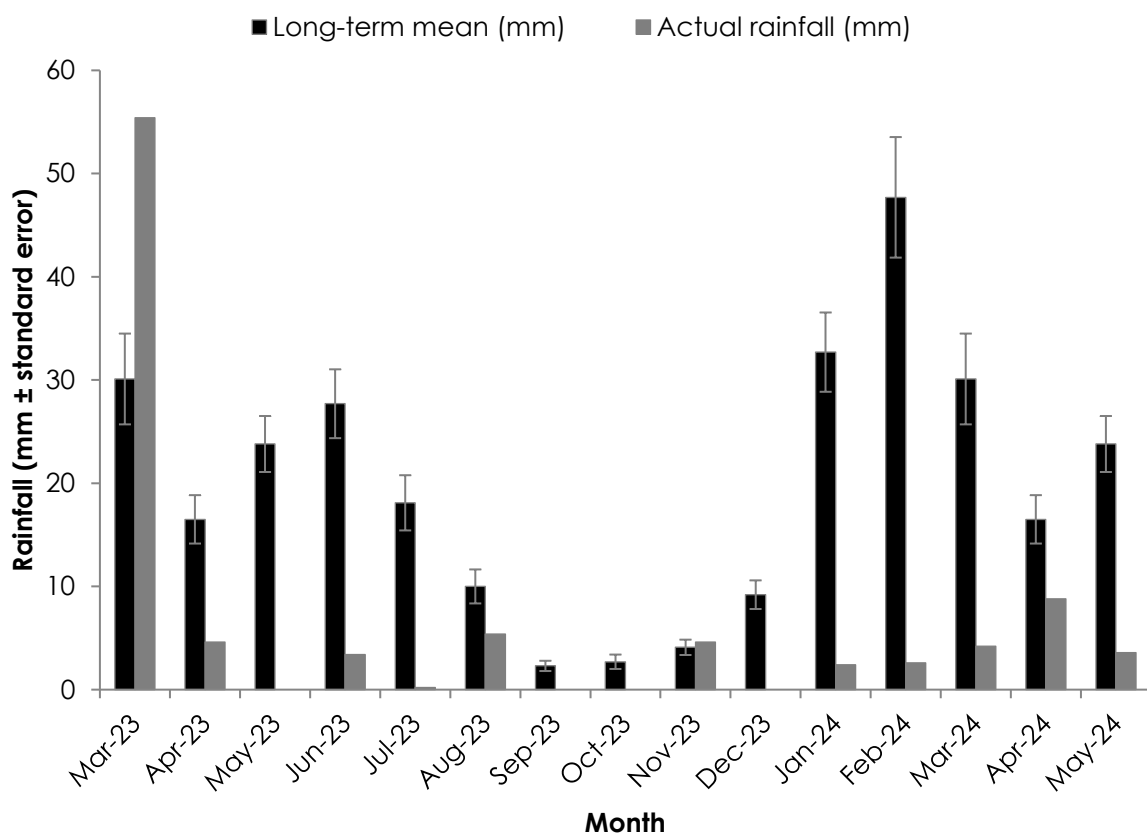


Figure 4-1: Long-term (1989 – 2023) mean monthly rainfall (mm) from the Cobra Airstrip Weather Station (No. 7209) and actual monthly rainfall (mm) in the 6 months preceding each field survey (BoM 2024).

Table 4-2: Temperatures and rainfall recorded during Phase 1 and Phase 2 of the Detailed Survey. Temperature data from Murchison Weather Station (No. 6099) and rainfall data from Cobra Airstrip Weather Station (No. 7209)(BoM 2024). A dash (-) indicates that data was not available for that date.

Date	Temperature (°C)		Rainfall (mm)
	Min	Max	
Phase 1			
08-09-23	12.5	30.5	0.0
09-09-23	16.0	30.5	0.0
10-09-23	-	33.5	0.0
11-09-23	-	34.5	0.0
12-09-23	-	33.0	0.0
13-09-23	14.0	28.5	0.0
14-09-23	15.0	26.0	0.0
15-09-23	12.5	30.0	0.0
16-09-23	16.0	33.5	0.0
17-09-23	16.0	29.5	0.0
18-09-23	13.5	30.0	0.0

Date	Temperature (°C)		Rainfall (mm)
	Min	Max	
19-09-23	14.0	30.0	0.0
Phase 2 Trip 1			
04-04-24	19.0	34.0	0.0
05-04-24	15.0	35.5	0.0
06-04-24	14.0	36.5	0.0
07-04-24	15.0	37.0	0.0
08-04-24	15.0	35.0	0.0
09-04-24	15.0	34.5	0.0
10-04-24	19.5	34.0	0.0
11-04-24	22.0	26.5	4.6
Phase 2 Trip 2			
21-05-24	10.5	26.5	0.0
22-05-24	7.5	27.5	0.0
23-05-24	6.0	-	0.0
24-05-24	-	29.5	0.0
25-05-24	9.0	-	0.0
26-05-24	-	30.0	0.0
27-05-24	8.0	-	0.0



4.2 Team and Licencing

Field work was conducted by experienced zoologists Caitlin Roberts (Survey Lead), Shannon Blatchford, Sam Girvan, Sam Ronan, Brandi Simmons, Eloise Tighe and Joey Laugharne (Table 4-3). Additionally, the Reconnaissance Survey was undertaken with senior botanist Scott Pansini, and the Targeted Yinnietharra Rock-dragon Survey was undertaken with specialist herpetologist Steve Wilson (Appendix G). All field team members have extensive experience undertaking ecological assessments within WA, including the Gascoyne region.

Bat echolocation recordings were analysed by Bob Bullen, bat specialist from BatCall WA. Bird data was analysed by ornithologist Nick Leseberg from Adaptive NRM. Potential SRE invertebrate fauna were analysed by Erich Volschenk from Alacran Environmental Science. The field work was conducted under DBCA Regulation 27 licence number BA27000911 and Section 40 authorisation number TFA 2324-0057, and WAEC permit number WAEC 22-07-76.

Table 4-3: Survey team and qualifications.

Personnel	Qualifications	Role	Years' Experience
Reconnaissance Survey: 6 – 11 June 2023			
Caitlin Roberts	BSc Animal Biology (Hons) MSc Wildlife Health and Conservation	Survey Zoologist	4
Scott Pansini	BSc Conservation and Wildlife Biology	Survey Botanist	5
Detailed survey: Phase 1: 8 – 19 September 2023			
Caitlin Roberts	BSc Animal Biology (Hons) MSc Wildlife Health and Conservation	Survey Lead	4
Shannon Blatchford	BSc (Ecology and Conservation Biology)	Survey Zoologist	14
Sam Girvan	BSc Zoology, Ecology and Conservation Biology MSc Ecology and Evolution	Survey Zoologist	5
Sam Ronan	BSc Environmental Biology	Survey Zoologist	5
Detailed Survey: Phase 2 Trip 1: 4 – 11 April 2024			
Caitlin Roberts	BSc Animal Biology (Hons) MSc Wildlife Health and Conservation	Survey Lead	4
Shannon Blatchford	BSc (Ecology and Conservation Biology)	Survey Zoologist	14
Brandi Simmons	BSc (Biology - Ecology Specialisation) Advanced Diploma in GIS Master of GIS (in progress)	Survey Zoologist	5
Eloise Tighe	BAdvSc Honours (Zoology)	Survey Zoologist	1
Phase 2 Trip 2: 21 – 27 May 2024			
Caitlin Roberts	BSc Animal Biology (Hons) MSc Wildlife Health and Conservation	Survey Lead	4
Joey Laugharne	BSc (Environmental Science and Cons. Biology) MSc (Environmental Management)	Survey Zoologist	5
Targeted Yinnietharra Rock Dragon Survey: 30 April – 3 May 2024			
Caitlin Roberts	BSc Animal Biology (Hons) MSc Wildlife Health and Conservation	Survey Lead	4
Steve Wilson	Information Officer at the Queensland Museum Author – Australian reptile field guides	Specialist Herpetologist	50



4.3 Sampling Techniques

4.3.1 Habitat Assessment and Mapping

Prior to the field work for the Detailed Survey, preliminary fauna habitats were identified and mapped based on satellite imagery, topography, broad land system mapping and broad vegetation mapping. The extent of these habitat types were ground-truthed during the reconnaissance survey, and representative areas were selected for detailed habitat assessment.

Habitat assessments were undertaken to characterise the quality and complexity of habitat available to fauna, with a focus on significant fauna. A total of 45 fauna habitat assessments were undertaken within the Survey Area (see Section 4.6). At each assessment location, the following key habitat parameters were recorded:

- Landscape and geological (substrata) features;
- Vegetation cover, condition and species composition;
- The presence or absence of woody debris, leaf litter, hollows, outcropping or other habitat structures;
- Ground cover and composition;
- Hydrological features such as the presence or absence of drainage line and surface water;
- Types of disturbance and levels of disturbance; and
- Any significant microhabitat features, such as caves or water sources, were also recorded and where applicable sampled via opportunistic or targeted survey methods.

At each habitat assessment site, representative photographs and GPS coordinates were recorded. Habitat characteristics were aligned with the WA Index of Biodiversity Surveys for Assessments (IBSA) Standards.

4.3.2 Site Selection

Following habitat assessment, sites for systematic sampling (Section 4.3.3) and targeted survey effort (Section 4.3.4) were identified. The location of sampling sites broadly follows a stratified random sampling design, capturing the main broad habitat types in the Survey Area while also:

- Maximising coverage and diversity of habitats/landforms;
- Considering accessibility and the likelihood of supporting significant fauna; and
- Avoiding heavily disturbed areas where possible.

4.3.3 Systematic Sampling

Eight systematic sites were established within the Survey Area, in six broad habitats (Table 4-5). These habitats comprised:

- Stony Plain;
- Minor Drainage
- Low Hills;
- Alluvial Plain;
- Major Drainage; and
- Rocky Outcropping.



Systematic sites were established within the main habitats present in the Survey Area to gain an understanding of the fauna assemblages present. At each site, the sampling program consisted of standardised trapping, fixed-time avifauna census, systematic searching, nocturnal spotlighting, motion-sensor camera deployments, bat echolocation recordings, and bird acoustic recordings. A detailed breakdown of the survey effort expended at each site is provided in Section 4.6.

4.3.3.1 Systematic Trapping

A standardised trapping grid was established at each systematic site during the field work for the Detailed Survey to capture terrestrial mammals, reptiles and amphibians (Figure 4-2). Each trapping grid comprised two drift fences; 40 cm high and 50 m long, set into the substrate. The following was installed along the drift fences within each standard trapping grid:

- Two types of pitfall traps: five standard 20 L PVC buckets and five PVC pipe traps (15 cm in diameter and 50 cm deep). Pitfall traps were set flush with the surface of the ground, with drift fence running through the centre.
- Twenty funnel traps measuring 75 cm x 18 cm x 18 cm were placed with one side pressed firmly against the fence in pairs. To protect animals from heat stress, funnels were shaded with reflective insulation sheeting.
- Twenty baited small Elliott box traps (9 cm x 10 cm x 33 cm) and two Sheffield cage traps (31 cm x 31 cm x 70 cm) were positioned in the trap line surrounds. To protect animals from heat stress, Elliott and Sheffield traps were placed in shaded locations where possible and covered with vegetation and/or custom-made shade covers/hessian bags. Elliott and Sheffield traps were baited with universal bait (a mixture of oats, peanut butter and sardines).

Traps were left open overnight and checked early the following morning for seven nights each, for a total trapping effort of 364 trap nights per site, equating to 2,912 trapping nights per phase, with a combined total of 5,824 trap nights conducted for the Detailed Survey (Table 4-5).



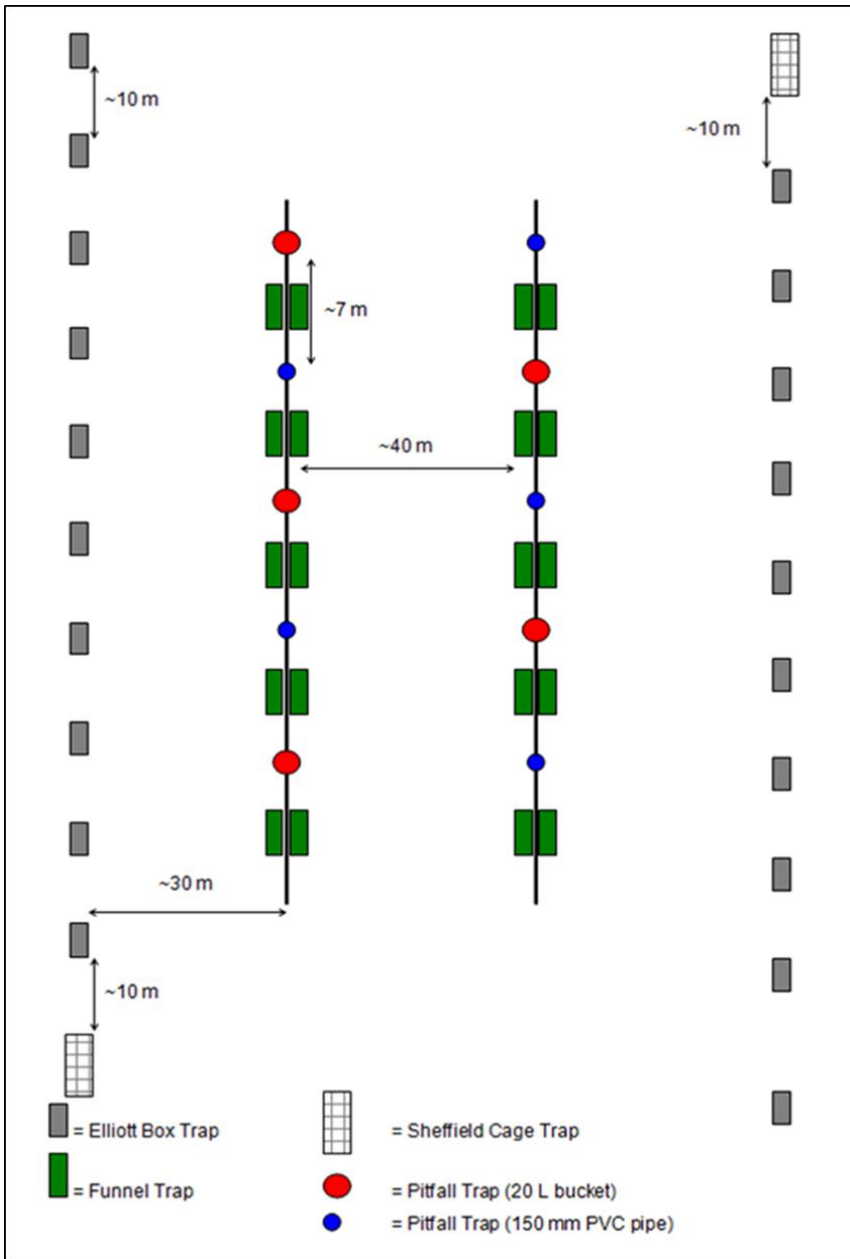


Figure 4-2: Layout of standard trapping grid deployed at each systematic site

4.3.3.2 Avifauna Census

A 20-minute avifauna census was conducted at each systematic site on each day of trapping during each phase of the Detailed Survey. Each avifauna census was conducted between 6:00 am and 11:00 am while undertaking trap clearing activities. During each census, sightings, calls and signs of bird presence (i.e. feathers, scats, nests) were recorded. A total of 280 minutes of avifauna census was conducted at each systematic site (Table 4-5).

4.3.3.3 Systematic Searches

Systematic diurnal searches for vertebrate fauna were conducted at each systematic site. This technique allows for the observation of species that are unlikely to be trapped because of their biology or behaviour (e.g. large individuals or diurnal species that are inactive when traps are open at night and/or species that don't forage far from specific habitat features). The specific methods employed included identification of active animals, investigating crevices, overturning logs and stones, searching beneath the bark of dead trees, investigating burrows and recording tracks, diggings, scats and other indirect

signs. Systematic searches were performed at each systematic site for 40 person minutes per systematic site during each phase, totaling 640 person minutes for the Detailed Survey (Table 4-5).

4.3.3.4 Spotlighting

Spotlighting was conducted using head torches and vehicle headlights to record nocturnal species that were unlikely to be trapped, such as nocturnal bird, reptile and frog species. Spotlighting was conducted for 40 person minutes at each systematic site during each phase, totaling 640 person minutes for the Detailed Survey (Table 4-5).

4.3.3.5 Motion-sensor Cameras

Motion-sensor cameras were used to document the presence of vertebrate fauna that are rarely captured via other trapping methods or systematic searches, due to size, general behaviour or trapability, such as macropods and large carnivores. Two motion-sensor cameras (Reconyx HF2X), baited with universal bait (a mixture of oats, peanut butter and sardines), were deployed at each systematic site for seven nights during each phase of the Detailed Survey (Table 4-5).

4.3.3.6 Bat Echolocation Recorders

Bat recordings were captured using SM4 (Wildlife Acoustics, Inc.) ultrasonic bat recorders fitted with an external omnidirectional SMM-U1 ultrasonic microphone. Each unit was preconfigured to activate at astronomical sunset each day and deactivate at astronomical sunrise the following morning, coinciding with peak bat activity times. One unit was deployed at each systematic site for two nights during each phase of the Detailed Survey (Table 4-5). Echolocation recordings were analysed by BatCall WA to develop a species inventory per systematic site.

4.3.3.7 Acoustic Recording Units

Bird acoustic recording units were deployed at systematic sites to contribute to the bird assemblage at each site. Units were set to begin recording one hour prior to sunset and to finish recording one hour after sunrise, coinciding with peak bird calling times. Methods to analyse calls are provided in Appendix H. One SM4 (Wildlife Acoustics, Inc.) bird acoustic recorder was deployed at each systematic site for two nights during each phase of the Detailed Survey (Table 4-5). Call recordings were analysed by bird call expert Nick Leseberg from Adaptive NRM.

4.3.4 Targeted Survey Methods

Targeted survey methods for significant fauna with potential to occur (informed by the desktop assessment (**Section 3.2**) and habitats identified during the reconnaissance survey), were selected to align with the relevant regulatory guidelines presented in Section 1.2 (Table 4-4).

Based on the findings of the desktop assessment (Section 3.3), particular focus was given to the Yinnietharra Rock-dragon, (Section 4.3.4.2); Southern Whiteface (Sections 4.3.4.2 and 4.3.3.7) and the Long-tailed Dunnart (Section 4.3.4.3). which were significant fauna identified as having potential to occur.,

There is limited contextual information regarding the distribution or methods for detection of the Yinnietharra Rock-dragon. Given the limited survey guidance available, several methods were trialed during the detailed surveys to detect the species. Methods were selected and refined following consultation with reptile experts Ray Llyod (Subconsultant Principal Zoologist), Paul Doughty (Curator of Herpetology at WA Museum), and Steve Wilson (Herpetologist and Information Officer at the Queensland Museum). Specifically, field methods used to target the Yinnietharra Rock-dragon comprised:

- Funnel traps (Section 4.3.4.1);
- Targeted searches (Section 4.3.4.2); and
- Motion-sensor cameras (Section 4.3.4.3).

Targeted survey sites for significant fauna were selected based on potential habitat (Table 4-4), access, previous experience in the region, and the potential occurrence of significant fauna within each habitat. The following points were considered when selecting targeted survey locations:

- Adequate spread across the Survey Area;



- Access; and
- Adequate coverage of habitat suitable for significant species identified as potentially occurring in the Survey Area, particularly;
 - Low weathered granite outcrops for the Yinnietharra Rock-dragon.
 - Open woodlands and shrublands for the Southern Whiteface.
 - Low/rocky hills for the Long-tailed Dunnart.

4.3.4.1 Funnel Traps

Pitfall trapping is recommended to target small to medium sized reptiles (EPA 2020), however this technique is likely to have limited success with the Yinnietharra Rock-dragon due to their preference for inhabiting low granite outcrops which limit pitfall placement (DEWHA 2011). Guidance within EPA (2020) states that funnel traps can be readily used in areas where the substrate precludes establishment of pitfall lines, such as on granites or ironstone outcrops. During Phase 1, targeted funnel traps were deployed in granite outcropping habitat to target the Yinnietharra Rock-dragon. Funnel traps were placed in pairs along a drift-fence which ran across the granite outcrops at two funnel trap sites. In total, 18 funnel traps were deployed across the two sites for 4 nights (72 trap nights). Funnel traps were not utilised during Phase 2 as they were found to be time consuming and provided no benefit over targeted searches. For example, another rock-dwelling agamid lizard, the Ring-tailed Dragon (*Ctenophorus caudicinctus*) was frequently observed moving across outcrops during targeted searches, however funnel traps yielded few captures of the species.

4.3.4.2 Targeted Searches

Targeted searches were conducted during the Detailed Survey to detect presence and/or secondary evidence of significant species within the Survey Area. Specifically, targeted searches included:

- Searches on/under exfoliating granite and crevices in rocky outcrops for the Yinnietharra Rock-dragon; and
- Searches along major drainage lines for significant avifauna such as the Peregrine Falcon and Grey Falcon.

Targeted searches were conducted by two people for a minimum of 30 minutes (60 person minutes); however time spent at a location varied depending on the extent of potentially suitable habitat present.

4.3.4.3 Motion-sensor cameras

Motion-sensor cameras were deployed in potentially suitable habitat for the Yinnietharra Rock-dragon and Long-tailed Dunnart, such as Rocky Outcropping and Rocky Hills, as well as in other widespread habitats that may be impacted by the Project such as Stony Plain and Low Hills. Additionally, motion-sensor cameras were deployed in habitats which were unable to be surveyed using systematic methods due to access constraints (Sandy Plain, Mulga Woodland, Rocky Hill). Each camera was baited with universal bait (a mixture of oats, peanut butter and sardines). Motion-sensor cameras were deployed for a minimum period of four nights each (total of 181 trap nights).

4.3.4.4 Echolocation Recording Units

The Survey Area is outside of the known range of significant bat species identified in the desktop assessment (e.g. Pilbara Leaf-nosed Bat and Ghost Bat). However, to gain a better understanding of bat species within the Survey Area, targeted echolocations were deployed in a variety of habitats across the Survey Area. Analysis of all SM4 echolocation data was undertaken by technical expert Bob Bullen from BatCall WA with detailed methods for analysis provided in Section 4.8.1.

4.3.4.5 Acoustic Recording Units

Acoustic recording units were deployed to target two significant bird species with potential to occur in the Survey Area: Southern Whiteface and Night Parrot. Targeted units for the Southern Whiteface were deployed in Minor and Major Drainage habitat which have the potential to support nesting and foraging. The Survey Area is within a high priority bioregion for Night Parrot survey (DBCA 2024b), however, no suitable Night Parrot roosting habitat (e.g. old-growth *Triodia* sp.) or foraging habitat (e.g. floodplains, paleo drainage systems or other low-lying areas supporting diverse assemblages of native grasses and herbs) were found to occur within the Survey Area. Given the lack of suitable roosting habitat present for the Night Parrot



in the Survey Area and broader region, acoustic recording units were deployed to achieve appropriate geographical coverage of the Survey Area for a minimum of 6 nights according to DBCA guidance for the survey of Night Parrot (DBCA 2024b).

Units were set to begin recording one hour prior to sunset and to finish recording one hour after sunrise. This duration captures peak calling times for non-breeding individuals, which tend to call within two hours after sunset and within two hours before sunrise, while allowing for the capture of potential calls associated with breeding birds which may occur throughout the night and closer to sunset and sunrise. Analysis of recordings for Night Parrot calls was undertaken by Night Parrot expert Nick Leseberg from Adaptive NRM with detailed methods provided in Appendix H. Analysis of recordings for Southern Whiteface calls was undertaken by Stantec zoologist Jasmin Pratt with detailed methods provided in Section 4.8.2.



Table 4-4: Targeted survey methods for significant fauna species informed by a pre-survey likelihood of occurrence within the Survey Area (desktop assessment and reconnaissance survey).

Common Name <i>Species Name*</i>	Listing		Pre-survey likelihood of occurrence within Survey Area	Survey method					Broad fauna habitat within the Survey Area								
	EPBC Act	BC Act		Acoustic recorder	Targeted funnel traps	Motion camera	Targeted searches	Systematic sites	Stony Plain	Low Hills	Major Drainage	Minor Drainage	Rocky Outcropping	Alluvial Plain	Mulga Woodland	Rocky Hill	Sandy Plain
Mammals																	
Long-tailed Dunnart (<i>Antechinomys longicaudata</i>)		P4	Possible			✓		✓		X						X	
Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>)		P4	Possible			✓		✓	✓	✓							
Birds																	
Night Parrot (<i>Pezoporus occidentalis</i>)	En	Cr	Unlikely	✓				✓									
Grey Falcon (<i>Falco peregrinus</i>)	Vu	Vu	Possible				✓	✓	X	X	X	X		X	X	X	X
Southern Whiteface (<i>Aphelocephala leucopsis</i>)	Vu		Likely	✓				✓			X	X			X		
Peregrine Falcon (<i>Falco peregrinus</i>)		OS	Likely				✓	✓	X	X	X	X	X	X	X	X	X
Fork-tailed Swift (<i>Apus pacificus</i>)		Mi	Possible					✓	X	X	X	X	X	X	X	X	X
Reptiles																	
Yinnietharra Rock-dragon (<i>Ctenophorus yinnietharra</i>)	Vu	Vu	Possible		✓	✓	✓	✓	X	X			X				

*Only fauna species considered likely to or possibly occurring are included with the exception on the Night Parrot. Although the Night Parrot it considered unlikely to occur, it was still targeted as the Survey Area is within a high priority bioregion for Night Parrot survey (DBCA 2024b).

4.3.5 Opportunistic Records

Vertebrate fauna observed outside of the systematic and targeted sampling during the Detailed Survey were documented and the resulting records were classified as 'opportunistic' within the Survey Area. Opportunistic records can be direct, such as from visual or aural observations, or indirect, such as from locating bones, carcasses, tracks, scats, burrows or nests. Opportunistic records were generated from observations made as follows:

- Before or after the fixed-time systematic searches or bird censuses;
- During trap line establishment;
- While travelling to and from survey sites; and
- At any time while working in or travelling within the Survey Area.

4.4 Species Distribution Modelling

Due to the limited information available on Yinnietharra Rock-dragon ecology, distribution and habitat preferences, Stantec undertook predictive habitat modelling for the species in the form of a species distribution model (SDM). The purpose of this was to better understand the environmental factors that drive the distribution and habitat selection of the Yinnietharra Rock-dragon, and to map the probability of the species occurring in the Survey Area.

SDMs are a widely used machine-learning technique that aim to understand the ecological niche (i.e., preferred habitat) of an organism, and utilise abiotic and biotic variables to model their potential persistence across a landscape (Elith and Leathwick 2009). In doing so, a variety of models can be used to identify these potential factors and subsequently map their potential distribution across the landscape. These models have been used successfully to understand the distribution of reptile species globally (Biber *et al.* 2022), including understudied species limited by knowledge gaps in habitat requirements and ecological drivers (Ahmadzadeh *et al.* 2013; Torkkola *et al.* 2021).

For complete SDM methods see the *Targeted Yinnietharra Rock-dragon Survey Memo* presented in Appendix G.

4.5 Short-Range Endemic Invertebrate (SRE) Survey Methods

4.5.1 SRE Habitat Assessments

Habitat assessments form an important component of terrestrial SRE invertebrate surveys. This is because a risk-based approach that uses habitat as a surrogate to infer a species distribution may be required in situations where SRE invertebrate species are only recorded from planned impact areas and the difficulties posed by adequately sampling targeted potential SRE invertebrate species during optimal timing, following rainfall. A risk-based approach will be considered by the EPA (EPA 2016a) under the following conditions:

- A potential SRE taxon is represented by one or few specimens only from within proposed development areas;
- Contextual data on the wider distribution and status of the taxon is unavailable from WAM or the DBCA; and
- Additional targeted surveys appear unlikely to yield results in a reasonable timeframe.

Additional habitat information was collected at each of the habitat assessment location to better understand the potential for these habitats to support SRE invertebrates (Section 4.3.1). There are no prescriptive guidelines to identify the habitats that must be searched when looking for potential SRE taxa, although the most prospective habitats tend to be those that are sheltered, isolated or both (EPA 2016a).

4.5.2 Collection Techniques

The SRE invertebrate survey methods involved targeted searches and collection of invertebrate specimens from dry pitfall traps and funnels. The techniques used for collecting SRE taxa are aligned with the recommendations made by the EPA (2016a) and endorsed by invertebrate specialists of the WAM and DBCA. Specimens were collected if they were from the following target groups which are prone to short range endemism;



- Mygalomorph spiders;
- Selenopid spiders;
- Harvestmen;
- Scorpions;
- Pseudoscorpions;
- Millipedes;
- Slaters; and
- Terrestrial snails.

4.5.2.1 Dry Pitfall and Funnel Trapping

Dry pitfall traps and funnels were established at systematic sites (Section 4.3.3.1) within the Survey Area. Invertebrate specimens from target groups were collected each morning during trap checks and preserved (Section 4.5.3) during the Detailed Survey.

4.5.2.2 Targeted Searches

Targeted searches for invertebrates belonging to SRE target groups were conducted in conjunction with the vertebrate targeted searches at systematic sites (Section 4.3.3.3) and at targeted SRE sites (Table 4-6). Targeted searches involved a combination of leaf litter sieving, burrow excavations and rock turning at each systematic site and within suitable habitat. Ultra-violet torches were used to search for scorpions during spotlighting conducted at each systematic site (Section 4.3.3.4). Microhabitats targeted during the searches included:

- The base of shrubs and trees;
- Under bark and amongst leaf litter and debris; and
- Under logs, rocks and in crevices.

In addition, burrows of scorpions and mygalomorph spiders found during targeted searches were excavated and any occupants collected and preserved as per Section 4.5.3.

4.5.3 SRE Specimen Processing, Preservation and Identification

All invertebrate specimens collected during the Detailed Survey were preserved on site in accordance with the WAM Taxonomic Services Submission Guidelines – March 2022 (WAM 2022). These preservation methods allow both morphological identification and DNA sequencing to be completed (where required). SRE specialist Dr Erich Volschenk of Alacran Environmental Science (Alacran) was engaged to morphologically identify invertebrate specimens and subsequently assess SRE status. Specimens that were not able to be identified to species level using morphological identification methods, due to either being of an inappropriate sex or life stage to allow for accurate identification, or due to a lack of taxonomic resolution, underwent DNA sequencing. Sequence generation from tissues was undertaken by the Australian Genome Research Facility before subsequent comparative analysis of sequencing against both Alacran and Genbank databases using the Basic Local Alignment Search Tool.



4.6 Survey Effort

Standardised systematic and targeted survey methods were employed during the Detailed Surveys. This was undertaken to ensure that species assemblages and significant fauna with potential to occur could be adequately detected. Survey effort for systematic sites is presented in Table 4-5 and Figure 4-3, and survey effort for targeted sites is presented in Table 4-6 and Figure 4-4.

Systematic trapping for vertebrate fauna totaled 5,824 trap nights (2,912 traps nights per phase) and included 2,240 funnel trap nights, 1,120 pitfall trap nights, and 2,464 Elliot and cage trap nights (Table 4-5). Systematic sampling also accounted for 37.3 avifauna census hours to detect conservation significant birds (including the Southern Whiteface), 10.7 systematic searching hours, 10.7 spotlighting hours, 224 motion-sensor cameras sampling nights, 32 bat echolocation recording nights, and 32 bird acoustic recording nights during the Detailed Survey (Table 4-5).

Targeted survey methods specific to each species of significance with the potential to occur were employed in suitable habitats, where encountered, across the Survey Area. Targeted survey effort presented below includes targeted searches and habitat assessments conducted within the Survey Area during the Targeted Yinnietharra Rock-dragon Survey (Appendix G). Targeted survey effort included motion-sensor cameras targeting Yinnietharra Rock-dragons and Long-tailed Dunnart, deployed at 30 locations for 181 nights, bat echolocation units deployed at 15 locations over 60 recording nights, and acoustic units targeting the Night Parrot and Southern Whiteface deployed at nine locations for 54 nights (Table 4-6). Additional targeted survey effort for the Yinnietharra Rock-dragon comprised 18 funnel traps deployed for 72 trap nights and 22 targeted searches (22 person hours; Figure 4-5). Habitat assessments were undertaken throughout the Survey Area (Figure 4-4). In total, 45 habitat assessments were conducted in the Survey Area. Most were completed in Stony Plain habitat (10 locations), followed by Low Hills and Slopes (8 locations), and Rocky Outcropping (7 locations) habitats.

Survey effort for SRE invertebrate fauna included both systematic and targeted methods (Figure 4-6). Systematic effort comprised 1,120 dry pitfall trap nights, and 10.7 systematic search hours (Table 4-5). Targeted survey effort comprised 15 targeted SRE searches, with the majority of searches occurring in Minor Drainage (six locations) and Rocky Outcropping (four locations) habitat (Table 4-6).



Table 4-5: Sampling effort conducted at each systematic trapping site during the Detailed Survey Phase 1 and Phase 2.

Sites	Trap nights						Avifauna census (mins.)	Systematic Searches (person mins)	Nocturnal Searches (person mins)	Motion-sensor camera nights (locations)	Bat recording nights (locations)	Bird recording nights (locations)
	Buckets	Pipes	Funnels	Small Elliots	Cages	Total						
Phase 1												
A	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
B	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
C	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
D	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
E	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
F	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
G	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
H	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
Phase 2												
A	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
B	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
C	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
D	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
E	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
F	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
G	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
H	35	35	140	140	14	364	140	40	40	14 (2)	2 (1)	2 (1)
Total	560	560	2,240	2,240	224	5,824	2,240	640	640	224 (32)	32 (16)	32 (16)



Table 4-6: Targeted survey effort within the Survey Area according to habitat.

Habitat	Extent within the Survey Area		Number of sites					
	(ha)	(%)	Motion-sensor camera	Acoustic recorders	Echolocation recorders	Habitat assessments*	Yinnietharra Rock-dragon targeted searches*	SRE targeted searches
Stony Plain	6,601.8	58.9	4	4	2	10	9	2
Minor Drainage	1,539.0	13.7	2	3	7	6	0	6
Low Hills	1,157.3	10.3	4	0	3	8	2	0
Alluvial Plain	904.2	8.1	0	0	0	3	0	0
Major Drainage	521.9	4.7	3	1	2	4	0	2
Rocky Outcropping	353.0	3.1	12	0	1	7	11	4
Rocky Hill	91.8	0.8	3	0	0	1	0	1
Mulga Woodland	10.3	0.1	1	0	0	2	0	0
Sandy Plain	8.0	0.1	1	1	0	2	0	0
Disturbed	27.8	0.2	-	-	-	-	-	-
Total	11,215.3	100	30	9	15	45	22	15

*An additional 13 habitat assessments and 10 targeted searches were undertaken outside the Survey Area as a component of the Targeted Yinnietharra Rock-dragon Survey (Appendix G).



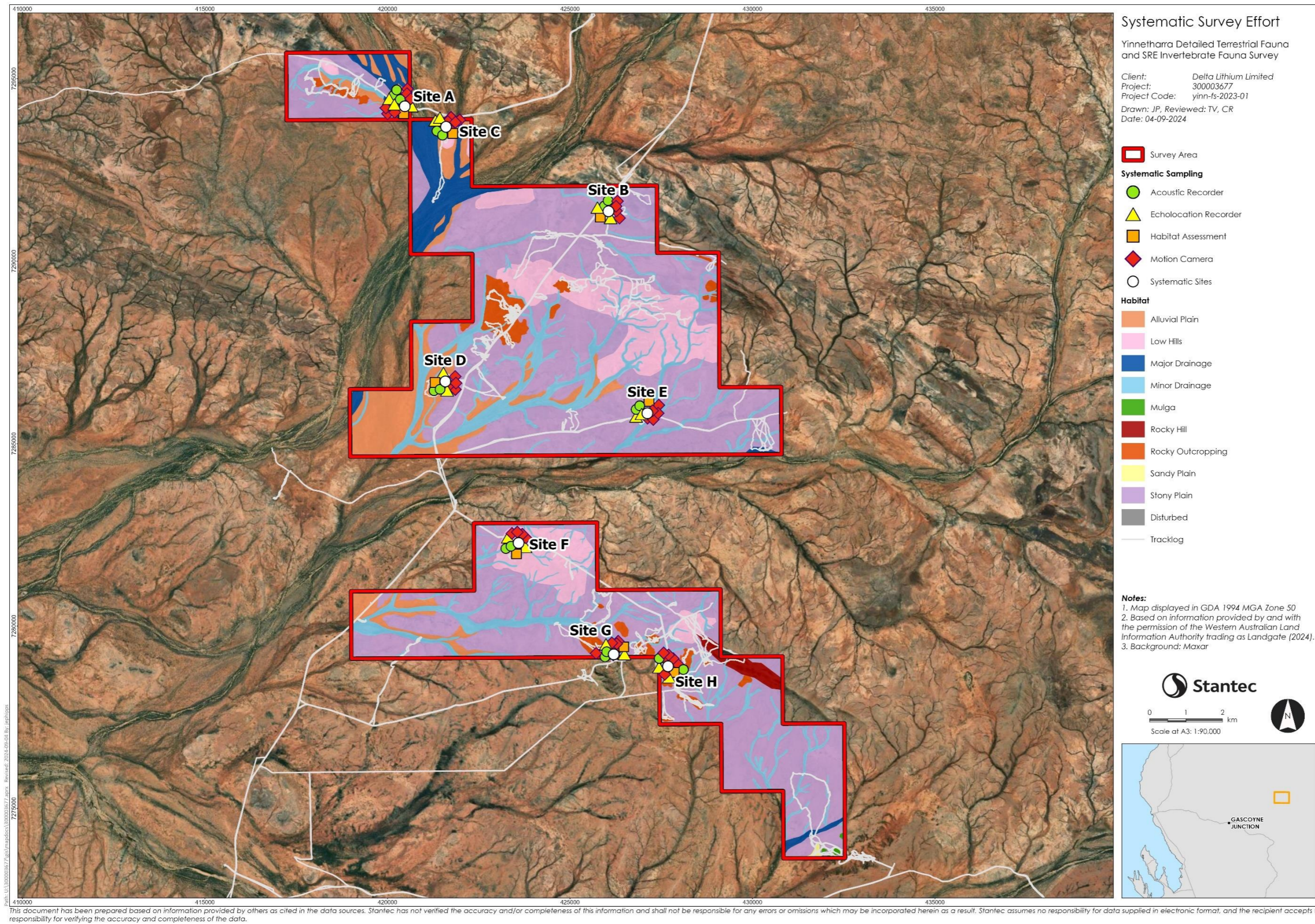


Figure 4-3: Systematic survey effort within the Survey Area.

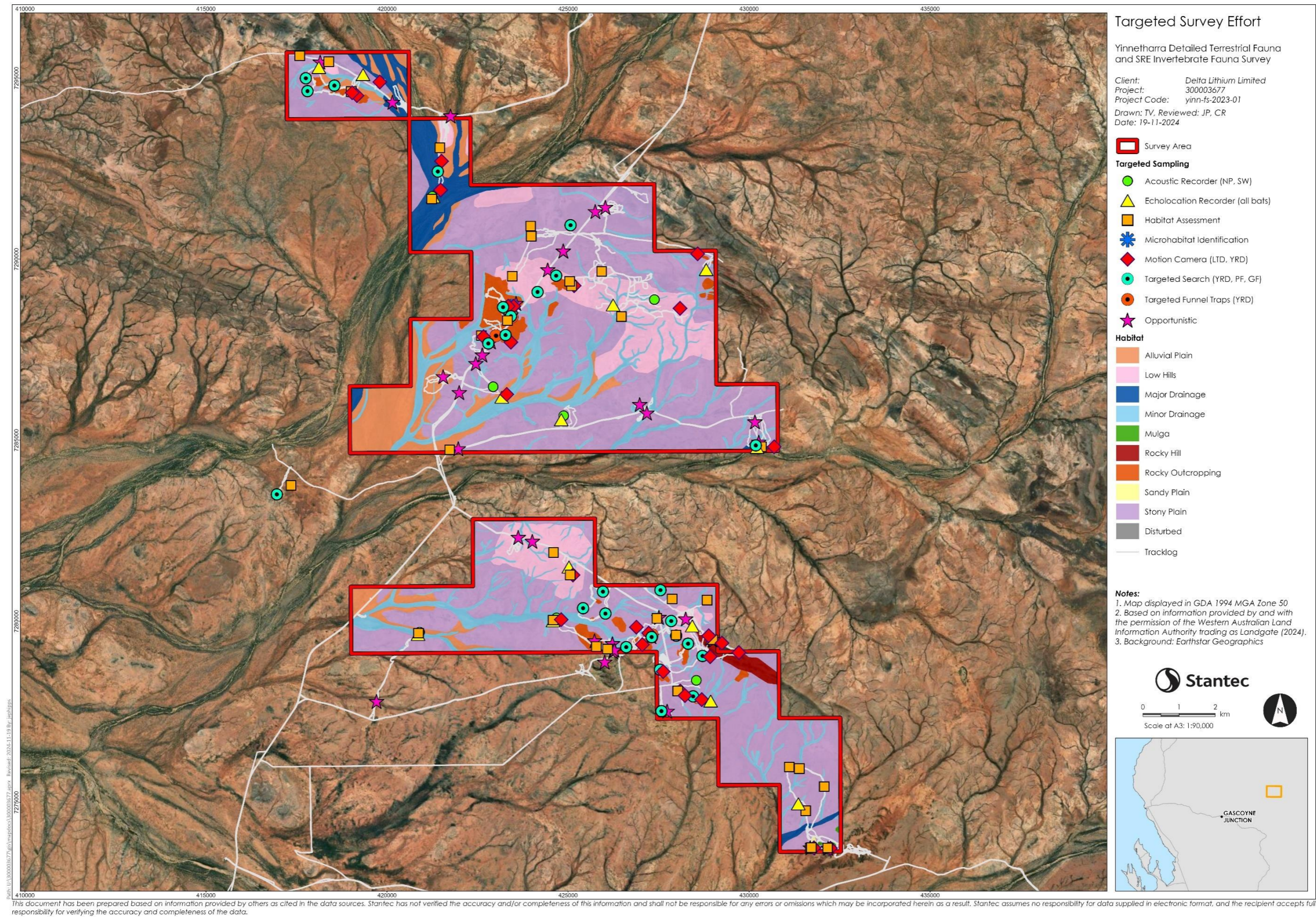


Figure 4-4: Targeted survey effort undertaken during the Detailed Survey and Targeted Yinnetharra Rock-dragon Survey. The following abbreviations are used to indicate species targeted by each method: SW = Southern Whiteface, YRD = Yinnetharra Rock-Dragon, LTD = Long-tailed Dunnart, GF = Grey Falcon, PF = Peregrine Falcon, NP = Night Parrot.

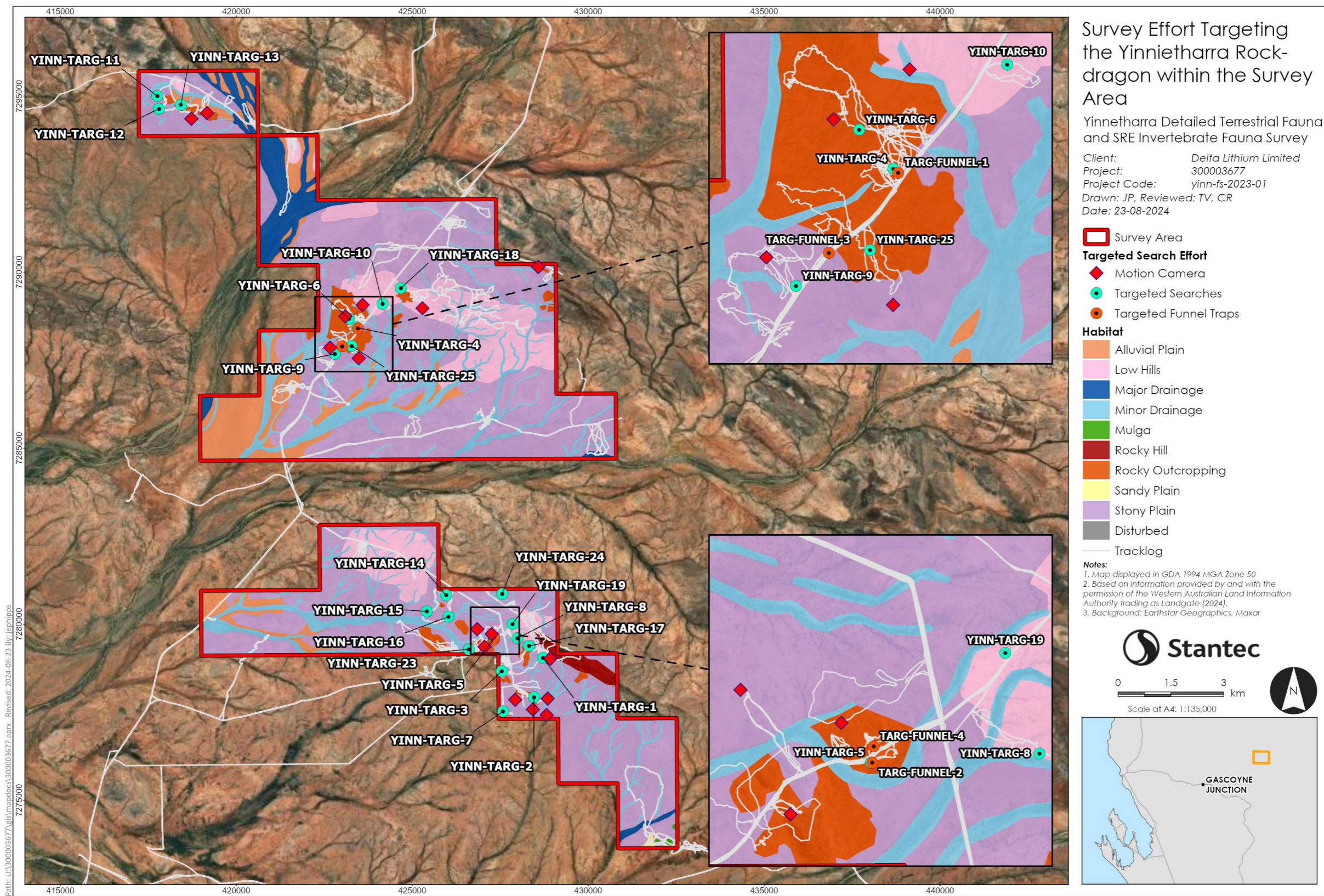


Figure 4-5: Targeted survey effort for the Yinnietharra Rock-dragon undertaken during the Detailed Survey and the Targeted Yinnietharra Rock-dragon Survey.

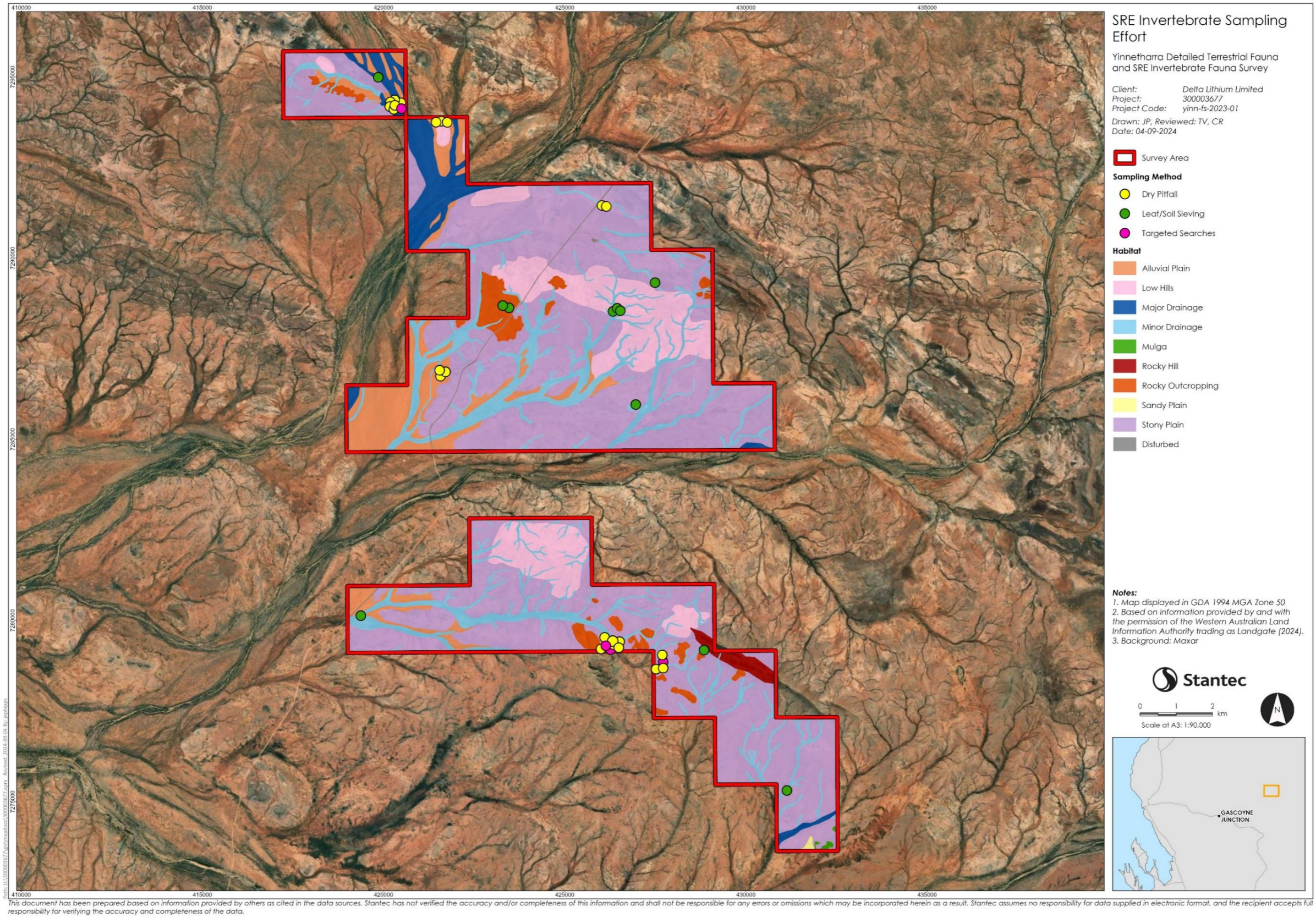


Figure 4-6: Survey effort for SRE invertebrate fauna undertaken during the Detailed Survey.

4.7 Taxonomy And Nomenclature

Fauna taxonomy is dynamic due to the ongoing description and revision of new species, and the increased understanding of the relationships of taxa through genetic and morphological studies. The nomenclature and taxonomy of reptiles, mammals and amphibians follows the Checklist of the Vertebrates of Western Australia (WAM 2023d) and the nomenclature and taxonomy of birds follows the Australian Faunal Directory (ABRS 2023) in this report, aligning with technical guidance (EPA 2020).

Vertebrate fauna species were identified in the field, as required, using standard field guides or scientific publications for:

- Mammals (Menkhorst and Knight 2010; van Dyck *et al.* 2013);
- Birds (Menkhorst *et al.* 2019; Pizzey and Knight 2012);
- Reptiles (Wilson and Swan 2021); and
- Amphibians (Cogger 2014; Tyler and Doughty 2009)

4.8 Data Management

4.8.1 Echolocation Data Treatment

Echolocation recordings from the Detailed Survey were analysed by Bob Bullen of BatCall WA to identify species diversity, using COOL EDIT 2000 (now available as AUDITION from Adobe Systems Inc.). Calls were compared with a database of reference calls for identification.

4.8.2 Acoustic Data Management

Bird call data from acoustic units was analysed for Night Parrot calls by Nick Leseberg from Adaptive NRM, an ornithology specialist with experience in call identifications, including those of Night Parrots, in WA. Calls were compared with a library of Western Australian Night Parrot calls, which appear to be subtly different to those of the eastern states (Jackett *et al.* 2017; Leseberg *et al.* 2019). Analysis was undertaken using the software Kaleidoscope Pro v5.1.8, targeting the frequency range of 1000 Hz – 4000 Hz, for which all known calls of the Night Parrot are distributed within (Jackett *et al.* 2017; Leseberg *et al.* 2019; Murphy *et al.* 2017a). Searching for calls over a large frequency range such as this is likely to produce a high number of false-positive results due to many other bird species calling at similar frequencies. However, this is necessary to capture the potential repertoire of the Night Parrot. Potential Night Parrot calls detected during the analysis were compared with a reference library comprising 897 known Night Parrot calls from WA. This library comprises calls recorded at sites where Night Parrots were confirmed visually and is therefore considered reliable for comparison (Leseberg *et al.* 2019). Analysis methods are presented in full in the analysis report (Appendix H).

Bird call data from acoustic units was analysed for Southern Whiteface calls by Stantec zoologist Jasmin Pratt, an ornithology specialist with experience in call identifications. Analysis was undertaken using the software Kaleidoscope Pro v5.5.0, targeting the frequency range of Southern Whiteface (SWF), 3500 – 7000 Hz. Analysis was restricted to triggers recorded for the first two hours and last three hours of recording time per night, targeting dawn and dusk when diurnal bird call activity peaks. A call classifier was trained using a Southern Whiteface call library and used to undertake a cluster analysis of bird call data. Cluster analysis groups similar sounding calls, with the call most similar to previously identified Southern Whiteface calls presented at the top. The number of clusters was set to a maximum of 100, all detections in the first 10 clusters and subsets of the remaining clusters were manually analysed.

4.8.3 Species Accumulation Curves

Species accumulation curves can be used to estimate the sampling adequacy of systematic observation techniques for a survey (EPA 2020). When a curve approaches an asymptote, it suggests that sampling effort has been sufficient to adequately collect the majority of species comprising the faunal assemblage at the locations sampled (Thompson and Withers 2003). The value at which the curve asymptotes can also be used as an approximate measure of the total size of the species assemblage at that location (Thompson and Withers 2003).



Species accumulation curves for the Detailed Survey were calculated using avifauna census data for birds, and systematic trapping data for mammals and herpetofauna (reptiles and amphibians combined). Species accumulation curves derived included Sobs (Mao Tao), to reflect the number of species observed (based on a given total of species recorded), and four richness estimators (Chao 1, Chao 2, Jackknife 1, and Bootstrap), to predict the total number of species that could potentially be recorded using these techniques. These four richness estimators are based variously on the functions of the number of species in only one or two samples (e.g. Chao 2 and Jackknife 1), the number of species with only one or two individuals across all samples (e.g. Chao 1), or the proportions of samples that contain each species (e.g. Bootstrap)(Gotelli and Chao 2013). Unless specified otherwise, bias-corrected formulas are used for Chao 1 and Chao 2 indicators (Gotelli and Chao 2013).

While species accumulation curves were created using systematic trapping and avifauna census data, many species were also detected via alternative techniques. In addition, species may not have been detected during the field work for various reasons such as:

- Weather patterns – species such as burrowing frogs may occur within the Survey Area year-round but are not detected in the absence of specific climatic events that trigger emergence;
- Variation in detectability – some species are readily trapped, seen and/or heard, but other species are more cryptic (e.g. many species of elapid snakes) and require concerted, highly-targeted surveys for detection; and
- Species rarity – species with restricted distributions or population sizes may not be detected without major, resource-intensive targeted surveys (e.g. Grey Falcon).

4.8.4 Similarity Analysis

An analysis of systematic fauna data was undertaken using the program PRIMER v7. This was to allow a comparison of terrestrial fauna assemblage results across a spatial scale, as outlined by current guidance (EPA 2020). A separate resemblance matrix was established for systematic abundance data of avifauna, mammals and reptiles, with the following records excluded from the contextual analysis due to their potential to cause bias:

- Opportunistic records;
- Frog species (amphibians), as the recording of these species is associated with unique weather conditions rather than survey effort or habitat and the dataset from the Detailed Survey was insufficient;
- Species, as these records are determined by echolocation recordings, which cannot be used to calculate abundance; and
- Motion-sensor camera records, as these could not be used to calculate accurate abundance.

Non-metric multidimensional scaling (nMDS) was used for the analysis of fauna assemblages. This technique relies on rank orders (distances) for ordination and compares biotic data between sites, providing a representation of relationships between sites and species. Prior to the analysis, abundance data was transformed ($\log(X + 1)$) to reduce skewness. A resemblance matrix was generated for each dataset using the Bray-Curtis index to calculate coefficient similarities between sites. The results of the nMDS procedure are presented as 2D plots, grouping sites with similar species composition together and separating sites that are dissimilar. The similarity of species composition between sites is also displayed (as a percentage) and overlaid on the plot. The strength of the analysis is indicated by a stress value that is generated by the nMDS, with a value of <0.2 regarded as an adequate explanation of the data (Clarke *et al.* 2006).

A cluster analysis was performed on each faunal dataset from the resemblance matrix (based on the group-average linking algorithm). This was used to generate a dendrogram (link-tree) illustrating the degree of similarity between different sites based on a subset of the fauna data across a small number of sampling events.



4.9 Assessment of Matters of National Environmental Significance

For the purposes of this report, MNES are defined as fauna that are listed under the EPBC Act and discussed in Section 5.4 Table 5-5 . The criteria for assessment is based on *the MNES Significant Impact Guidelines* (DotE 2013). Significant impact criteria for threatened species requires an assessment of whether the records represent an ‘important population’ of a species and whether the habitat in the Survey Area represents critical or supporting habitat to the species. Applicable regulatory guidance and information provided by subject matter experts (SMEs) defines whether specific criteria for each MNES species have been met. Criteria applied for the assessment of MNES are provided in Appendix F and discussed in further detail in Section 5.4, where applicable.



5. Results and Discussion

5.1 Vertebrate Fauna Habitats

Nine broad vertebrate fauna habitats were identified within the Survey Area during the Detailed Survey (Figure 5-1; Table 5-1), and are classified as follows:

- Stony Plain;
- Minor Drainage;
- Low Hills;
- Alluvial Plain;
- Major Drainage;
- Rocky Outcropping;
- Rocky Hill;
- Mulga Woodlands; and
- Sandy Plain.

Stony Plain habitat made up the majority (6,601.8 ha or 58.9%) of the Survey Area, followed by Minor Drainage (1,539.0 ha or 13.7%; Figure 5-1; Table 5-1). Habitat condition ranged from completely degraded (Disturbed habitat) to excellent, mainly influenced by livestock grazing and presence of weeds (e.g. Buffel Grass). The Survey Area also intersects sections of Cobra Dairy Creek Road and contains approximately 7.8 ha (0.2%) of disturbed habitat. That this excludes areas recently cleared for exploration drilling which has been captured under 'disturbance types' in Table 5-1. Each of the habitat types identified were defined in terms of distribution and significance according to the following criteria:

- **Distribution:** habitats widespread and common throughout the Survey Area were categorised as 'widespread'; otherwise, they were categorised as being of 'limited extent'. Six of the nine habitats were considered to have a limited extent. The remaining three were considered widespread.
- **Significance:** fauna habitats considered important for significant vertebrate fauna were categorised as 'significant on a local and regional scale'; otherwise, they were categorised as 'being of limited significance'. Five of the nine habitats were considered significant and may support significant fauna, particularly listed threatened species, or distinct assemblages (Minor Drainage, Low Hills, Major Drainage, Rocky Hill and Mulga Woodland). The remaining four habitats were of limited significance for supporting significant fauna.



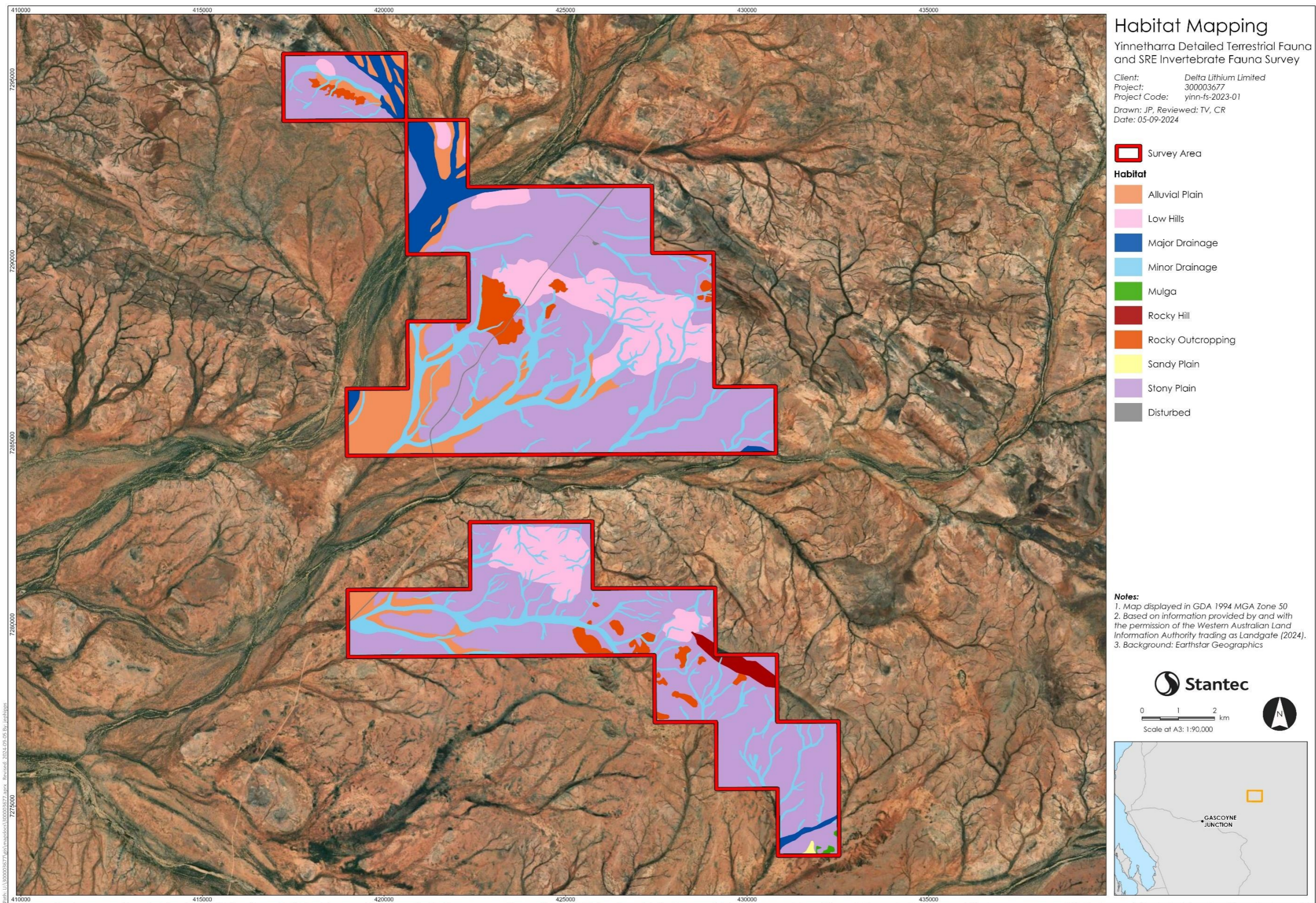











Figure 5-1: Fauna habitats identified within the Survey Area

Table 5-1: Fauna habitats identified within the Survey Area.

Habitat Distribution in the Survey Area and Significance	Broad Habitat Description	Extent within Survey Area		Systematic Site	Habitat Condition	Disturbance Types	Representative Photograph
		(ha)	(%)				
Stony Plain <ul style="list-style-type: none"> Widespread Limited significance to significant species 	<p>Stony Plain habitat comprised low lying areas that have slight to no gradient and a substrate of quartz and granite stones, gravel and pebbles. This habitat contained limited to moderate granite outcropping when adjacent to Rocky Outcropping habitat. Vegetation typically included: <i>Eremophila cuneifolia</i>, <i>Acacia synchronicia</i>, <i>Acacia xiphophylla</i>, <i>Eremophila fraseri</i> subsp. <i>fraseri</i>, and <i>Senna artemisioides</i> subsp. <i>helmsii</i> low open shrubland over <i>Aristida contorta</i>. This habitat generally had limited woody debris and leaf litter.</p>	6,601.8	58.9	B and H	Very Good to Excellent	<ul style="list-style-type: none"> Livestock and feral herbivore grazing Road/ access tracks Mining exploration 	
Minor Drainage <ul style="list-style-type: none"> Widespread Significant (Southern Whiteface) 	<p>Minor Drainage habitat comprised relatively small channels, usually dominated by shrubs with scattered tall hollow bearing trees. Vegetation typically included: <i>Acacia kempeana</i> and <i>Acacia fuscanera</i> tall shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubs over <i>Aristida contorta</i>, <i>Eriachne aristidea</i> and <i>Cenchrus ciliaris</i> open tussock grassland. Density of understorey varies within the habitat with denser areas likely to represent suitable foraging habitat for the Southern Whiteface.</p> <p>Substrates were sand and/or clay-based with certain drainages containing some quartz gravel. While not observed during the Detailed Survey, these habitats likely support temporary water pools following rainfall.</p>	1,539.0	13.7	E	Good to Very Good	<ul style="list-style-type: none"> Livestock and feral herbivore grazing Road/ access tracks Mining exploration Weeds 	
Low Hills <ul style="list-style-type: none"> Widespread Significant (Long-tailed Dunnart) 	<p>Low Hills habitat comprised low, undulating quartz and granite hills interspersed by drainage and areas of Stony Plain. This habitat also contains calcrete landforms such as hills and lower plains. Vegetation typically included: <i>Hakea preissii</i>, <i>Acacia cuspidifolia</i>, and <i>Acacia aptaneura</i> scattered tall shrubs over and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> and <i>Senna glutinosa</i> subsp. <i>luerssenii</i> open shrubland over <i>Sclerolaena cuneata</i> and <i>Sclerolaena densiflora</i> scattered herbs. Rocky substrate varied from quartz/granite pebbles to larger granite rocks. Moderate granite outcropping was observed in some areas, particularly in the north east portion of the Survey Area.</p>	1,157.3	10.3	C and F	Good to Excellent	<ul style="list-style-type: none"> Livestock and feral herbivore grazing Mining exploration Road/ access tracks 	

Habitat Distribution in the Survey Area and Significance	Broad Habitat Description	Extent within Survey Area		Systematic Site	Habitat Condition	Disturbance Types	Representative Photograph
		(ha)	(%)				
Alluvial Plain <ul style="list-style-type: none"> Limited Limited significance to significant species 	Alluvial Plain habitat comprised flat, open, low-lying floodplains found in association with drainage lines. Vegetation typically included: <i>Acacia cuspidifolia</i> and tall open shrubland over <i>Rhagodia eremaea</i> scattered shrubs over <i>Frankenia setosa</i> low open shrubland. This habitat had limited woody debris and leaf litter.	904.2	8.1	D	Degraded to Very Good	<ul style="list-style-type: none"> Livestock and feral herbivore grazing Weeds Road/ access tracks 	
Major Drainage <ul style="list-style-type: none"> Limited Significant (Southern Whiteface, Grey Falcon, Peregrine Falcon) 	Major Drainage habitat was associated with large channels supporting an upper storey of relatively tall and mature <i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i> and <i>Acacia citrinoviridis</i> woodland over <i>Cyperus vaginatus</i> very open sedgeland over <i>Cenchrus ciliaris</i> open tussock grassland. These habitats had a greater vegetation cover relative to other habitats in the Survey Area, forming woodlands with an abundance of woody debris and hollows. Substrates were primarily sand-based with some patches of quartz gravel. While not observed during the Detailed Survey, these habitats support temporary water pools following rainfall.	521.9	4.7	A	Good to Very Good	<ul style="list-style-type: none"> Livestock and feral herbivore grazing Weeds Road/ access tracks 	
Rocky Outcropping <ul style="list-style-type: none"> Limited Limited significance to significant species 	Rocky Outcropping habitat comprised large granite boulders and domes rising above sandy-clay soils with limited rock cover. Granite outcropping radiated out from larger boulders, gradually becoming lower and less complex. Vegetation typically included: <i>Acacia tetragonophylla</i> tall open shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubland over <i>Aristida contorta</i> , <i>Cenchrus ciliaris</i> and <i>Cymbopogon ambiguus</i> very open tussock grassland. This habitat generally contained many crevices and alcoves which provided refuge for a variety of fauna. Additionally, this habitat is used for nesting and perching by several raptor species. Note that the granite outcrops present in this habitat are too large to constitute suitable Yinnietharra Rock Dragon habitat (Appendix G).	353.0	3.1	G	Very Good to Excellent	<ul style="list-style-type: none"> Livestock and feral herbivore grazing Weeds Road/ access tracks 	

Habitat Distribution in the Survey Area and Significance	Broad Habitat Description	Extent within Survey Area		Systematic Site	Habitat Condition	Disturbance Types	Representative Photograph
		(ha)	(%)				
Rocky Hill <ul style="list-style-type: none"> Limited Significant (Long-tailed Dunnart) 	Rocky Hill habitat comprised slopes and crests of larger quartz hills rising above the surrounding Low Hills and Stony Plain. Vegetation typically included: <i>Acacia incurvaneura</i> tall open shrubland over <i>Eremophila latrobei</i> subsp. <i>latrobei</i> and <i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i> open shrubland over <i>Aristida contorta</i> very open tussock grassland. This habitat supports microhabitats such as crevices, and alcoves, however to a lesser extent than the Rocky Outcropping habitat. Substrate consisted of quartz and granite rocks with limited visible soil.	91.8	0.8	n/a	Very Good	<ul style="list-style-type: none"> Livestock and feral herbivore grazing Weeds 	
Mulga Woodland <ul style="list-style-type: none"> Limited Significant (Southern Whiteface) 	Mulga Woodland habitat comprised bands of <i>Acacia incurvaneura</i> open woodland on clay-based soils. Vegetation typically comprised: <i>Acacia incurvaneura</i> and <i>Acacia kempeana</i> low woodland over <i>Acacia tetragonophylla</i> , <i>Senna artemisioides</i> subsp. <i>helmsii</i> and <i>Ptilotus obovatus</i> var. <i>obovatus</i> open shrubland over <i>Digitaria brownii</i> and <i>Aristida contorta</i> open tussock grassland. This habitat had greater vegetation cover compared to other habitat types and is more likely to support a greater diversity of woodland bird species.	10.3	0.1	n/a	Very Good	<ul style="list-style-type: none"> Livestock and feral herbivore grazing Weeds 	
Sandy Plain <ul style="list-style-type: none"> Limited Limited significance to significant species 	Sandy Plain habitat comprised low lying grassland that had a very slight to no gradient and a of substrate of red-brown sand. Vegetation typically included: <i>Acacia curryana</i> and <i>Acacia kempiana</i> tall open shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> open shrubland over <i>Aristida holathera</i> var. <i>holathera</i> , <i>Aristida contorta</i> and * <i>Cenchrus ciliaris</i> open tussock grassland.	8.0	0.1	n/a	Very Good	<ul style="list-style-type: none"> Livestock and feral herbivore grazing Weeds 	
Disturbed		27.8	0.2	n/a	Completely Degraded	<ul style="list-style-type: none"> Mining exploration Road/ access tracks 	n/a
Total		11,215.3	100				

5.2 Significant Microhabitat Features

5.2.1 Fig Trees

Fig trees (*Ficus platypoda*) can support dense leaf litter cover, providing shelter and mesic conditions for small vertebrate fauna and SRE invertebrate fauna. Fig trees were recorded at two locations within the Survey Area in Rocky Outcropping habitat (Figure 4-4). At the time of survey, both trees contained scarce unripe fruit and moderate leaf cover.

5.2.2 Water Sources

Water sources are a limiting factor for fauna in arid environments (James *et al.* 1995) and are an important feature of the Gascoyne region, albeit typically temporarily during and following the wet season. The most important features are those which can provide resources for most if not all of the year. Areas containing permanent/ephemeral water sources are comparatively more productive ecosystems which can provide direct and indirect benefits to terrestrial fauna (Murray *et al.* 2003).

While there are extensive drainage systems through the Survey Area and surrounding region (where water can persist following rainfall), there were no water sources identified within the Survey Area during Phase 1 or Phase 2 of the Detailed Survey. This is likely due to the below average rainfall received in the six months prior to each phase of the Detailed Survey (Section 4.1). While it is expected that both minor and major drainage lines support temporary pools following significant rainfall, there are no permanent surface water sources occurring in the Survey Area except for man-made stock watering points.

5.3 Fauna Assemblages

5.3.1 Species Richness

A total of 126 species of vertebrate fauna were identified within the Survey Area (Table 5-2). Species recorded during the Detailed Survey comprised of 18 native mammals, four non-native mammals, 74 birds, 29 reptiles and one amphibian. This represents 43.6% of the total number of species identified during the desktop assessment identified 289 species (n=289) as potentially occurring within the Survey Area (Section 3.3). This assemblage is compiled from previous surveys and database searches therefore may include species that may occur occasionally in the Survey Area intermittently, but do not necessarily rely on habitat present the Survey Area (such as birds that may fly overhead) or species that occur as vagrants (e.g. White-bellied Sea-eagle). All of the species that were recorded during the Detailed Survey were also identified within the desktop assessment. The number of species recorded during the Detailed Survey was comparable to a previous dual-phase detailed survey conducted near the Survey Area (n=134) (ecoscape 2016) (Table 5-2).

Species richness at a given location generally depends on the diversity of microhabitats, and the size, number and/or extent of these microhabitats. The Minor Drainage habitat at Site E had the highest species richness (R=40) (Table 5-3). This was followed by the Major Drainage habitat at Site B (R=38), and Alluvial Plain habitat at Site D (R=33). The two systematic sites within Low Hills habitat, Sites C and F, had the lowest species richness (R=21 and R=23, respectively) (Table 5-3). Patterns of abundance differed slightly from diversity; the Major Drainage habitat at Site A and Stony Plain habitat at Site H far exceeded other habitats (A=371 and A=351, respectively). This was followed by Minor Drainage Habitat at Site E (A=287), and Rocky Outcropping habitat at Site G (A=245). The two Low Hills habitats at Sites C and F had the lowest abundance (A=157, and A=120, respectively) (Table 5-3).

These abundance and diversity patterns are likely due to habitat complexity, climatic factors (such as below average rainfall and extreme temperatures), the presence of introduced predator species and disturbance. The Minor Drainage habitat supported a density of *Acacia kempeana* and *Acacia fuscaneura*, and a moderate level of leaf litter and woody debris, providing structurally complex habitat. This could explain the relatively high fauna diversity and abundance, particularly of roosting, foraging, and nesting avifauna comparative to other habitats (R=29, A=245). Similarly, the Major Drainage habitat supported an upper storey of *Eucalyptus camaldulensis* subsp. *obtusata* and *Acacia citrinoviridis*, and higher levels of wood debris, hollows, and leaf litter. The Low Hills sites lacked this floral structural complexity and tended to be more sparsely vegetated, which may explain the lower abundance and diversity of vertebrate fauna at this site.



The two systematic sites within Stony Plain habitat, Sites B and H, had very different fauna diversity and abundance. The disparity is likely due to disturbance, as Site B was located in closer proximity (~300 m) to Cobra-Dairy Creek Rd than site H, and between Phase 1 and 2, Delta Lithium’s exploration camp was moved north to within 150 m of pitfall traps at Site B, which likely attributed to the lower diversity and abundance of species recorded at this site. Additionally, Stony Plain habitat at Site H was more complex than at Site B, containing more shrub cover and some minor granite outcropping. Note that the high abundance observed at Site H was likely further compounded by many Zebra Finch (*Taeniopygia guttata*) records (n=162), a species which is known to disperse in large flocks in response to water availability (Menkhorst *et al.* 2019).

Table 5-2: Species richness for the Survey Area recorded during the desktop assessment and field survey.

Faunal group	Species Recorded During the Detailed Survey	Relevant Regional Reports	Relevant Database Searches					Total
		ecoscape (2016)	DBCA (2023b) ¹	(DoAWE 2023) ¹	DBCA (2022) ¹	Birdlife Australia (2023b) ²	ALA (2023a) ²	
Mammals	18	15	7	3	5	-	15	25
Mammals (non-native)	4	5	4	-	-	-	5	7
Birds	74	85	95	14	5	145	155	171
Reptiles	29	25	35	2	1	-	66	75
Amphibians	1	4	2	0	0	-	11	11
Total	126	134	143	19	11	145	252	289

¹ Database search radius 50km buffer

² Database search radius 100km buffer



Table 5-3: Fauna species richness and abundance from systematic sampling of habitats during the Detailed Survey.

Habitat	Site	Native Mammals		Native Birds		Native Reptiles		Native Amphibians		Total	
		R	A	R	A	R	A	R	A	R	A
Major Drainage	A	1	1	25	313	11	42	1	15	38	371
Stony Plain	B	2	2	15	191	8	12	0	0	25	205
Low Hills	C	0	0	18	133	5	24	0	0	23	157
Alluvial Plain	D	0	0	25	195	8	24	0	0	33	219
Minor Drainage	E	0	0	29	245	11	42	0	0	40	287
Low Hills	F	0	0	16	108	5	12	0	0	21	120
Rocky Outcropping	G	3	9	19	205	9	31	0	0	31	245
Stony Plain	H	1	2	17	298	12	51	0	0	30	351
Total		4	14	57	1,688	25	239	1	15	87	1,956

Key to table: (R) - richness, (A) - abundance count.

Note values only reflect species recorded via systematic methods with abundance data, comprising systematic searches, systematic trapping (excluding cameras and echolocation units) and avifauna censuses.

5.3.2 Mammals

The desktop assessment identified 25 species of native mammals that may occur in the Survey Area; of these, 18 were recorded during the Detailed Survey. This equated to 72% of mammal species identified in the desktop assessment and 120% of species recorded by a previous survey near the Survey Area (ecoscape 2016) (Table 5-2). This includes ten bat species detected via echolocation units, five small mammals trapped at systematic sites and on remote cameras, and three large mammals (macropods, dingoes) detected during systematic searching and on remote cameras. While 25 species were identified during the desktop assessment, six species are unlikely to occur as the Survey Area is outside of their known distribution (e.g. Bilby, Northern Quoll). Of the 18 species recorded, only four species were detected at systematic sites using methods which can be used to calculate abundance (e.g. systematic trapping, systematic searching; Table 5-3).

Overall, native mammal abundance ($A=14$) and species richness ($R=4$) was low during systematic sampling, likely due to the extremely dry conditions in the six months preceding Phase 2 of the Detailed Survey (Section 4.1). During Phase 2 there were no small mammal species recorded during systematic sampling, suggesting that populations had contracted following months of extremely low rainfall. Additionally, Feral Cats were recorded on 21 motion cameras within the Survey Area, indicating there is high predation pressure on small mammals. Overall the mammal assemblage is typical of the region, with the exception of the Inland Forest-bat (*Vespadelus baverstocki*) which was found beyond the northern extent (Murchison region) of its reported range (Baker and Gynther 2023). However it is noted that the species distribution is poorly understood (Baker and Gynther 2023).

The habitat type with the highest native mammal diversity, based on the results of systematic sampling, was Rocky Outcropping ($R=3$, $A=9$), followed by Stony Plain (combined total from sites B & H: $R=2$, $A=4$; Table 5-3). Three habitat types did not record any species of native mammals during systematic sampling: Low Hills (Site C & F), Alluvial Plain (Site D) and Minor Drainage (Site E). The higher diversity within Rocky Outcropping habitat is likely due to the presence of many rock crevices which provide important refuge for a range of mammal species.

The most commonly recorded native mammal species from the systematic sites within the Survey Area was the Sandy Inland Mouse (*Pseudomys hermannsburgensis*), which was captured in pitfalls on six occasions from four sites (A, B, G, H), followed by the Red Kangaroo (*Osphranter rufus*) which was recorded on five occasions from three sites (D, G, H). Overall, ten bat species were recorded across the Survey Area during systematic and targeted sampling. Site H (Stony Plain) had the highest diversity of bats, supporting seven species. The two most commonly recorded bat species were the Little Broad-nosed Bat (*Scotorepens greyii*) and Gould's Wattled Bat (*Chalinolobus gouldii*), which were both recorded at all eight systematic sites and at 13 and 14 targeted sites, respectively. No significant mammal species were recorded during the Detailed Survey. Of the eight significant mammal species identified in the desktop assessment, none were considered likely to occur and two (Long-tailed Dunnart and Western Pebble-mound Mouse) were considered as possibly occurring (Section 5.4).

The comparison of mammal assemblages recorded during the Detailed Survey demonstrated that there was substantial overlap in species composition between the habitats and across the two phases (Figure 5-2; Figure 5-3; Figure 5-4). With the exception of the Rocky Outcropping habitat (Site G), all systematic sites had at least 40% similarity in species composition (Figure 5-3). Three mammal species were only recorded in the Rocky Outcropping habitat present at Site G: Woolley's Pseudantechinus (*Pseudantechinus woolleyae*) was recorded twice during systematic sampling, and the Short-beaked Echidna (*Tachyglossus aculeatus*) and Common Rock-rat (*Zyomys argurus*) were recorded on motion-sensor cameras. The high level of similarity observed across the majority of sites can be attributed to the generally low mammal species diversity and abundance recorded during the Detailed Survey.



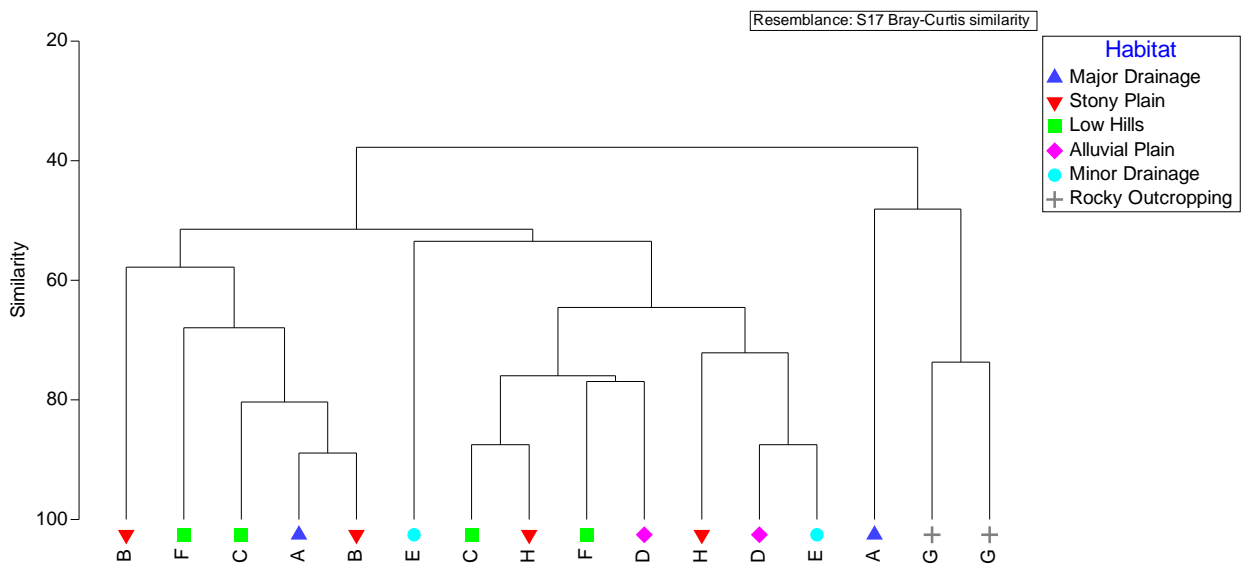


Figure 5-2: Cluster analysis of mammals recorded from habitats surveyed systematically during the Detailed Survey.

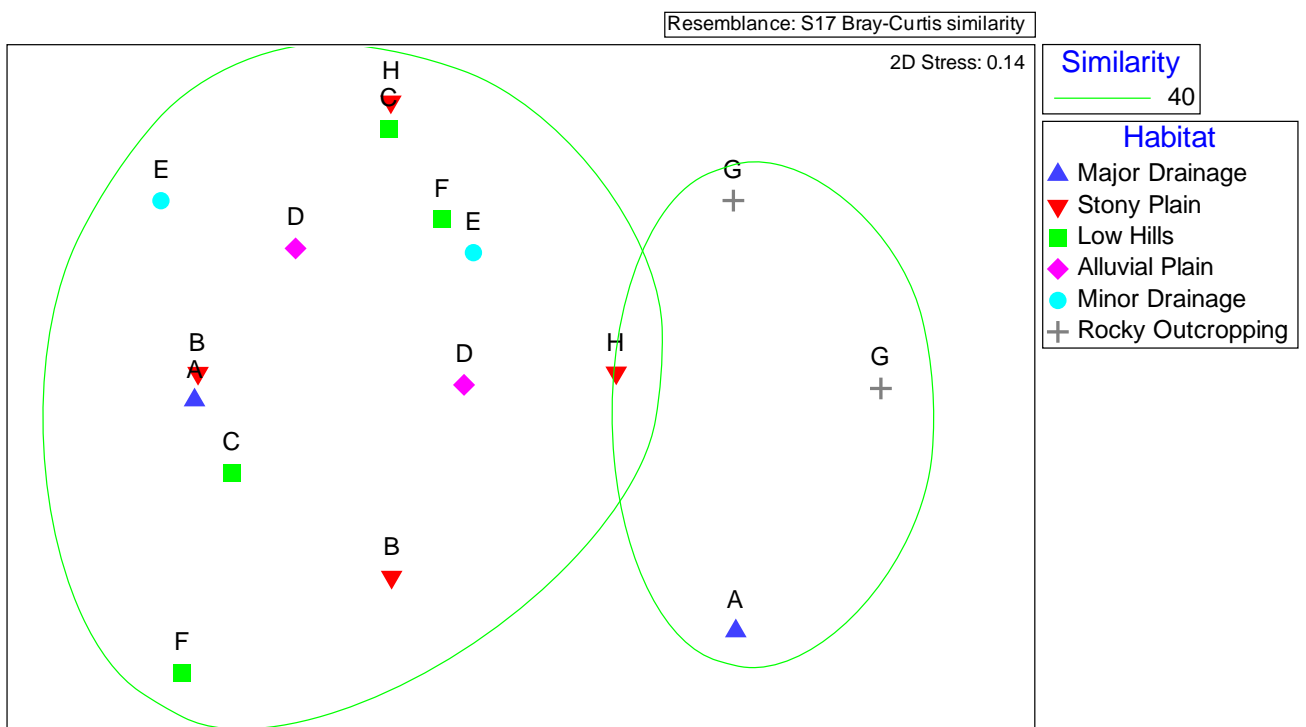


Figure 5-3: nMDS plot of mammals recorded from habitats surveyed systematically during the Detailed Survey with 40% similarity overlay.

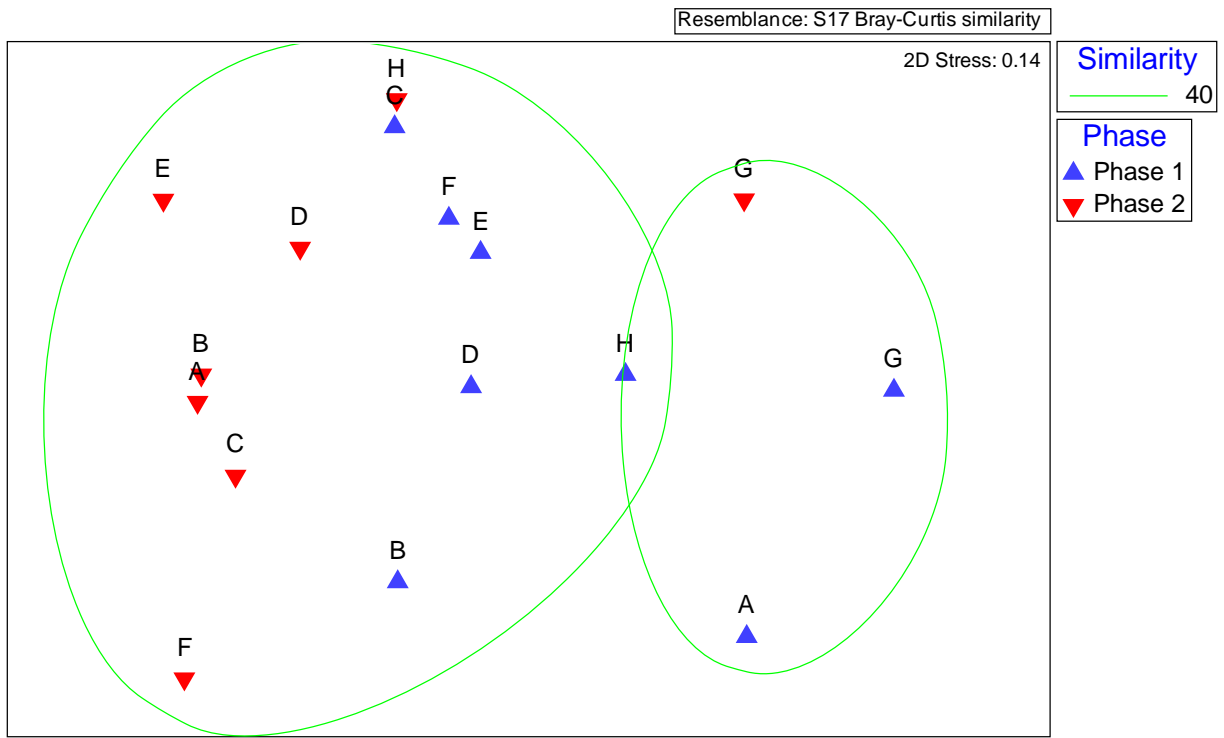


Figure 5-4: nMDS plot of mammals recorded at systematic sites during each phase of the Detailed Survey with 40% similarity overlay

5.3.3 Birds

The desktop assessment identified 171 species of native birds that may have the potential to occur in the Survey Area; and of these, 74 were recorded during the Detailed Survey. This equated to 43.3% of bird species identified in the desktop assessment and 88.2% of species recorded by a previous survey near the Survey Area (ecoscape 2016) (Table 5-2). Of the 171 bird species identified in the desktop assessment, 35 comprised waterbird/shorebird species which were not expected to occur given the lack of water present within the Survey Area. Of the 74 species recorded, only 57 species were detected at systematic sites using methods which can be used to calculate abundance (e.g. systematic searching, avifauna census) (Table 5-3).

Based on the results of systematic sampling, the Minor Drainage habitat at Site E contained the highest bird species richness (R=30), followed by Major Drainage and Alluvial Plain (R=25 for both). Major Drainage habitat had the highest bird species abundance (A=313), followed by the Stony Plain habitat at Site H (A=298), and the Minor Drainage habitat at Site E (A=245). High diversity and abundance likely relate to the presence of denser and more floristically complex vegetation at Minor and Major Drainage sites compared with all other systematically sampled habitats. These two habitats have higher suitability for bird roosting, nesting and foraging. As mentioned in Section 5.3.1, the high bird abundance at Site H is influenced by the large number of Zebra Finches recorded (n=162), representing 54% of total bird records at that site.

The most common species at the systematic sites was the Zebra Finch (n = 608), followed by the Grey-crowned Babbler (*Pomatostomus temporalis*) (n = 168) and the Galah (*Eolophus roseicapilla*) (n = 142). These species are relatively common in the landscape and typically occur in a wide range of habitats (Menkhorst *et al.* 2017). Of the 74 bird species recorded within the Survey Area, one was listed as significant fauna. Two Southern Whiteface (*Aphelocephala leucopsis*; Vu) were recorded nesting at Site E during Phase 2 of the Detailed Survey (Section 5.4.1.1). Additionally, one significant bird species, the Peregrine Falcon (*Falco peregrinus*; OS), is considered likely to occur within the Survey Area due to the proximity of historical records and presence of suitable nesting sites in Major Drainage habitat present within the Survey Area (Section 5.4.2.1).

The systematic sites had a moderate level of similarity (~50%) across habitat types indicating that different habitats support relatively similar avifauna assemblages in the Survey Area (Figure 5-5; Figure 5-6). There was also substantial overlap in avifauna assemblages recorded across the two phases of the Detailed Survey with the exception of the following Phase 2 sites: Site E (Minor Drainage), Site B (Stony Plain), Site D (Alluvial Plain), and Site G (Rocky Outcropping) (Figure 5-7). This difference may be attributed to the extremely dry conditions which proceeded Phase 2, decreasing the diversity and abundance of avifauna present in the Survey Area (Section 4.1). Total avifauna abundance declined by 62.5% between Phase 1 (A = 1,228) and Phase 2 (A = 460) the field surveys.

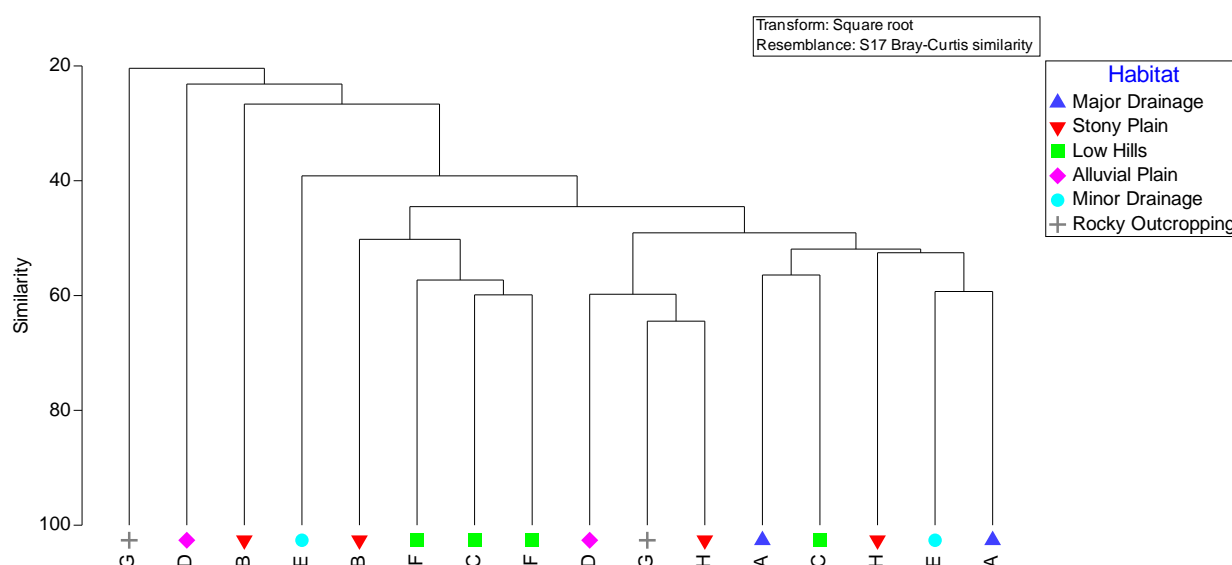


Figure 5-5: Cluster analysis of avifauna recorded from habitats surveyed systematically during the Detailed Survey.





Figure 5-6: nMDS plot of avifauna recorded from habitats surveyed systematically during the Detailed Survey with 50% similarity overlay.

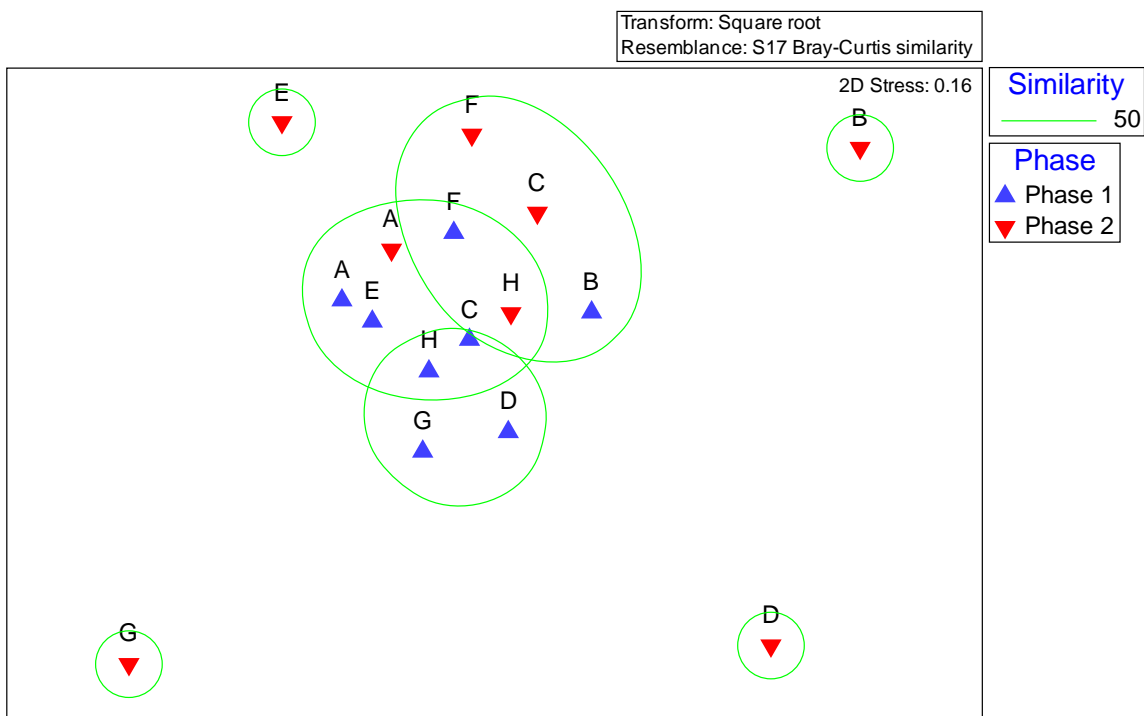


Figure 5-7: nMDS plot of avifauna recorded at systematic sites during each phase of the Detailed Survey with 50% similarity overlay.

5.3.4 Reptiles

The desktop assessment identified 75 species of reptiles that may occur in the Survey Area, and of these, 29 were recorded during the Detailed Survey. This equated to 38.6% of reptile species identified in the desktop assessment and 116% of species recorded by a previous survey near the Survey Area (ecoscape 2016) (Table 5-2). Of the 29 species recorded, only 25 species were detected at systematic sites using methods which can be used to calculate abundance (e.g. systematic trapping, systematic searching) (Table 5-3).

The habitat type with the highest reptile diversity, based on the results of systematic sampling, was the Stony Plain habitat at Site H (R=12), followed closely by Minor Drainage (R=11), and Major Drainage (R=11; Table 5-3). The Stony Plain habitat at Site H also had the greatest reptile abundance (A=51), again followed closely by Minor Drainage (A=42) and Major Drainage (A=42). While Stony Plain habitat generally lacked a diversity of microhabitats, Site H featured low granite outcrops and more woody debris, perhaps contributing to the greater reptile diversity. Both Minor and Major Drainage habitat contained ground cover vegetation in addition to woody debris and leaf litter, providing suitable shelter for a variety of reptile species.

The most common species of reptile recorded during the systematic sampling was the Stern Rock Ctenotus (*Ctenotus severus*) (n=41), followed by the Variegated Dтеля (*Gehyra variegata*) (n=35). These two species are considered common and/or widespread throughout the region (Wilson and Swan 2021). Three species were only recorded once during systematic sampling: the Fire-tailed Skink (*Morethia ruficauda*), Inland Broad-striped Slider (*Lerista nichollsi*), and Jan's Banded Snake (*Simoselaps bertholdi*). Additionally, the Jan's Banded Snake, recorded in Rocky Outcropping habitat, was the only species of snake recorded during the Detailed Survey.

There were no significant reptile species recorded within the Survey Area. The Yinnietharra Rock-dragons was not recorded inside the Survey Area during either systematic or targeted surveys and no suitable habitat for the species was found to occur. However, during Phase 2 of the Detailed Survey one Yinnietharra Rock-dragon was opportunistically recorded along Cobra-Dairy Creek Road 15 km south west of the Survey Area (Section 5.4.1.2). During the separate Targeted Yinnietharra Rock-dragon Survey (Appendix G), the species was recorded 19 times from two locations 17 – 19.5 km south west of the Survey Area. Habitat where the species was found to occur comprised sparsely distributed, low weathered granite outcrops on sparse quartz/granite gravel (1-4cm) and sandy clay soil (Section 5.4.1.2). While there are areas of granite outcropping within the Survey Area (Rocky Outcropping habitat) these areas have larger and more closely spaced granite outcrops compared to those at known Yinnietharra Rock-dragon habitat.

Systematic sites demonstrated a low level of similarity (10%) in reptile diversity and abundance, indicating habitats support relatively different reptile assemblages (Figure 5-8; Figure 5-9). The three sites that supported the greatest diversity and abundance of reptiles (Site A, Site E, and Site H) had the greatest level of similarity between them (40%). Sites F (Low Hills) and D (Alluvial Plain) were the least similar to other sites with a similarity levels of 10% and 25% respectively. The low level of similarity observed between Site F and other systematic sites can be attributed to the low species diversity and abundance recorded at Site F during both phases of the Detailed Survey (Table 5-3). Conversely, Site D likely has a low similarity to other sites because it supports two reptile species which were only recorded at this site: Central Netted Dragon (*Ctenophorus nuchalis*) and the Common Desert Ctenotus (*Ctenotus leonhardii*). Similarity across phases was variable with some sites showing high levels of similarity between phases and others showing lower similarity. Sites which had higher similarity between phases included Site A (Major Drainage), Site E (Minor Drainage), Site H (Stony Plain), and Site D (Alluvial Plain; Figure 5-10).



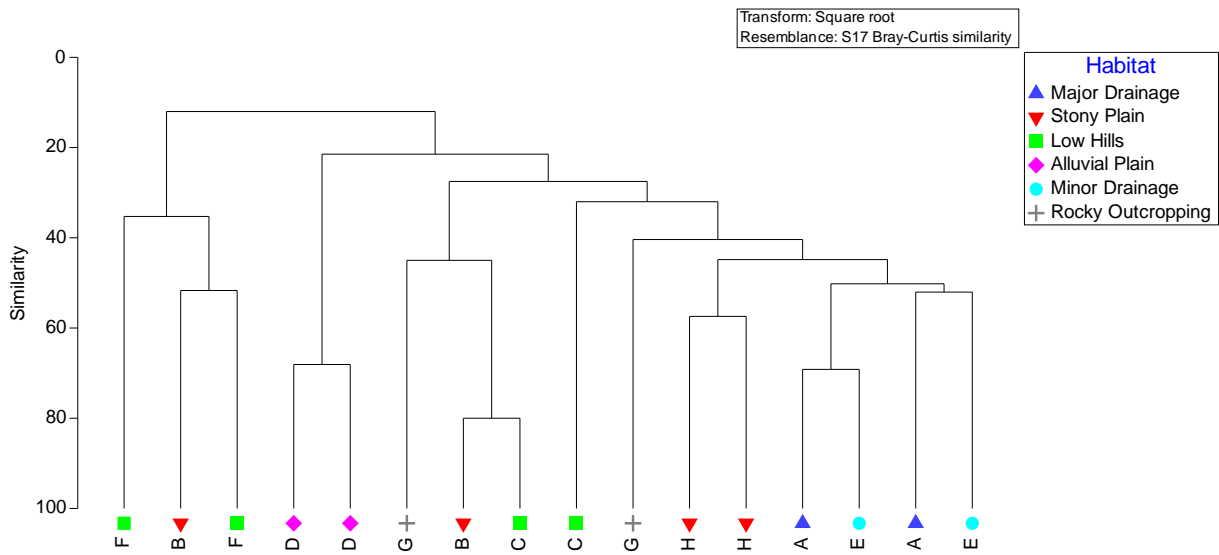


Figure 5-8: Cluster analysis of reptiles recorded from habitats surveyed systematically during the Detailed Survey.

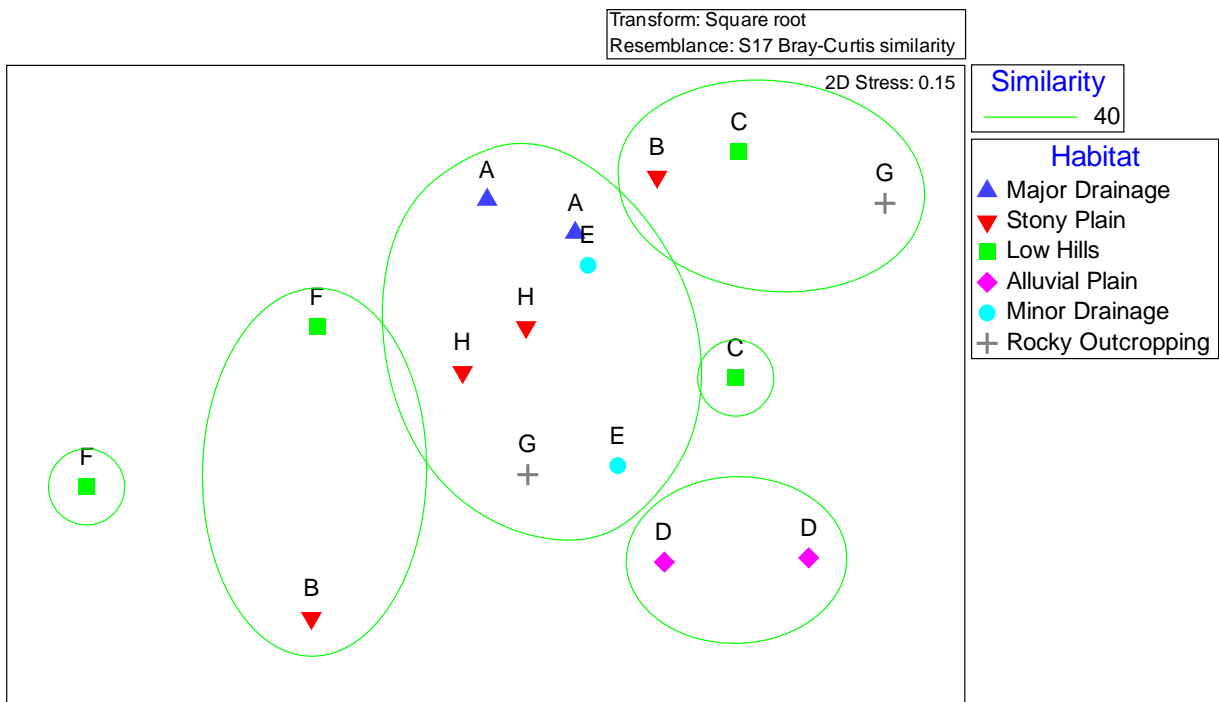


Figure 5-9: nMDS plot of reptiles recorded from habitats surveyed systematically during the Detailed Survey with 50% similarity overlay.

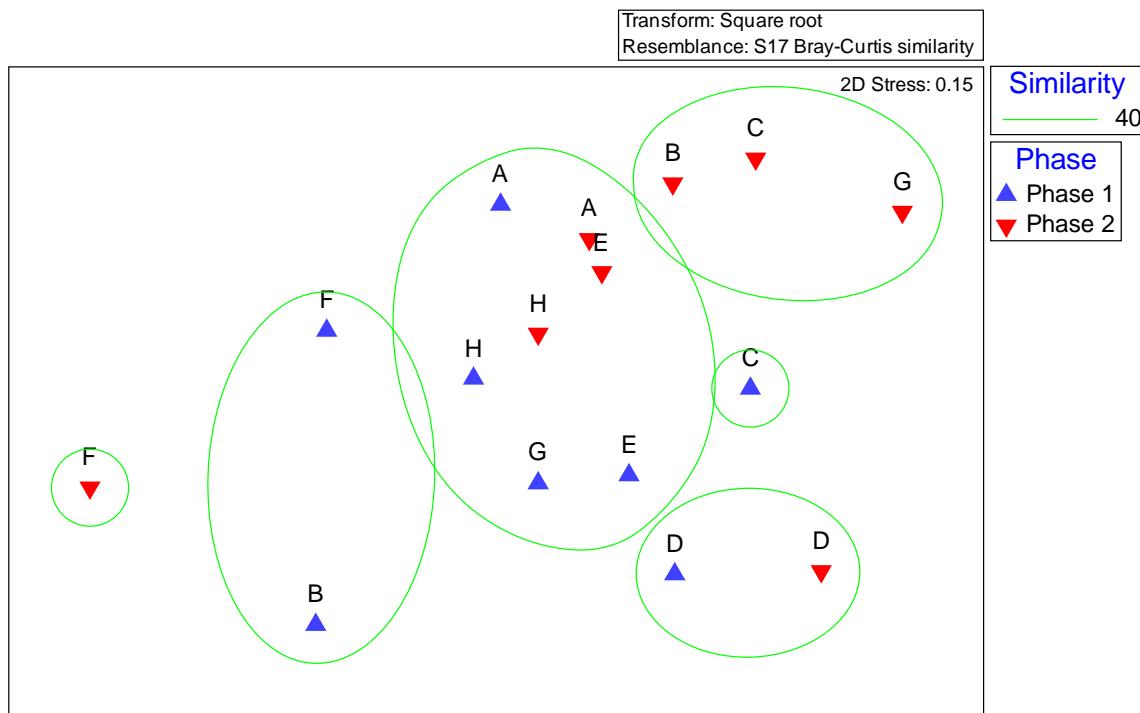


Figure 5-10: nMDS plot of reptiles recorded at systematic sites during each phase of the Detailed Survey with 50% similarity overlay.

5.3.5 Amphibians

The desktop assessment identified 11 species of amphibians that potentially occur within the Survey Area, with four species detected by a survey previously conducted near the Survey Area (Table 5-2). Of these, only one species; Spencer's Burrowing Frog (*Platyplectrum spenceri*), was recorded during the Detailed Survey. This equates to 9% of frog species identified in the desktop assessment and 25% of species identified by previous surveys near the Survey Area. Spencer's Burrowing frog was only recorded during Phase 1 in the Major Drainage habitat at Site A (15 individuals recorded). The low number of frog species recorded is likely due to the below average rainfall the Survey Area received in the six months preceding Phase 1 and Phase 2. No water pools were recorded in the Survey Area during the Detailed Survey.

5.3.6 Introduced Fauna

The desktop assessment identified seven species of introduced fauna that potentially occur within the Survey Area (Table 5-2). In total, four introduced mammal species were detected within the Survey Area, including European Cattle (*Bos taurus*), Feral Cats (*Felis catus*), European Rabbits (*Oryctolagus cuniculus*), and House Mice (*Mus musculus*). Evidence of European Cattle was observed throughout the Survey Area, which is to be expected given the Survey Area is within a cattle station (Yinnetharra Station). Feral Cats were recorded at 21 locations within the Survey Area, including seven systematic motion-sensor cameras, 13 targeted motion-sensor cameras, and one opportunistic sighting. Feral Cats were recorded in every habitat type present within the Survey Area except for Sandy Plain. European Rabbits were observed twice opportunistically at the same location along Dairy Cobra Creek Road. The House Mouse was caught at systematic trapping sites in Stony Plain, Low Hills, Alluvial Plain, Minor Drainage and Major Drainage habitats.

5.3.7 Sampling Adequacy

Species accumulation curves can be used to estimate the sampling adequacy of systematic observation techniques for a survey (EPA 2020). Species accumulation curves were calculated using the methods outlined in Section 4.8.3 and were created using only systematic trapping, systematic searching and avifauna census data. Estimations of species richness were calculated using four asymptotic richness estimators (Chao1, Chao2, Jackknife1, and Bootstrap) and plotted against the observed number of species (Sobs). When a curve approaches asymptote, it suggests that sampling effort has been

sufficient to adequately collect the majority of species comprising the faunal assemblages at the locations sampled that can be detected via systematic sampling methods and which are present at the time and location of sampling (Thompson and Withers 2003). Several species richness estimators (Chao1, Chao2, Bootstrap and Jackknife 1) were used to predict the total number of fauna species (by group) within the Survey Area based on the available data.

Four native mammal species were recorded from systematic sites during systematic trapping and systematic searching. The species richness estimators for the Stantec Survey reached asymptote for mammals for one accumulation estimator (Chao 1; Figure 5-11). This indicated that sampling was sufficient to detect the majority of the mammal species present. Richness predictors indicate between 80% and 100% of mammal species were recorded during the Detailed Survey, and that one additional species may be recorded with increased survey effort (Table 5-4). An additional 14 native mammal species (Appendix B) were recorded in the Survey Area from motion-sensor camera, echolocation recorders and opportunistic observations. These species were not recorded during systematic sampling and therefore were not included in the species accumulation curves. Large mammal species such as macropods cannot be captured in traps and bat species are only captured from echolocation recordings which cannot be included in the analysis.

Fifty-seven bird species were recorded from systematic sites during avifauna censuses and systematic searching. The species richness estimators for the Detailed Survey did not reach asymptote for avifauna for all accumulation estimators (Figure 5-12). This indicated that further sampling may yield some additional species. Richness predictors indicate between 77% and 88% of avifauna species were recorded during the Detailed Survey, and that between 7 and 16 additional species may be recorded with increased survey effort (Table 5-4). An additional 17 avifauna species (Appendix B) were recorded in the Survey Area from motion-sensor cameras, acoustic recording units and opportunistic observations. These species were not recorded during systematic sampling and therefore were not captured in the species accumulation curves.

Twenty-five reptile species were recorded from systematic sites during systematic trapping and systematic searching. The species richness estimators for the Detailed Survey approached asymptote for reptiles for all accumulation estimators (Figure 5-13). This indicated that while further sampling may yield some additional species, survey effort was sufficient to detect the majority of reptile species present. Richness predictors indicate between 89% and 98% of reptile species were recorded during the Detailed Survey, and that between 1 and 3 additional species may be recorded with increased survey effort (Table 5-4). An additional four reptile species, including the Black-headed Monitor (*Varanus tristis*), Gould's Monitor (*Varanus gouldii*), and Yellow-spotted Monitor (*Varanus panoptes*) (Appendix B) were recorded in the Survey Area from motion-sensor cameras and opportunistic observations. These species were not recorded during systematic sampling and therefore were not captured in the species accumulation curves. While these species are considered common, larger goannas can escape large pitfall traps and therefore are unlikely to be recorded in systematic sampling.

Fauna detection and capture are influenced by a variety of factors, and during this Survey, lack of rainfall preceding both phases would be considered a key factor. During Phase 1, conditions were appropriate for the capture of all groups within the Survey Area; warm enough for reptile activity but not too warm to deter avifauna activity. During Phase 2 Trip 2, conditions were cooler, contributing to a low number of reptile captures, however the rainfall and cooler temperatures contributed to greater avifauna activity. Other than the small rainfall events that occurred prior to Phase 2 Trip 2, extremely limited rainfall occurred between Phase 1 and Phase 2 (Section 4.1), likely contributing to a lower number of species recorded during Phase 2. No small mammals (e.g. dunnarts, rodents) were recorded systematically during Phase 2 indicating that populations may have contracted following limited rainfall. Similarly, much lower bird abundance was observed during Phase 2 (A=460) relative to Phase 1 (A=1,228). Given the potential for water to pool in Minor and Major Drainage habitat present within the Survey Area, it is possible that had greater rainfall occurred prior to field surveys that additional avifauna species (e.g. waterbirds) and amphibians may have been recorded.

Despite the dry conditions that preceded both phases of survey work, the data and species accumulation curves generally indicate that the survey effort was sufficient to detect the majority of mammal and reptile species present in the Survey Area. However, additional survey effort may have resulted in the observation of more bird species.



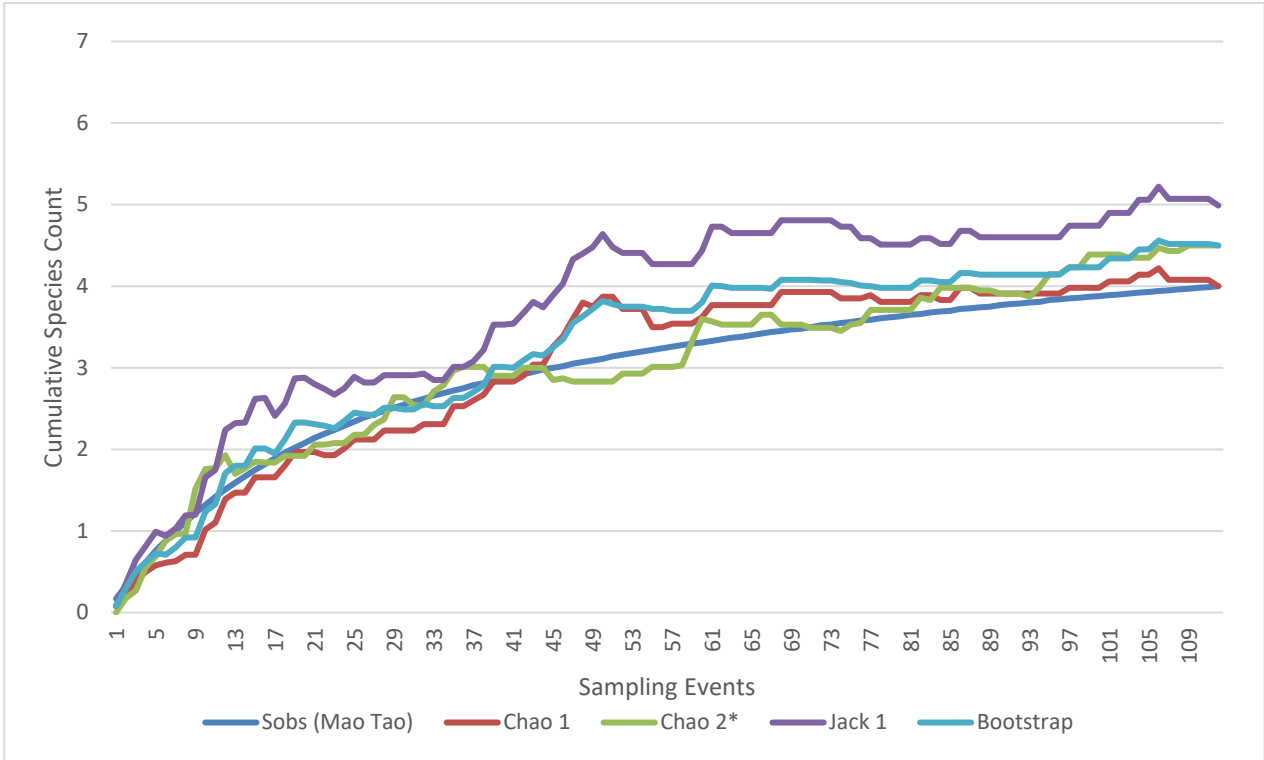


Figure 5-11: Species accumulation curves for mammal species recorded from systematic sampling during the Detailed Survey. Asterisk (*) indicates that a value was computed using classic rather than bias-corrected analysis.

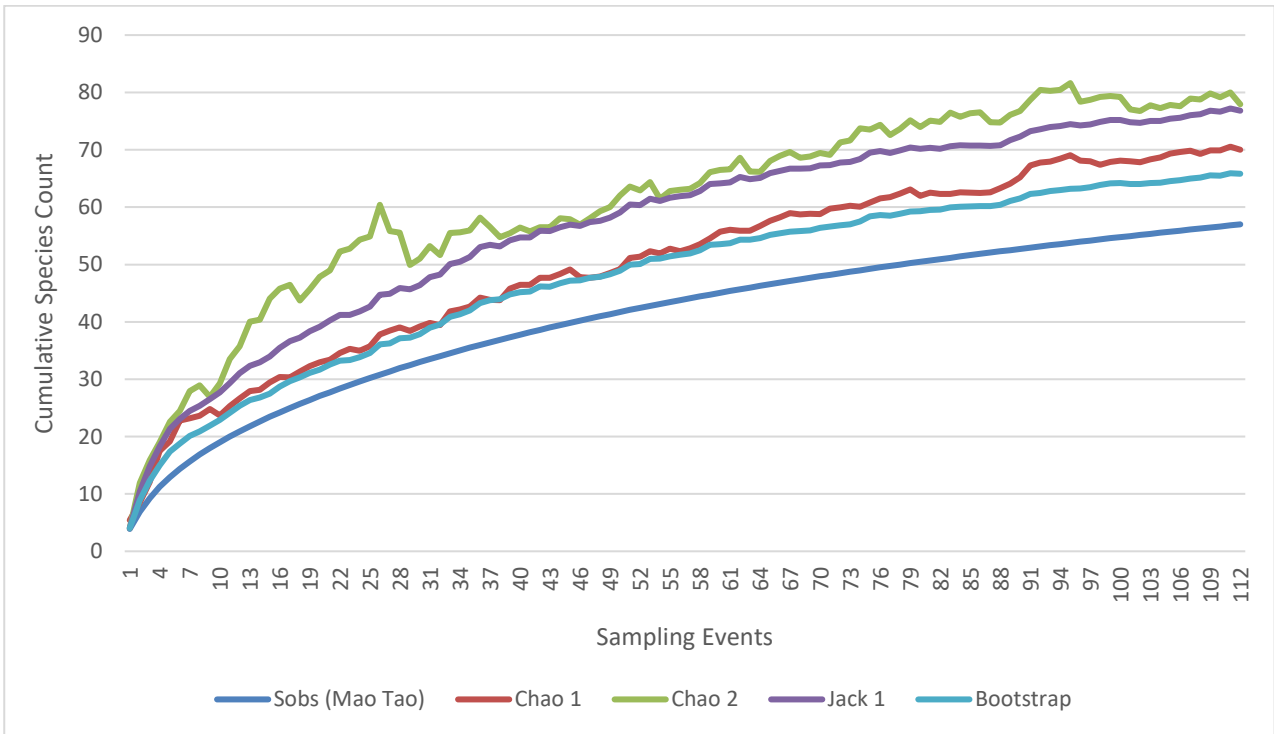


Figure 5-12: Species accumulation curves for bird species recorded from systematic sampling during the Detailed Survey.

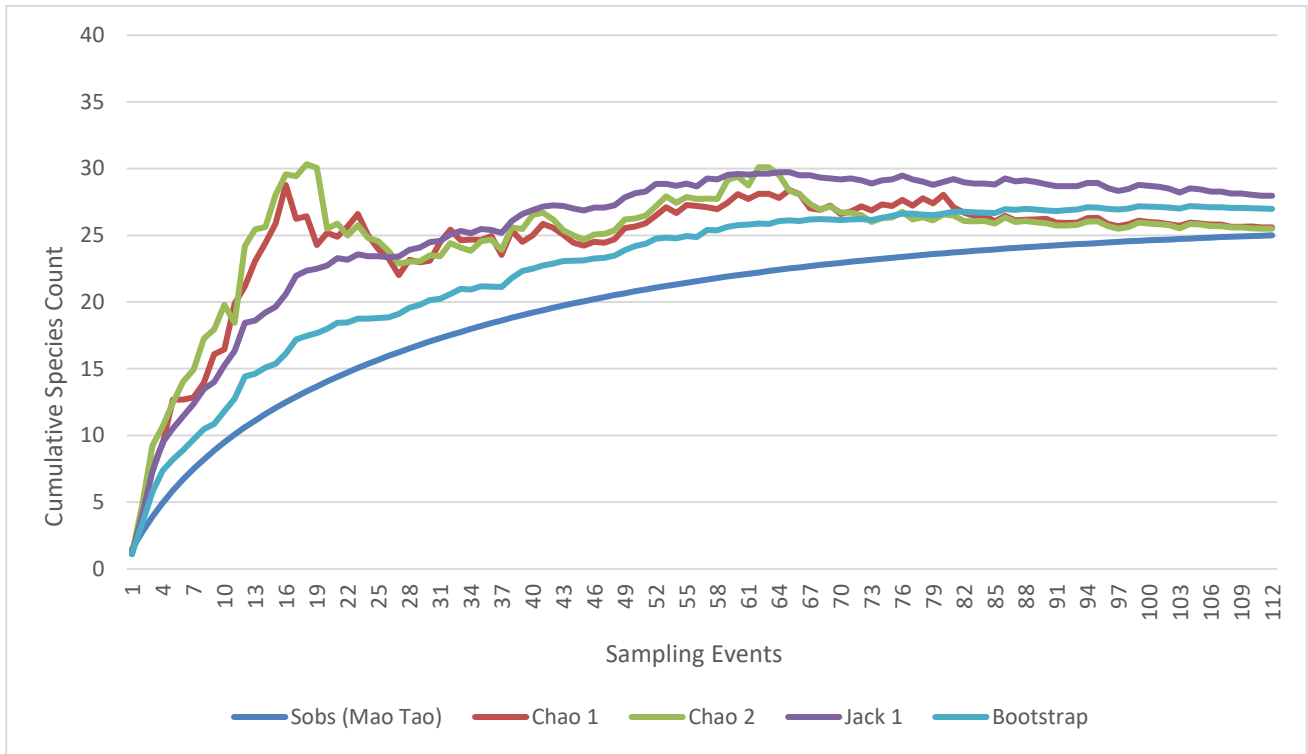


Figure 5-13: Species accumulation curves for reptile species recorded from systematic sampling during the Detailed Survey.

Table 5-4: Observed and predicted species richness from systematic sampling during the Detailed Survey.

Fauna group	Observed vs Estimated		Species Richness	Proportion recorded (%)
Mammals	Obs.	Sobs	4	-
	Estimated	Chao 1	4	100
		Chao 2*	4.5	89
		Jackknife 1	4.99	80
		Bootstrap	4.5	89
Birds	Obs.	Sobs	57	-
	Estimated	Chao 1	69.99	81
		Chao 2	77.92	73
		Jackknife 1	76.82	74
		Bootstrap	65.81	87
Reptiles	Obs.	Sobs	25	-
	Estimated	Chao 1	25.6	98
		Chao 2	25.5	98
		Jackknife 1	27.97	89
		Bootstrap	26.99	93

Key to table: (*) - Computed using classic rather than bias-corrected analysis.



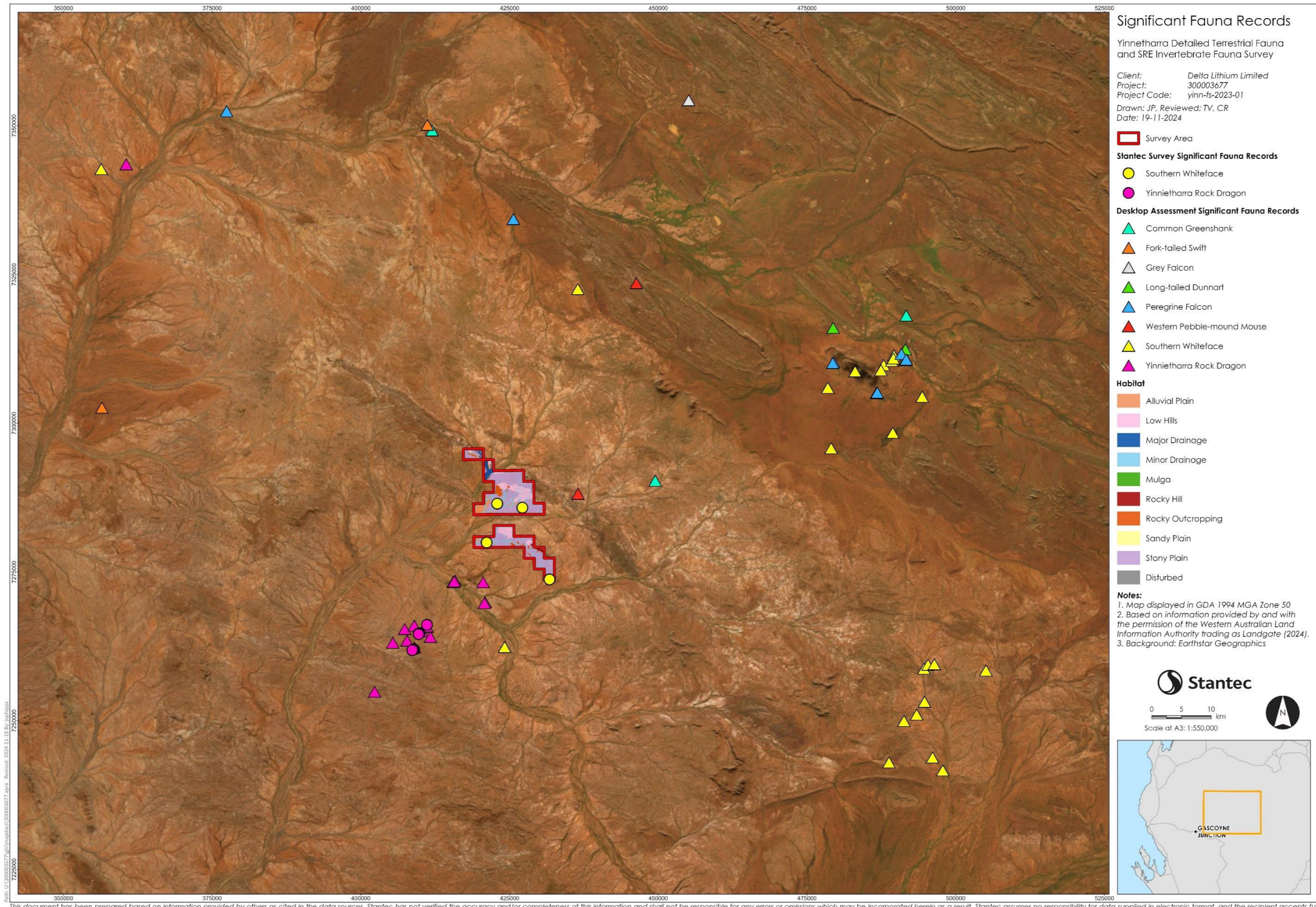
5.4 Significant Vertebrate Fauna

5.4.1 Significant Species Recorded

The desktop assessment identified 28 terrestrial vertebrate fauna species of significance with the potential to occur within the Survey Area, comprising eight mammal, 17 bird and three reptile species (Section 3.3.2). Only one significant vertebrate fauna species was recorded within the Survey Area: the Southern Whiteface (*Aphelocephala leucopsis*; Vu; Section 5.4.1.1; Figure 5-14). Two individuals were observed at one location, and eight calls were detected on targeted acoustic units from an additional three locations. No other significant species were recorded within the Survey Area despite extensive systematic and targeted survey effort, nor were any recorded opportunistically while moving through the Survey Area.

One significant species, the Yinnietharra Rock-dragon, was recorded opportunistically during the Detailed Survey at a location 15 km south west outside of the Survey Area. Additionally, during the separate Targeted Yinnietharra Rock-dragon Survey, an additional 19 records of the species were recorded outside of the Survey Area between 17 and 19.5 km south west of the Survey Area (see Section 5.4.1.2 and Appendix G). However, this species is considered unlikely to occur (Appendix C) based on the findings of the Targeted Yinnietharra Rock-dragon Survey Appendix G), the SDM and consultation with specialist herpetologist Steve Wilson, there is no habitat with the four characteristics considered suitable for the Yinnietharra Rock-dragon within the Survey Area and despite considerable survey effort, the species was not recorded within the Survey Area. The Yinnietharra Rock-dragon is discussed in further detail in Section 5.4.1.2.





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Figure 5-14: Significant species recorded during the Detailed Survey, the Targeted Yinnietharra Rock-dragon Survey, and desktop assessment

5.4.1.1 Southern Whiteface (*Aphelocephala leucopsis*; Vu)- Confirmed in Survey Area

Conservation Status and Species Ecology

The Southern Whiteface is listed as Vulnerable under the EPBC Act. It is a small (~11.5 cm) thornbill-like bird which has a characteristic white band across its forehead. The species occurs throughout most of mainland Australia south of the tropics, from the northeastern edge of the Western Australian wheatbelt, east to the Great Dividing Range (Menkhorst *et al.* 2019).

The Southern Whiteface forages almost exclusively on the ground, feeding on a variety of insects, spiders and seeds. Foraging groups usually consist of 2-8 individuals; however the species may congregate in larger flocks during the non-breeding season (Higgins and Peter 2002). Breeding usually occurs between July and October; however, this may be impacted by rainfall in arid regions. The Southern Whiteface builds its nest using grass, bark and roots in tree hollows or crevices. The species has a typical clutch size of 3-4 eggs and young fledged 14 to 19 days after hatching (Higgins and Peter 2002).

Threatening Processes

The Southern Whiteface was listed as vulnerable in March 2023 due to an estimated 30-50% decline in population every ten years since 1999, with no indication that declines are slowing (Garnett and Baker 2022). The main threats to the species are habitat loss (loss of breeding habitat through removal of living and dead trees with hollows and crevices which are essential for roosting and nesting) fragmentation and habitat degradation, particularly in parts of their range where there has been extensive habitat clearing for intensive agriculture (Garnett and Baker 2022). Given the Southern Whiteface forages almost exclusively on the ground, any habitat degradation (i.e. from introduced herbivores, fire, clearing) that adversely impacts the layer of dense understory of grasses and herbs, within critical habitat for the species, would limit availability of essential foraging habitat. An additional threat to the species is climate change increasing the likelihood of extreme events such as drought and wildfire (Evans *et al.* 2017).

Habitat Requirements

The species occurs in a wide range of open woodlands and shrublands, typically dominated by acacias or eucalypts on ranges, foothills and lowlands, and plains (Higgins and Peter 2002). The Southern Whiteface forages in habitats with low tree densities and a herbaceous understorey litter cover (Antos and Bennett 2006).

Distribution in Relation to the Survey Area

The species has been historically recorded at 40 locations within the desktop search extent (100 km buffer of the Survey Area). The nearest record occurs approximately 14 km south of the Survey Area, and the most recent observation was in 2016, approximately 63 km south-east of the Survey Area (Birdlife Australia 2023a). Within the desktop search extent, based on an interpretation of aerial imagery, the species has largely been recorded within or adjacent to Minor or Major Drainages in the landscape.

The species was confirmed as present within the Survey Area (Figure 5-15) with two individuals observed emerging from a tree hollow, indicative of nesting, at systematic trapping Site E in Minor Drainage habitat. Based on an interpretation of aerial imagery, this record within Minor Drainage habitat is consistent with the habitat types of regional records within the Survey Area surrounds (Figure 5-16). Additionally the species was detected at three sites via targeted acoustic units during Phase 1 of the Survey: one site within Minor Drainage (three detections), one site within Sandy Plain (two detections) and one site within Stony Plain (three detections). Minor Drainage habitat within the Survey Area comprises of dominant species; *Acacia kempeana* and *Acacia fuscaneura* tall shrubland, which is consistent with descriptions of the species occurring within a wide range of woodlands and shrublands habitat, typically dominated by acacias or eucalypts (Higgins and Peter 2002). Minor drainage habitat comprises (13.7%) of the Survey Area, however this habitat extends beyond the Survey Area and appears to be widespread within the surrounding landscape based on analysis of aerial imagery. Additionally, previous records of the species appears to align with this habitat type in the Survey Area surrounds based on aerial imagery (Birdlife Australia 2023a). An additional two broad fauna habitats limited in extent within the Survey Area provide suitable habitat for the species; Major Drainage (4.7%) and Mulga Woodland (0.1%), both of which extend beyond the Survey Area. One acoustic unit in Sandy Plain habitat detected the Southern Whiteface on three occasions during Phase 1. While Sandy Plain habitat is not consistent with descriptions of Southern Whiteface habitat, the acoustic unit was placed within 200m of Mulga Woodland habitat, perhaps explaining the detection of the species at that location. Similarly, one acoustic unit in Stony Plain



habitat detected the Southern Whiteface on one occasion during Phase 1. While Stony Plain habitat is not consistent with descriptions of Southern Whiteface habitat, the acoustic unit was placed approximately 200m of Minor Drainage habitat, perhaps explaining the recording of the species at that location.

Matters of National Environmental Significance

Habitat critical to survival: According to DCCEEW (2023c) critical habitat for the Southern Whiteface includes areas of:

- Relatively undisturbed open woodlands and shrublands with an understorey of grasses or shrubs, or both;
- Habitat with low tree densities and an herbaceous understorey litter cover which provides essential foraging habitat;
- Living and dead trees with hollows and crevices which are essential for roosting and nesting.

Habitat within the Survey Area comprises of relatively undisturbed open woodlands and shrublands with an understorey of grasses or shrubs aligning with the above definition of critical habitat for the species above. Two individuals of Southern Whiteface were recorded within Minor Drainage line habitat (displaying behaviour indicative of nesting, emerging from a tree hollow). Additionally Major Drainage and Mulga Woodland contain areas of habitat aligning with critical foraging habitat for the species within the Survey Area. Although the species may occur within other habitats within the Survey Area that align with the description of critical habitat according to DCCEEW (2023c), within the context of the Survey Area, the most prospective habitats for the species align with Minor Drainage line, Major Drainage and Mulga Woodland.

Habitat condition within these habitat types ranged from good to very good with the most observed disturbance types comprising weed invasion and cattle grazing. While other habitats present within the Survey Area contain open shrubland (Stony Plain, Low Hills, Alluvial Plain), they lack a dense understorey of grasses and herbs which, based on the known ecology of the species, would otherwise provide suitable foraging habitat for the species. Additionally, Minor and Major Drainage habitats denser and more floristically complex vegetation compared with all other habitats within the Survey Area. Minor Drainage (dominant species; *Acacia kempeana* and *Acacia fusca* tall shrubland), Major Drainage (associated with large channels supporting an upper storey of relatively tall and mature *Eucalyptus camaldulensis* subsp. *obtusata* and *Acacia citrinoviridis* woodland) and Mulga Woodlands (*Acacia incurvaneura* and *Acacia kempeana* low woodland over *Acacia tetragonophylla*, *Senna artemisioides* subsp. *helmsii* and *Ptilotus obovatus* var. *obovatus* open shrubland over *Digitaria brownii* and *Aristida contorta* open tussock grassland) are the only habitats within the Survey Area which contain trees suitable for Southern Whiteface roosting and nesting. These habitats are not confined to within the Survey Area and based on analysis of aerial imagery, appear widespread within the surrounding region.

Important population: There are no specific important populations identified in DCCEEW (2023c) for the Southern Whiteface as there is no recovery plan for the species at the time of this report. There were limited detection of the species from four locations within the Survey Area, despite extensive systematic and targeted survey effort, which may be a reflection of the relatively limited extents of broad fauna habitats aligned with critical habitat in the Survey Area for the species; Minor Drainage (13.7%), Major Drainage (4.7%) and Mulga Woodland (0.1%). Critical habitat for the species is not confined to the Survey Area and 40 previous records of the species have been confirmed within the surrounding region. However, the population within the Survey Area may trigger the criteria for an 'important population' (DoE 2013) for the following reasons:

- Two individuals were recorded emerging from a tree hollow, indicative of nesting, within Minor Drainage Line habitat, indicating that the Survey Area supports breeding habitat for the species; and
- The Survey Area is also close to the northern limit of the species' range which may trigger the criteria for an important population that occurs near the limit of the species range (DoE 2013)(Figure 5-17).



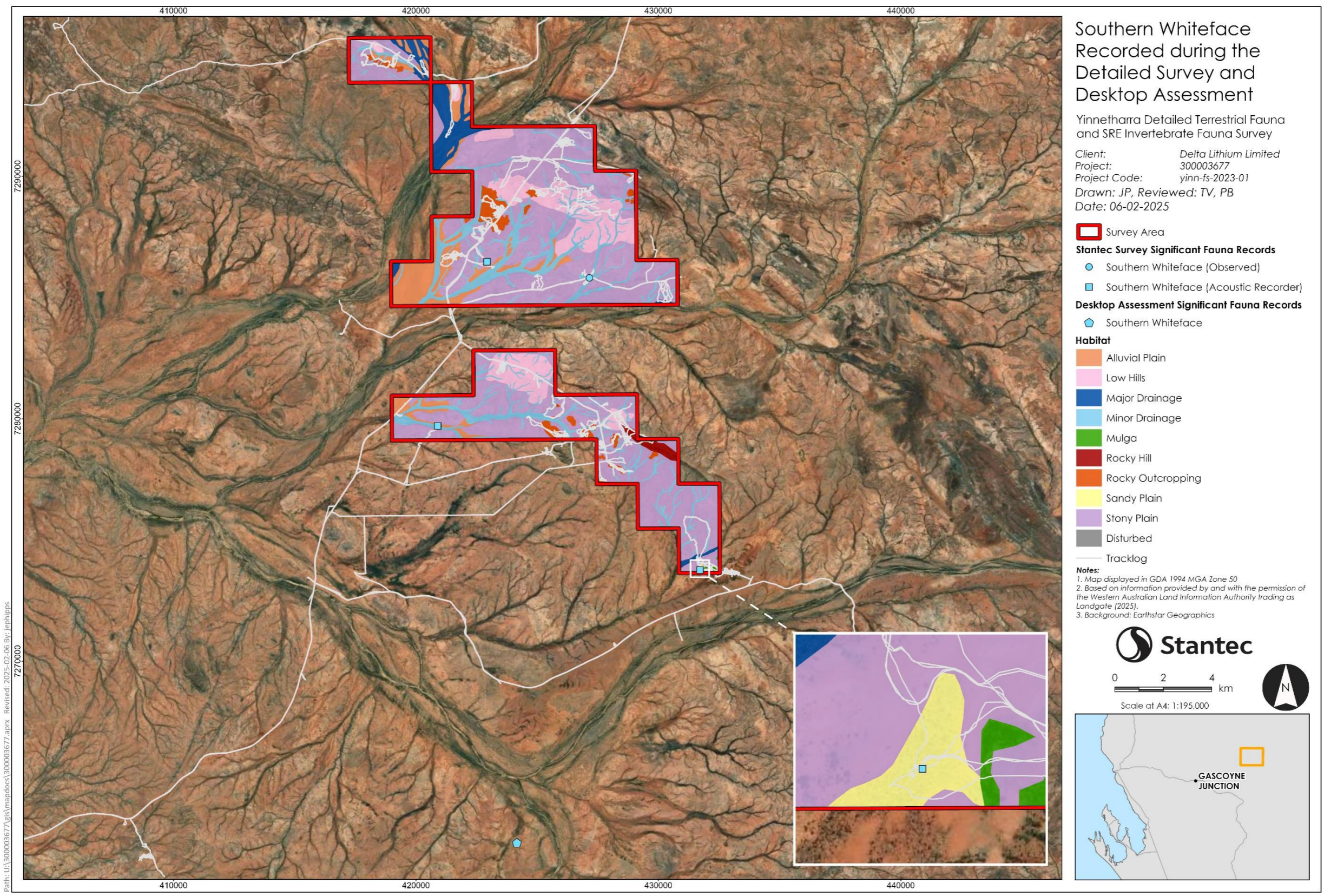
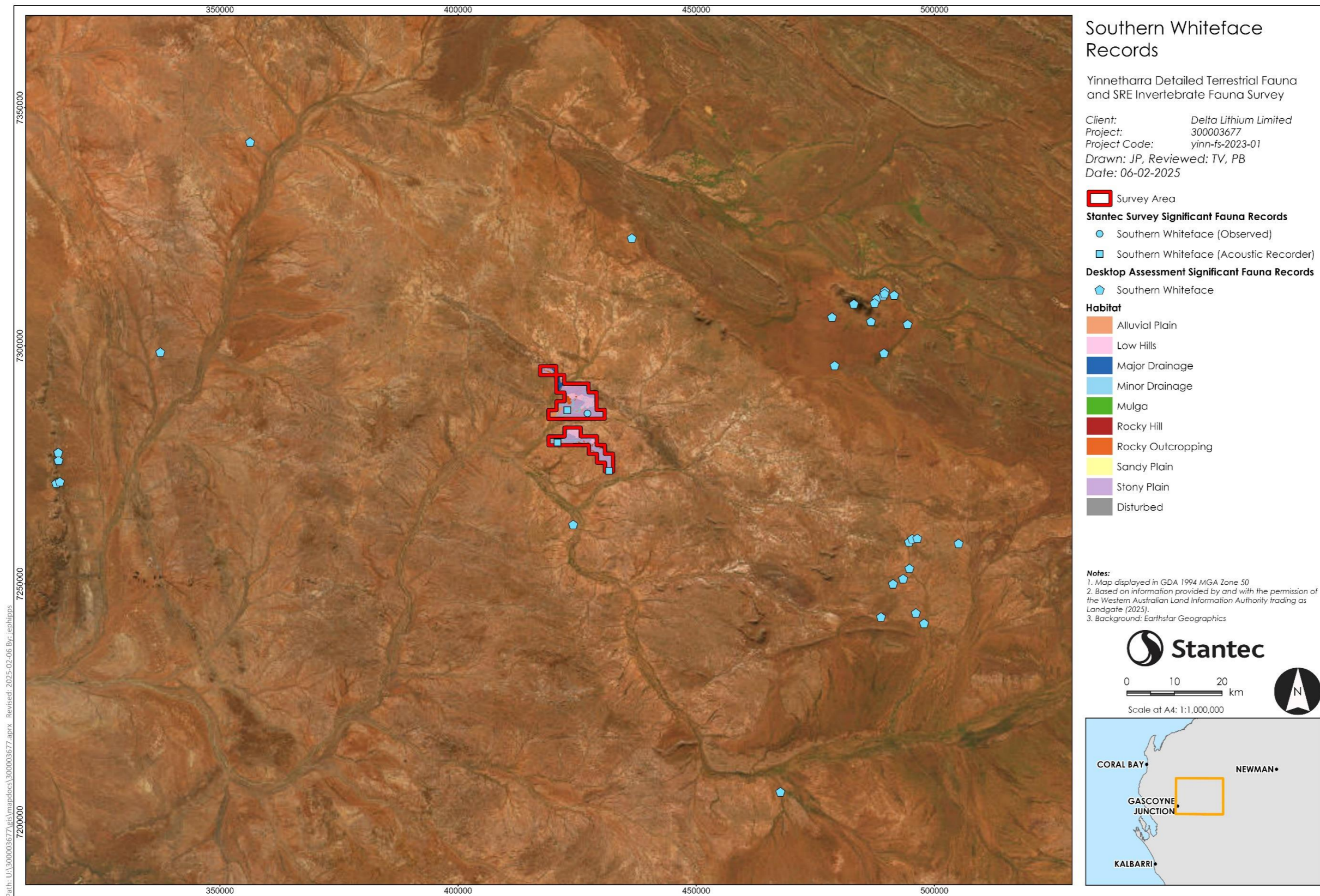


Figure 5-15: Southern Whiteface records from the Detailed Survey and desktop assessment



This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Figure 5-16: Southern Whiteface records from the Detailed Survey and desktop assessment in a regional context

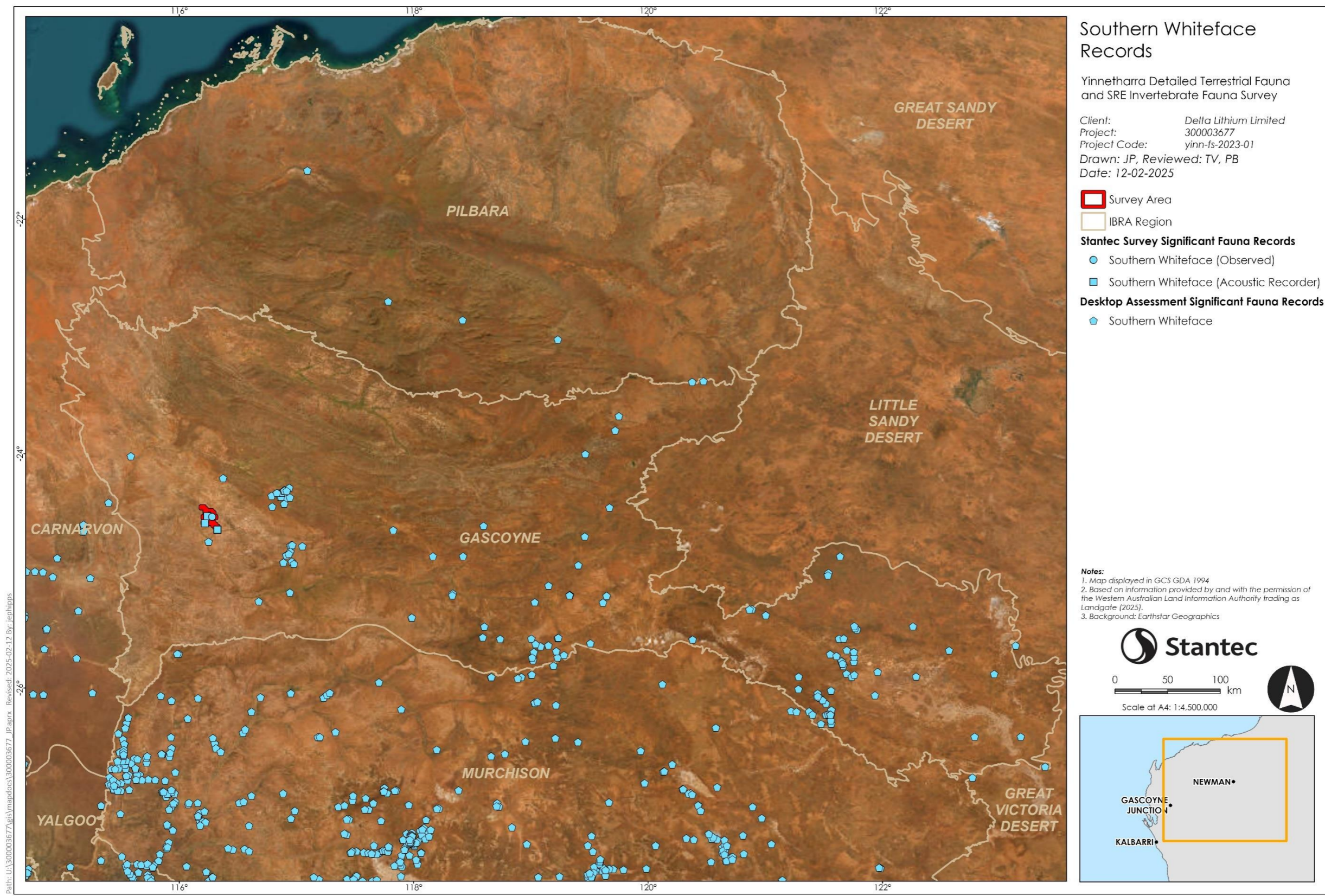


Figure 5-17: Southern Whiteface distribution in north-west Western Australia with respect to the Survey Area (records from Atlas of Living Australia (ALA 2025)).

5.4.1.2 Yinnietharra Rock-dragon (*Ctenophorus yinnietharra*; Vu, Vu)- Recoded in Survey Area Surrounds

Conservation Status and Species Ecology

The Yinnietharra Rock-dragon is listed as Vulnerable under the EPBC Act and BC Act. The Yinnietharra Rock-dragon is a rock-dwelling agamid lizard known only from areas of southern Yinnetharra Station, and a single location from Minnie Creek Station (DBCA 2022). Published records of the species are over 30 years old, with the exception of the Minnie Creek record from 2006 (DBCA 2022). However, there are anecdotal reports of herpetologists visiting Yinnetharra Station within the last ~5 years and recording the species (Pers. comm. S Wilson 2024). The Yinnietharra Rock-dragon is an understudied reptile with a limited distribution, and consequently little is known about the species.

Threatening Processes

The main threats to the species include habitat degradation by pastoral activities and cattle grazing as well as boulder harvesting. Due to the Yinnietharra Rock-dragon's limited distribution and small population size, it is vulnerable to any stochastic events which may impact the species (DEWHA 2008).

Habitat Requirements

Published definitions of suitable Yinnietharra Rock-dragon habitat are limited, with the *Approved Conservation Advice for Ctenophorus Yinnietharra* (DEWHA 2008) stating that ground surveys to determine the species' habitat preferences are a high research priority. It was therefore an objective of the Targeted Yinnietharra Rock-dragon Survey to better define suitable habitat for the species. Published descriptions of suitable Yinnietharra Rock-dragon habitat state that the species occupies tall open shrublands where it inhabits low granite outcrops which are often less than 1 m² in area (Cogger *et al.* 1993; G. Shea and M. Peterson pers obs in DEWHA 2011). The Yinnietharra Rock-dragon is a habitat specialist, inhabiting granite outcrops composed of Archaean (>2.5 billion years ago) gneissic biotite granites and granodiorite (Cogger *et al.* 1993). It does not appear to occupy the massive granite outcrops in the same area which are instead inhabited by the widely distributed Ring-Tailed Dragon (*Ctenophorus caudicinctus*) (G. Shea and M. Peterson pers obs in DEWHA 2011). Results of the Targeted Yinnietharra Rock-dragon Survey (Appendix G) built on this description, and defined suitable habitat as:

- Suitable Yinnietharra Rock-dragon habitat comprises very low, weathered granite outcrops that typically rise to heights of only 0.5 - 1.0 m. Outcrops are typically less than 1m² in area; however, some larger outcrops can also be present (>1m², <3 m²). These low outcrops occur on plains and low rises where they are widely spaced, separated by open, sparsely vegetated expanses spanning about 50 – 100m, and are not found in association with larger and more extensive granite outcropping which occurs in the region. Ground cover is predominantly sparse quartz/granite gravel (1-4cm) and sandy clay soil; however, may contain patches of larger pebbles (5-10cm) which are more densely spaced. Overall, ground cover is much less dense than the quartz plain which commonly occurs in the surrounding region. Critical elements within this habitat are the woody shrubs (*Acacia* spp. and *Eremophila* spp.) that offer shade and additional elevated perching sites for the species.

Based on this description and consultation with specialist herpetologist Steve Wilson, it is thought that there are four key characteristics a habitat must have to be considered suitable:

1. Substrate – Primarily gravel (1-4 cm) but may be pebble sized (5-10 cm) quartz and granite on sandy clay soils. Rock cover is sparse compared to dense quartz plain habitat that commonly occurs in the surrounding region.
2. Presence of granite outcrops – Species requires low weathered granite outcrops.
3. Size of granite outcrops – Majority (>90%) of outcrops present are only 0.5 to 1 m in height and less than 2 m in length.
4. Density of granite outcrops – Outcrops are sparsely distributed, often separated by distances of 50 – 100 m.

Distribution in Relation to the Survey Area

The species has been recorded at 36 locations within the desktop search extent (100 km buffer of the Survey Area). Of those, 28 records are within 20 km of the Survey Area, and the most recent observation in 2006, approximately 79 km north west of the Survey Area (DBCA 2022).



During Phase 1 and 2 of the Detailed Survey, 17 targeted searches were undertaken for the Yinnietharra Rock-dragon, however it was not recorded within the Survey Area. During Phase 2, one individual was observed opportunistically along Cobra-Dairy Creek Road, approximately 15 km south-west of the Survey Area. Given there is limited information available on species ecology, distribution and habitat preferences, Stantec undertook a separate Targeted Yinnietharra Rock-dragon Survey of the Survey Area and broader region where the species has been recorded historically.

During the Targeted Survey the species was recorded on 19 occasions from two locations outside the Survey Area between 17 and 19.5 km south-west of the Survey Area (Figure 5-14). The species was not recorded within the Survey Area despite a total targeted survey effort (Detailed Survey and Targeted Survey; Figure 4-5) of:

- 22 targeted searches (22 person hours);
- 16 targeted motion cameras (91 trap nights); and
- 18 targeted funnel traps (72 trap nights).

To better understand the distribution of the Yinnietharra Rock-dragon relative to the Survey Area, an SDM was developed as a component of the Targeted Yinnietharra Rock-dragon Survey (Appendix G). Ten models were generated, incorporating species records from the Targeted Yinnietharra Rock-dragon Survey. Two models were found to have the highest accuracy and were combined into a final weighted ensemble model (Figure 5-18). According to this model, the highest habitat suitability for the Yinnietharra Rock-dragon is found ~15 km southwest of the Survey Area, aligning with both historical Yinnietharra Rock-dragon records and the data from the Targeted Survey (Figure 5-19). No areas within the Survey Area were classified as having a high habitat suitability. The model suggested that some moderately suitable habitat is present in isolated southern sections of the Survey Area however, the Targeted Survey did not support this finding. These areas of granite outcropping were observed to be larger and more widely distributed compared to known Yinnietharra Rock-dragon habitat.

For complete SDM results see the *Targeted Yinnietharra Rock-dragon Survey Memo* presented in Appendix G.

Matters of National Environmental Significance

Habitat critical to survival: Critical habitat is not defined for the species. However, Rock-dragon applying the four characteristics of suitable habitat described above, there was no suitable Yinnietharra Rock-dragon habitat observed within the Survey Area. Habitats were assessed using observations made during targeted searches, habitat assessments (Appendix E; Appendix G), and opportunistically as field teams traversed the Survey Area. These results are consistent with the SDM which indicated that habitat classified as highly suitable for the Yinnietharra Rock-dragon does not occur in the Survey Area (Figure 5-19). While there are areas of granite outcropping within the Survey Area (Rocky Outcropping habitat) these areas have larger and more closely spaced granite outcrops compared to those at known Yinnietharra Rock-dragon habitat. Where low weathered outcrops did occur in the Survey Area (Stony Plain or Low Hills habitat), substrate consisted of dense quartz and granite rocks which does not align with suitability criterion 2 (substrate) presented above. During the Targeted Survey, suitable habitat was only recorded at six sites located 15 -19.5 km south of the Survey Area (see Appendix G). Similarly, the SDM indicated that the most suitable habitat occurs in the vicinity of the historic and Targeted Survey Yinnietharra Rock-dragon records, located ~15 km southwest of the Survey Area.

Important Population: Given the absence of suitable habitat for the species and the lack of records despite intensive survey effort, the Survey Area does not comprise an important population for the Yinnietharra Rock-dragon.



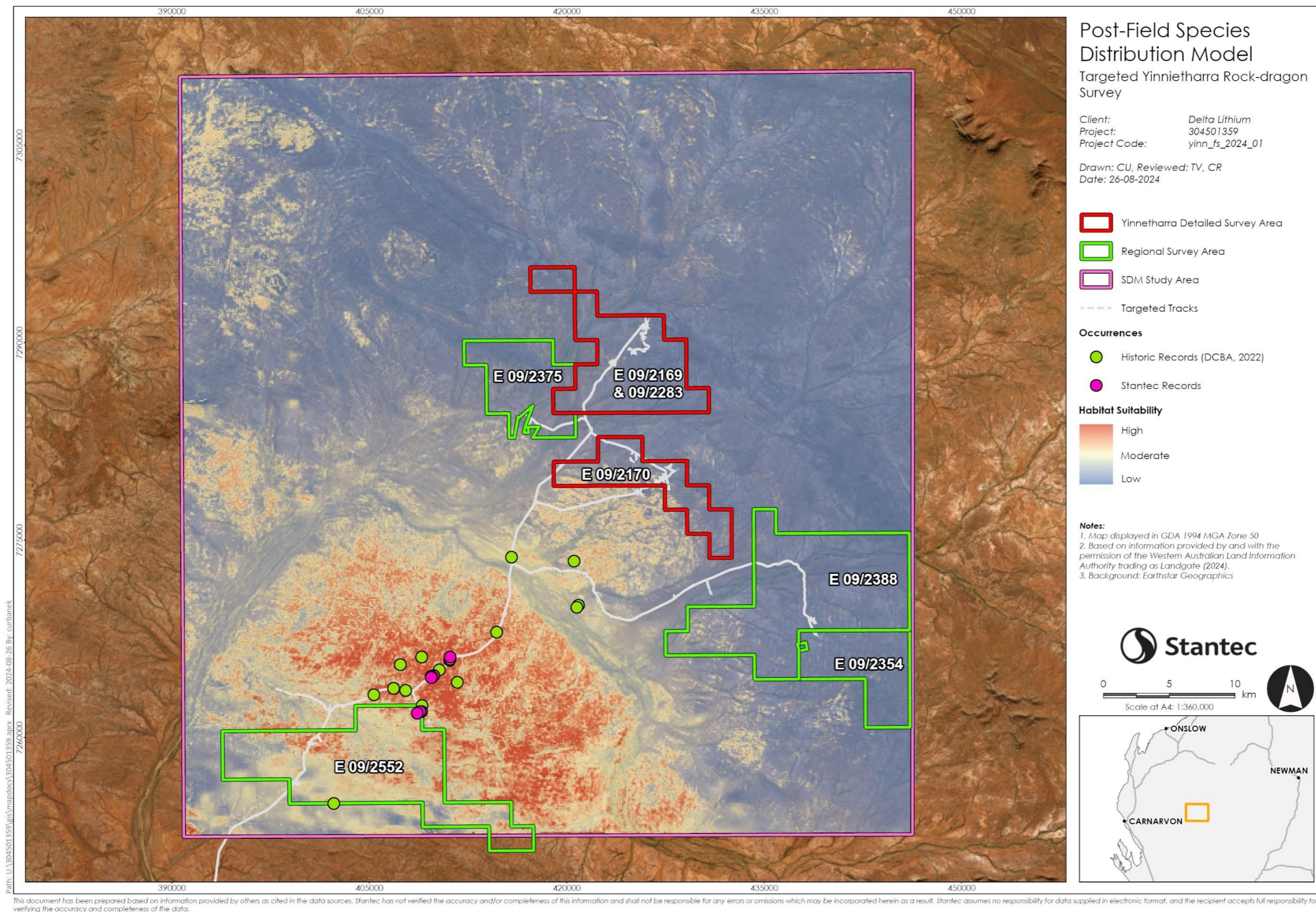


Figure 5-18: Ensemble post-field species distribution model, showing the habitat suitability of the Yinnietharra Rock-dragon based on the combined climate and biophysical model outputs (red shows high suitability and blue shows low suitability habitat).

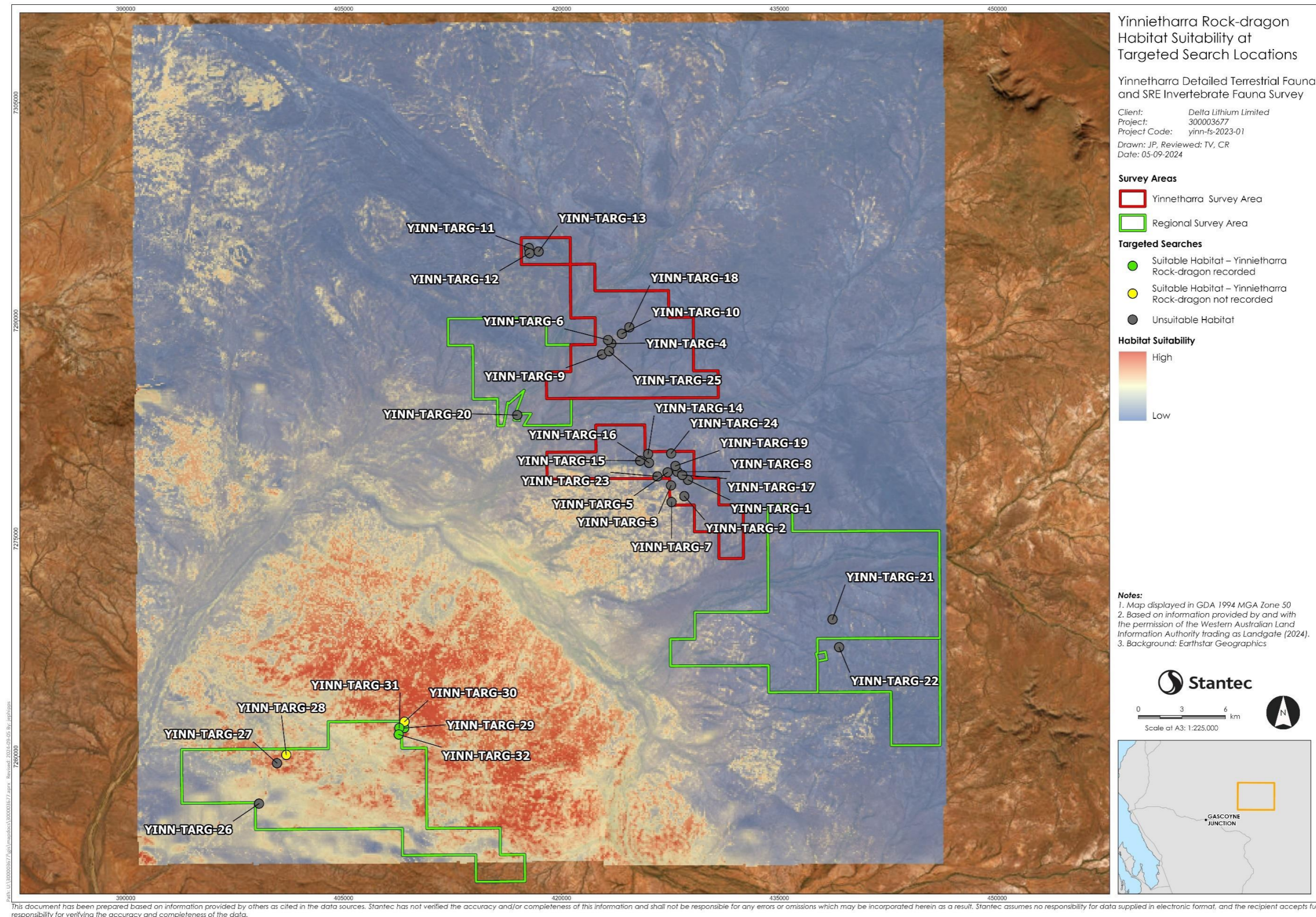


Figure 5-19: Yinnietharra Rock-dragon habitat suitability at targeted search sites compared to habitat suitability presented in the ensemble post-field species distribution model. Suitability of targeted search sites was assessed using the four criteria presented in Section 5.4.1.2 under *Matters of National Environmental Significance* (presence of outcrops, size of outcrops, density of outcrops, and substrate).

5.4.2 Significant Species Likely or Possibly to Occur

The likelihood of occurrence for each significant species was assessed against the criteria provided in Section 3.2.3, and are detailed in Table 5-5. Of the fauna not recorded within the Survey Area, one is considered likely to occur (Peregrine Falcon; *Falco peregrinus*; OS based on proximity of nearby records and the presence of suitable habitat for the species within the Survey Area. The Peregrine Falcon is discussed in further detail in Section 5.4.2.1. , Based on the criteria outlined in Section 3.2.3, four significant species are considered to possibly occur in the survey area, the Long-tailed Dunnart, Western Pebble-mound Mouse, Grey Falcon, Fork-tailed Swift, with reasons for their classification detailed in Table 5-5.

5.4.2.1 Peregrine Falcon (*Falco peregrinus*; OS)- Likely

Conservation Status and Species Ecology

The Peregrine Falcon is listed as of special concern under the BC Act. Peregrine Falcons are large birds of prey with a black hood, blue-black upperparts and creamy white chin, throat and underparts, which are finely barred from the breast to the tail. The Peregrine Falcon is a powerful aerial hunter that inhabits most environments with suitable nest sites across Australia, with a preference for cliff faces for nesting (Menkhorst *et al.* 2017). Occurring across a range of habitats from woodlands to open grasslands and coastal cliffs, it hunts and feeds predominantly on other birds, but is also known to prey on rabbits and other moderate-sized mammals, bats and reptiles (DotE 2016b).

Threatening Processes

The major threat to the species is habitat loss, particularly wooded areas which serve as nesting sites for the species in the absence of cliffs (DEE 2016). Other threats include accidental poisoning from baits left for feral animals and agricultural chemicals (DEE 2016).

Distribution in Relation to the Survey Area

The species has been recorded at 15 locations within the desktop search extent (100 km buffer of the Survey Area). The nearest record occurs approximately 39 km north of the Survey Area, and the most recent observation was recorded in 2015, approximately 55 km north east of the Survey Area (DBCA 2022). The species was not recorded in the Survey Area during the Detailed or Targeted Survey; however the Survey Area contains Major Drainage habitat which is suitable for Peregrine Falcon nesting. Additionally, the species can forage across all habitats identified in the Survey Area. Therefore, although the Peregrine Falcon was not recorded within the Survey Area, suitable habitat for the species is present and the species is considered likely to occur.

5.4.3 Significant Species Unlikely to Occur or Considered Irrelevant to the Survey Area

A total of 12 significant species are considered unlikely to occur within the Survey Area. In addition, 11 species were excluded from the likelihood of occurrence assessment (Table 5-5) as the Survey Area is outside their current range and known distribution. These 11 species are not considered relevant within the context of this Survey, based on the criteria outlined in Section 3.2.3. Species considered unlikely to occur or not relevant to the survey area are summarised in Appendix C.



Table 5-5: Likelihood of occurrence of significant fauna within the Survey Area..

Common name (<i>Scientific name</i>)	Listing		Key threats and reason for listing	Habitat and ecology	Likelihood of occurrence and reason for likelihood
	EPBC Act	BC Act			
Mammals					
Long-tailed Dunnart (<i>Antechinomys longicaudata</i>)		P4	Relatively little is known about the species distribution and biology (van Dyck and Strahan 2008), however potential threats may include inappropriate fire regimes, habitat alteration by non-native herbivores and predation by Red Foxes and Feral Cats.	<p>Rocky, hilly areas, occasionally open areas with a stony, rocky mantle (van Dyck and Strahan 2008).</p> <p>Critical and supporting habitat has not been defined for non-MNES species. Suitable habitat in the Survey Area for this species includes:</p> <ul style="list-style-type: none"> • Low Hills • Rocky Hill 	<p>Possible</p> <p>Four records have been historically recorded within 100 km of the Survey Area. The nearest record (from 1992) is approximately 56 km north east of the Survey Area (DBCA 2023a). The most recent record (from 2012) is 81 km south of the Survey Area. The Survey Area contains suitable Low Hills and Rocky Hill habitat and occurs within the species' known distribution range (van Dyck and Strahan 2008).</p>
Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>)		P4	Four key threats have been identified for the species; the most severe is habitat loss and fragmentation due to mining (Woinarski <i>et al.</i> 2014). Others listed threats include predation by red foxes and feral cats, habitat degradation and resource loss due to non-native herbivores (Woinarski <i>et al.</i> 2014).	<p>Rocky ranges with spinifex and stony substrates. Inhabits gently sloping hills of rocky ranges where the ground is stony and vegetated by spinifex with a sparse overstorey of eucalypts and scattered shrubs of <i>Senna</i> spp., <i>Acacia</i> spp. and <i>Ptilotus</i> spp. (van Dyck and Strahan 2008).</p> <p>Critical and supporting habitat is not defined for non-MNES species. Suitable habitat in the Survey Area for this species includes:</p> <ul style="list-style-type: none"> • Stony Plain • Low Hills 	<p>Possible</p> <p>Six Western Pebble-mound Mouse records have been historically recorded within 100 km of the Survey Area, with the nearest record (from 1997) located approximately 6 km east of the Survey Area (DBCA 2023a). Eco Logical (2018) recorded one possibly active Western Pebble-mound Mouse mound approximately 40 km north of the Survey Area in 2017.</p> <p>The species' distribution range previously extended south into the Gascoyne and Murchison regions; however, it is believed that the species is confined to the central</p>



Common name (<i>Scientific name</i>)	Listing		Key threats and reason for listing	Habitat and ecology	Likelihood of occurrence and reason for likelihood
	EPBC Act	BC Act			
					and eastern Pilbara (Dunlop and Pound 1981). A likelihood ranking of possible was assigned based on the proximity of nearby records and the occurrence of potentially suitable habitat for the species within the Survey Area
Birds					
Grey Falcon (<i>Falco hypoleucos</i>)	Vu	Vu	Largest threat to species is associated with clearing for agriculture, which has reduced habitat in semi-arid zones (Garnett <i>et al.</i> 2011a). Additionally, grazing by exotic herbivores is likely to have reduced regeneration of trees in the arid zone, therefore reducing nesting habitat availability (Garnett <i>et al.</i> 2011a).	Inhabits open plains with treed watercourses in inland arid regions (Menkhorst <i>et al.</i> 2017). Tends to forage near watercourses by ambushing flocks of smaller drinking birds (Menkhorst <i>et al.</i> 2017). Critical habitat comprises breeding and roosting habitats, and supporting habitat comprises foraging habitat and watercourse (Appendix F). Critical habitat within the Survey Area includes: <ul style="list-style-type: none"> Major Drainage Line Supporting habitat within the Survey Area includes: <ul style="list-style-type: none"> Stony Plain Minor Drainage Low Hills Alluvial Plain Major Drainage Rocky Hill Mulga Woodlands Sandy Plain 	Possible The Grey Falcon was recorded approximately 68 km north east of the Survey Area (Birdlife Australia 2023b; DBCA 2023a). The Survey Area contains some critical habitat (Major Drainage), supporting habitats, and occurs within the species distribution range (Menkhorst <i>et al.</i> 2019).



Common name (<i>Scientific name</i>)	Listing		Key threats and reason for listing	Habitat and ecology	Likelihood of occurrence and reason for likelihood
	EPBC Act	BC Act			
Southern Whiteface (<i>Aphelocephala leucopsis</i>)	Vu		The main threats to the species are: habitat loss and degradation (Garnett and Baker 2022), climate change increasing frequency of droughts (Evans <i>et al.</i> 2017). Reason for listing: Estimated 30-50% decline in population every ten years since 1999, with no indication that declines are slowing (Garnett and Baker 2022).	Inhabits sparsely treed woodlands and shrublands dominated by acacias or eucalypts with an understorey of grasses and shrubs. Considered sedentary though individuals may disperse to wetter areas outside their normal range during periods of low rainfall. They forage almost exclusively on the ground, feeding on invertebrates and seeds (Antos and Bennett 2006; Higgins and Peter 2002). Critical habitat comprises essential foraging habitat, essential roosting and nesting habitat (Appendix F). Supporting habitat is defined as foraging habitat for this species (Appendix F). Critical and supporting habitat types within the Survey Area includes: <ul style="list-style-type: none"> • Minor Drainage • Major Drainage • Mulga Woodlands 	Confirmed The species has been historically recorded, with 40 species records occurring within 100 km of the Survey Area (Birdlife Australia 2023b). During Phase 1, the species was detected on acoustic units from three locations. During Phase 2 Trip 2, two individuals were recorded nesting at one location (Site E) in Minor Drainage habitat.
Fork-tailed Swift (<i>Apus pacificus</i>)	Mi	IA	Species migrates between Australia and much of Asia. Therefore, protected under international agreements CAMBA, JAMBA and ROKAMBA. There are no significant threats to the Fork-tailed Swift in Australia. Potential threats include habitat destruction and predation by feral animals (DotEE 2019a).	Aerial species, which forages high above the tree canopy and rarely lower (Johnstone and Storr 1998). Forage in high-flying flocks over a wide range of habitats, however may be more abundant over inland plains (Menkhorst <i>et al.</i> 2017). The species tends to arrive in Australia between October and November, with numbers peaking in late summer, and migrate north in April (Menkhorst <i>et al.</i> 2017). Species is	Possible The species is a non-breeding visitor to Australia, is exclusively an aerial forager and has a large foraging range (Menkhorst <i>et al.</i> 2019). The species has been historically recorded approximately 55 km north of the Survey Area in 2009 and 60 km west of the Survey Area in 2002 (DBCA 2023a) and it is



Common name (<i>Scientific name</i>)	Listing		Key threats and reason for listing	Habitat and ecology	Likelihood of occurrence and reason for likelihood
	EPBC Act	BC Act			
				occasionally observed during winter (Menkhorst <i>et al.</i> 2017). The species is an aerial forager and does not rely on any specific habitat in the Survey Area.	possible that the species may forage over the Survey Area intermittently.
Peregrine Falcon (<i>Falco peregrinus</i>)		OS	The major threat to the species is habitat loss, particularly wooded areas which serve as nesting sites to the species in the absence of cliffs (DotEE 2016).	The species occurs in habitats supporting nest sites, preferentially cliff-faces however also uses raptor stick nests (Menkhorst <i>et al.</i> 2019). Critical and supporting habitat is not defined for non-MNES species. There are no cliff-faces suitable for nesting within the Survey Area, however the species may potentially utilise tall stands of eucalypts for nesting where present. Nesting habitat in the Survey Area may include: <ul style="list-style-type: none"> Major Drainage Line (tall stands of eucalypts) Foraging habitat in the Survey Area may include: <ul style="list-style-type: none"> Stony Plain Minor Drainage Low Hills Alluvial Plain Major Drainage Rocky Hill Mulga Woodlands Sandy Plain Rocky Outcropping 	Likely The species has been historically recorded, with 15 records occurring within 100 km of the Survey Area. The nearest record occurs approximately 39 km north of the Survey Area, and the most recent observation was recorded in 2015, approximately 55 km north east of the Survey Area (DBCAs 2022). The Survey Area occurs within the species distribution range and supports suitable nesting and foraging habitat (Menkhorst <i>et al.</i> 2019).

Reptiles



6. Short-Range Endemic Invertebrate Fauna

6.1 SRE Invertebrate Fauna Habitat

Each of the nine habitat types identified and delineated during the Detailed Survey were assessed for their potential to support SRE taxa based on the distribution and connectivity within the landscape, and presence of microhabitats:

- **Distribution:** habitats widespread and common throughout the Survey Area and region were categorised as Widespread; otherwise, they were categorised as being of Limited Extent. Six habitats were considered to have Limited Extent: Rocky Outcropping, Major Drainage, Alluvial Plain, Rocky Hill, Sandy Plain and Mulga Woodland.
- **Connectivity:** habitats which formed continuous or closely connected areas were considered well connected, while habitats with little to no connectivity between habitat patches were considered isolated. Three habitats were considered to be isolated: Rocky Outcropping, Rocky Hill, and Sandy Plain.
- **Microhabitats:** habitats which had areas of sheltered, relatively mesic environments such as slopes with south-west facing aspects, vine thickets, rock piles, drainage systems, deep gorges, mound springs/natural springs, fire refuge areas such as cliffs/isolated rock piles, and other similar habitats (EPA 2016a).

Three habitats Rocky Outcropping, Major Drainage and Rocky Hill - were assessed as having high suitability to support SRE taxa (Table 6-1). These habitats contained multiple microhabitat features and were all of limited extent within the landscape.

Three habitats comprising Minor Drainage, Low Hills and Mulga Woodland were assessed as having moderate suitability to support SRE species (Table 6-1). Low Hills and Minor Drainage habitat were considered to be both well connected and widespread, however they both contained multiple important microhabitat features. Mulga Woodland habitat was considered to be of limited extent in the landscape and contained an important microhabitat feature (leaf litter).

Three habitats comprising Stony Plain, Alluvial Plain and Sandy Plain were assessed as having limited suitability to support SRE species. Both Stony Plain and Alluvial Plain habitat were identified as widespread and well connected throughout the landscape, whereas Sandy Plain habitat was considered limited and isolated (Table 6-1). All three habitats were assessed as containing limited microhabitats suitable for supporting SRE taxa.



Table 6-1: Assessment of SRE potential within the identified habitats of the Survey Area.

Habitat	Assessment Criteria			SRE potential
	Microhabitats	Connectivity	Extent	
Rocky Outcropping	<ul style="list-style-type: none"> • South-west facing slopes • Ficus groves • Deep leaf-litter • Boulder/Rock pile • Outcropping • Alcoves • Crevices 	Isolated	Limited	High
Rocky Hill	<ul style="list-style-type: none"> • South-west slopes • Outcropping • Crevices • Alcoves 	Isolated	Limited	High
Major Drainage	<ul style="list-style-type: none"> • Deep leaf-litter • Drainage system • Outcropping 	Connected	Limited	High
Minor Drainage	<ul style="list-style-type: none"> • Deep leaf-litter • Drainage system 	Connected	Widespread	Moderate
Low Hills	<ul style="list-style-type: none"> • Outcropping • Crevices 	Connected	Widespread	Moderate
Mulga Woodland	<ul style="list-style-type: none"> • Leaf litter 	Connected	Limited	Moderate
Stony Plain	<ul style="list-style-type: none"> • Outcropping 	Connected	Widespread	Limited
Alluvial Plain	<ul style="list-style-type: none"> • Nil 	Connected	Widespread	Limited
Sandy Plain	<ul style="list-style-type: none"> • Nil 	Isolated	Limited	Limited

6.2 SRE Invertebrate Taxa

In total, 13 taxa (70 specimens) from SRE target groups (Section 3.2.4) were collected during the Detailed Survey (Figure 6-1). Of these, 11 taxa were represented by undescribed morphospecies and subsequently classified as potential SRE species due to insufficient geographical context. The remaining two taxa were considered widespread and are not discussed in further detail. Potential SRE records have been presented in a single dataset (Table 6-2). This dataset presents for each potential SRE taxon.

- Whether specimens have also been recorded outside the Survey Area,
- Habitat(s) and number of locations within that habitat each taxa were collected from; and
- Number of specimens recorded from each trapping method.

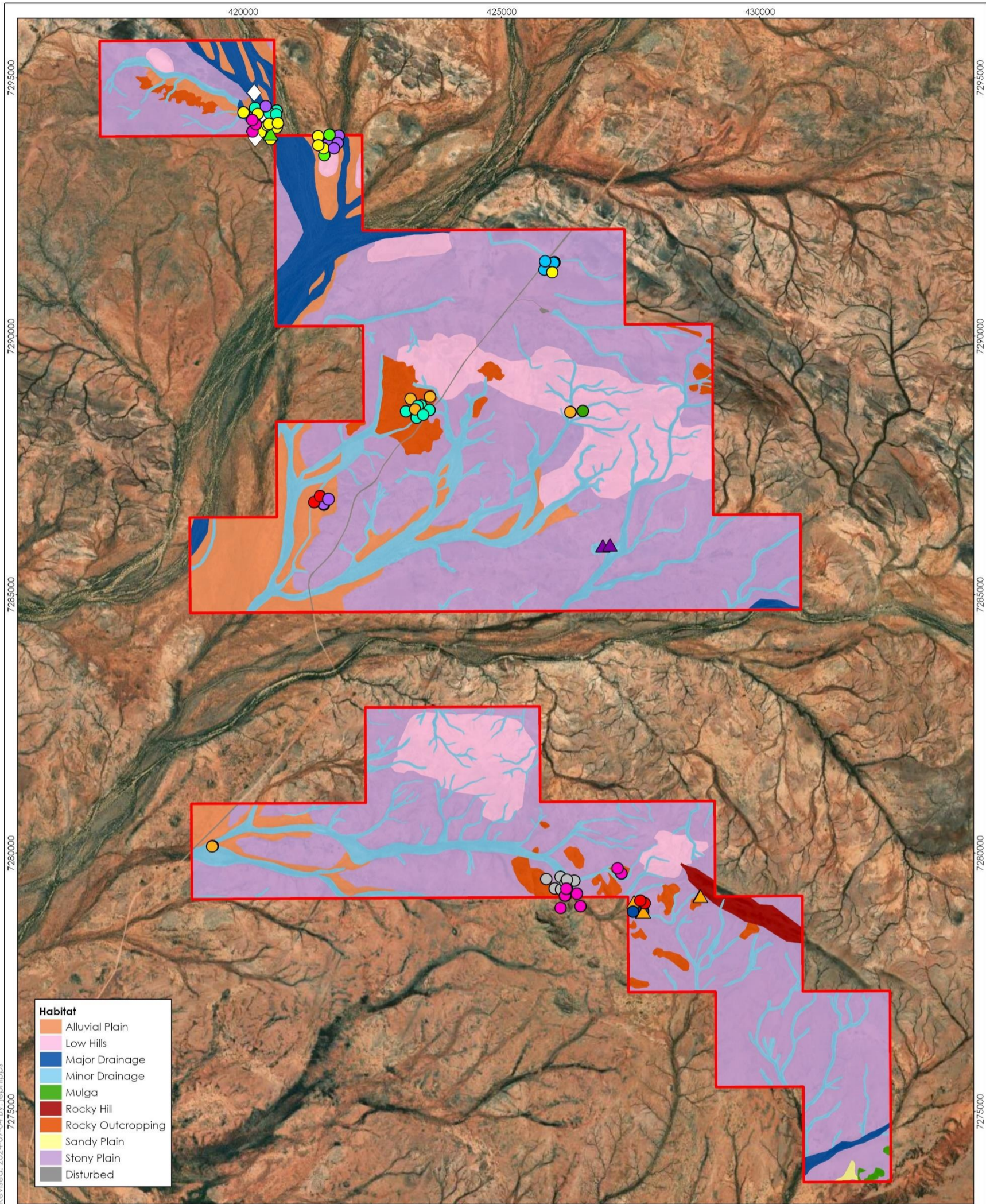
The SRE status of taxa can often be difficult to determine due to insufficient geographical context, or a lack of taxonomic resolution. Consequently, in line with EPA guidance for specimens identified as 'potential SRE' taxa, habitat associations have been provided in this report to be used as a surrogate to infer potential distributions or SRE status of the taxa. Three taxa were identified as more likely to represent SRE species based on their occurrence in only high value SRE habitat (Rocky Outcropping and Major Drainage). This included one mygalomorph spider and two scorpions (Table 6-2):

- *Aname* 'Yin01'
- *Lychas* 'bituberculatus complex Yin01'; and
- *Urodacus* 'Yin01'.



Table 6-2: Potential SRE taxa collected during the Detailed Survey. Habitats highlighted in red indicate high potential to support SRE taxa.

Taxa	SRE Status	Survey Area			Specimens recorded by sampling method			Number of sites within each habitat each taxon recorded from						Total number of locations taxa recorded from (total number of specimens)
		Inside	Outside	Only recorded in high potential habitat	Dry pitfall	Burrow excavation	Soil and Leaf Litter Sieving	Rocky Outcropping	Low Hills	Major Drainage	Minor Drainage	Alluvial Plain	Stony Plain	
Mygalomorph Spiders														
<i>Aname</i> 'Yin01'	Potential SRE: DDG	X	-	X	-	4		1	-	-	-	-	-	1(4)
<i>Aname</i> 'Yin02'	Potential SRE: DDG	X	-	-	4	-	-	-	-	-	-	1	1	2(4)
<i>Kwonkan</i> 'Yin03'	Potential SRE: DDG	X	-	-	1	-	-	-	-	-	-	-	1	1(1)
Pseudoscorpions														
<i>Beierolpium</i> 'Yin01'	Potential SRE: DDG	X	-	-	-	-	8	2	-	-	1	-	-	3(8)
<i>Indolpium</i> 'Yin01'	Potential SRE: DDG	X	-	-	-	-	1	-	-	-	1	-	-	1(1)
Scorpions														
<i>Lychas</i> 'bituberculatus complex Yin01'	Potential SRE: DDG	X	-	X	2	-	2	2	-	1	-	-	-	3(4)
<i>Lychas</i> 'harveyi complex Yin02'	Potential SRE: DDG	X	-	-	1	-	-	-	-	-	-	-	1	1(1)
<i>Urodacus</i> 'Yin01'	Potential SRE: DDG	X	-	X	13	-	-	2	-	1	-	-	-	3(13)
<i>Urodacus</i> 'Yin02'	Potential SRE: DDG	X	-	-	4	-	-	-	1	1	-	1	-	3(4)
Isopod														
<i>Buddelundia</i> 'Yin01'	Potential SRE: DDT	X	-	-	27	-	-	-	1	1	-	-	1	3 (27)
<i>Buddelundia</i> 'Yin02'	Potential SRE: DDT	X	-	-	1	-	-	-	1	-	-	-	-	1(1)



Yinnetharra Detailed Terrestrial Fauna and SRE Invertebrate Fauna Survey

Yinnetharra Detailed Survey
 Client: Electrostate Malinda Pty Ltd
 Project: 300003677
 Project Code: yinn_fs_2023_01
 Drawn By: JP, TR: CU, CR
 Date: 04-09-2024



- Survey Area
- SRE Species Records**
- Potential SRE: DDG**
- Aname 'Yin01'
- Aname 'Yin02'
- Beierolpium 'Yin01'
- Buddelundia 'Yin01'
- Buddelundia 'Yin02'
- Indolpium 'Yin02'
- Kwonkan 'Yin03'
- Lychas 'bituberculatus complex Yin01'
- Lychas 'harveyi complex Yin02'
- Urodacus 'Yin01'
- Urodacus 'Yin02'
- Widespread**
- Lychas 'splendens
- Oratemnus 'PSE121'
- Scolopendromorpha sp.
- Non-target**
- Araneomorphae sp.

Notes:
 1. Map displayed in GDA 1994 MGA Zone 50
 2. Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2024).
 3. Background: Maxar



Path: U:\300003677\GIS\mapdocs\300003677.aprx Revised: 2024-09-04 By: lechippas

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Figure 6-1: Potential SRE invertebrate taxa recorded in the Survey Area.

6.2.1 Mygalomorph Spiders

***Aname* 'Yin01'**

Aname 'Yin01' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by four specimens collected from one location in Rocky Outcropping habitat. This habitat was classified as having high potential to support SRE taxa (Section 6.1).

***Aname* 'Yin02'**

Aname 'Yin02' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by four specimens collected from two locations in Alluvial Plain and Stony Plain habitat. These habitats were classified as having low potential to support SRE taxa (Section 6.1).

***Kwonkan* 'Yin03'**

Kwonkan 'Yin03' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by one specimen collected from one location in Stony Plain habitat. This habitat was classified as having low potential to support SRE taxa (Section 6.1).

6.2.2 Pseudoscorpions

***Beierolpium* 'Yin01'**

Beierolpium 'Yin01' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by eight specimens collected from three locations in Rocky Outcropping and Minor Drainage habitat. Rocky Outcropping habitat was classified as having high potential to support SRE taxa, and Minor Drainage habitat was classified as having moderate potential (Section 6.1).

***Indolpium* 'Yin02'**

Indolpium 'Yin02' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by one specimen collected from one location in Minor Drainage habitat. This habitat was classified as having moderate potential to support SRE taxa (Section 6.1).

6.2.3 Scorpions

***Lychas* 'bituberculatus complex Yin01'**

Lychas 'bituberculatus complex Yin01' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by four specimens collected from three locations comprising Rocky Outcropping and Major Drainage habitat. Both habitats were classified as having high potential to support SRE taxa (Section 6.1). Two specimens were collected from the leaf litter of two fig trees located 60 m apart (Section 5.2.1). The *Lychas* 'bituberculatus complex' is represented by several distinct clades in the Pilbara, but this taxon appears to be represented by other morphospecies in the Great Sandy Desert, Midwest and Kimberley regions (Appendix I).

***Lychas* 'harveyi complex Yin02'**

Lychas 'harveyi complex Yin02' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by one specimen collected from one location in Stony Plain habitat. This habitat was classified as having low potential to support SRE taxa (Section 6.1). The *Lychas* 'harveyi complex' is represented by at least two clades in the Pilbara region, both of which appear to be widespread (Appendix I).

***Urodacus* 'Yin01'**

Urodacus 'Yin01' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by 13 specimens collected from three locations in Rocky Outcropping and Major Drainage habitat. Both habitats were classified as having high potential to support SRE taxa (Section 6.1).



***Urodacus* 'Yin02'**

Urodacus 'Yin02' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by four specimens collected from three locations in Major Drainage, Alluvial Plain, and Low Hills habitat. Major Drainage habitat is classified as having a high potential to support SRE taxa whereas Alluvial Plain and Low Hills habitat were classified as having low and moderate potential, respectively (Section 6.1).

6.2.4 Isopods

***Buddelundia* 'Yin01'**

Buddelundia 'Yin01' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by 27 specimens collected from three locations comprising Low Hills, Stony Plain, and Major Drainage habitat. Major Drainage habitat is classified as having a high potential to support SRE taxa whereas Stony Plain and Low Hills habitat were classified as having low and moderate potential, respectively (Section 6.1).

***Buddelundia* 'Yin02'**

Buddelundia 'Yin02' was classified as a potential SRE owing to geographical data deficiency (Appendix I). This morphospecies was represented by one specimen collected from one location in Low Hills habitat. This habitat was classified as having moderate potential to support SRE taxa (Section 6.1).



7. Survey Limitations and Constraints

There are a number of possible limitations and constraints that can impinge on the adequacy of a fauna survey (EPA 2020). All fauna surveys are limited to some degree by time and seasonal factors; consequently, it is most ideal if multiple surveys of an area are undertaken over several years and across different seasons. The limitations and constraints are summarised in Table 7-1.

Table 7-1: Potential limitations and constraints of the Detailed Survey and Targeted Survey.

Potential Limitation	Constraint	Comments
Competency and experience of consultants	No	Paul Bolton was the Technical Lead, who is an experienced zoologist with over 19 years' experience designing surveys in Western Australia. Caitlin Roberts (4 years' experience) was the Survey Lead for all field surveys and was supported in the field by Shannon Blatchford with 14 years of experience. All team members are competent zoologists/ecologists, and all species identifications were confirmed by Team Leaders and senior staff: Caitlin Roberts (Zoologist, 4 years' experience) and Shannon Blatchford (Senior Zoologist, 13 years' experience).
Scope	No	All terrestrial vertebrate fauna groups were surveyed using standardised and well-established techniques, and available previous survey work in the vicinity of the Survey Area was reviewed. Bat echolocation recordings were analysed by Bob Bullen from Bat Call WA. Bird acoustic calls were analysed by WA Night Parrot specialist Nick Leseberg. Potential SRE specimens were identified by invertebrate taxonomist Dr Erich Volschenk of Alacran Environmental Science using morphological or genetic sequencing.
Proportion of species identified	No	The inventory of 128 species of vertebrate fauna recorded during the Detailed Survey represented 44.3% of the total number of species identified by database searches and surveys in the vicinity of the project (n=289). The species accumulation curves suggest that additional survey effort would not significantly increase the number of species recorded in the Survey Area. Most taxonomic groups expected within the Survey Area were represented and the species richness for each fauna group was similar to that of a previous survey completed in the area. All species were identified using the latest published literature.
Information sources (e.g. historical or recent)	Partial	The Gascoyne region is under surveyed with limited publicly available reports for fauna surveys conducted in the vicinity of the Survey Area. The majority of contextual data was compiled from nine database searches conducted using a 100 km buffer of the Survey Area. Database searches were completed to generate a list of fauna previously recorded within, and in the vicinity of the Survey Area, with an emphasis on species of significance.
Completeness and intensity	No	The dual-phase detailed survey in 2023-2024 was conducted according to scope of works. Each major fauna habitat within the Survey Area was sampled using systematic and targeted survey methods (Section 4.3). Three habitats were not systematically sampled due to restricted access, however these habitats comprised a minor proportion of the Survey Area, totalling 1% of the Survey Area. Targeted units were deployed within these habitats to achieve adequate survey effort and coverage. All planned survey works were conducted according to the scope: the Survey Area was systematically surveyed across eight sites for a total of 5,824 trap nights, 2,240 minutes of avifauna census, 640 minutes of systematic searches, 224 motion-sensor camera nights (32 locations) and 32 echolocation recorder nights (16 locations) (Table 4-5). Targeted survey effort included 30 motion-sensor cameras, 9 acoustic recorders, 15 echolocation recorders, 22 targeted searches for Yinnietharra Rock-dragons, and 15 targeted SRE searches (Table 4-6).



		Given the survey effort across the Survey Area, there is sufficient information to inform an environmental assessment for the Project.
Timing/ weather/ season/ cycle	Partial	<p>Rainfall was below the long-term average in the six months preceding Phase 1 and only 13.8 mm of rain fell between Phase 1 and Phase 2. These dry conditions were reflected in lower capture numbers and lower species diversity recorded during Phase 2.</p> <p>During Phase 2 Trip 1, a rainfall event caused the Survey team to close traps three days early and demobilise from site. The Survey team returned to site in late May to complete the recommended seven nights of trapping for each systematic site (EPA 2020).</p> <p>Guidance states that the optimum time to survey for reptiles is between September to April, placing Phase 2 Trip 2 just out of season for that group. However, this is not considered a limitation as conditions were suitable for surveying reptiles during Phase 1 and Phase 2 Trip 2. Additionally, total reptile diversity (R=29) was greater than that recorded by a previous survey near the Survey Area (R=25). Additionally, it is recommended that surveys for birds, amphibians occur post rainfall, with no preferred survey timing stated for mammals, , therefore Phase 2 Trip 2 was timed appropriately for those groups.</p>
Disturbances	No	The Survey Area included areas of exploration/station tracks, drilling, and a public road. However, these the main areas of disturbance were localised rather than extensive, and sufficient sampling was conducted in unaffected areas to determine fauna assemblages. Between Phase 1 and Phase 2 of the Detailed Survey, the exploration camp was relocated to within 150 m of the pitfall traps installed at Site B. This additional disturbance may have contributed to the low trap numbers observed at this site during Phase 2. However, trap numbers were lower across all systematic sites during Phase 2, likely due to dry conditions.
Remoteness/ access problems	Partial	<p>The Survey Area contains limited access tracks throughout making some areas difficult to survey. Despite this, the Survey team achieved good coverage of the Survey Area and prioritised on-foot searches of habitats, with a particular focus on areas more likely to support significant species or unique assemblages.</p> <p>Survey access to areas within the proposed mining footprint was not limited, however the Targeted Survey was constrained by limited access to surrounding tenements within the Survey Area, on which the Yinnietharra Rock-dragon had been historically recorded. Of the 28 historic Yinnietharra Rock-dragon records within 20 km of the Survey Areas, only two occurred on tenements where land access was permitted. Stantec was unable to visit many regional locations where the species may occur, limiting efforts to ground truth species distribution modelling. In addition, lack of access to potential Yinnietharra Rock-dragon populations may have decreased the number of data points (Yinnietharra Rock-dragon records) that could be inputted into the SDM to refine accuracy.</p>



8. Summary

Electrostate commissioned Stantec to undertake a dual phase Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Fauna Survey of the Yinnetharra Project Area (the Survey Area). The objective of the Detailed Survey was to serve as a baseline assessment to understand the key environmental factors that may be impacted by developments, therefore, to inform future environmental assessments for the Project. This was achieved by conducting a comprehensive desktop assessment, Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Fauna Survey, Targeted Yinnetharra Rock-dragon Survey, and fauna habitat mapping for the Survey Area. The key results and conclusions are as follows:

1. The Survey Area is within a region which has not been surveyed extensively for vertebrate and invertebrate terrestrial fauna. The desktop assessment comprised nine database searches and the review of two surveys that were previously undertaken in the vicinity of the Survey Area. These previous surveys comprised one dual phase Detailed Fauna Survey and one Basic Fauna Survey.
2. Survey methods comprised eight systematic sites with 5,824 trap nights using pitfall, small Elliott, funnel and cage trapping, as well as avifauna census, motion-sensor camera, echolocation recorder, spotlighting and systematic searching methods. Targeted methods used during the Detailed Survey comprised targeted searching (vertebrate and SRE invertebrate fauna), funnel traps (2 locations, 72 trap nights), motion-camera deployment (30 locations, 181 recording nights), opportunistic recording, acoustic bird call recording (nine locations, 54 recording nights), bat echolocation recording (15 locations, 60 recording nights).
3. Nine broad fauna habitat types were identified within the Survey Area: Stony Plain, Minor Drainage, Low Hills, Alluvial Plain, Major Drainage, Rocky Outcropping, Rocky Hill, Mulga Woodland, and Sandy Plain. Of these, Major Drainage, Minor Drainage, Low Hills, Rocky Hill, and Mulga Woodland were considered significant habitats which may be used by significant species for shelter and foraging.
4. The desktop assessment identified 28 significant fauna with the potential to occur within the Survey Area comprising eight mammals, 17 birds and three reptiles.
5. A total of 126 vertebrate fauna species were recorded during this Survey. This represents 43.6% of the total number of species identified from the database searches and fauna surveys undertaken in the vicinity of the Survey Area (n=289). Species recorded during the Detailed Survey comprised 18 native mammals, four non-native mammal, 74 native birds, 29 reptiles and one amphibian.
6. One significant species was recorded from four locations within the Survey Area during the Detailed Survey: the Southern Whiteface. Critical habitat for this species occurs within three broad fauna habitats within the Survey Area; Major Drainage (4.7%) containing suitable breeding trees and essential foraging habitat with areas of dense understorey within Minor Drainage (13.7%) containing scattered suitable breeding trees with patches of dense understorey providing suitable foraging habitat and Mulga Woodlands (0.1%) containing ecotones where dense acacia shrubs are juxtaposed with open ground. In addition, one significant species, the Peregrine Falcon, is considered likely to occur. Suitable Peregrine Falcon nesting habitat within the Survey Area comprises mature *Eucalyptus camaldulensis* subsp. *obtusata* trees present within Major Drainage habitat, while suitable foraging habitat occurs in all habitat types present within the Survey Area.
7. One significant species, the Yinnetharra Rock-dragon, was recorded opportunistically during the Detailed Survey at a location 15 km south-west of the Survey Area. During the Targeted Yinnetharra Rock-dragon Survey an additional 19 records of the species were recorded within the region between 17 and 19.5 km south-west of the Survey Area.
8. No Yinnetharra Rock-dragons or suitable Yinnetharra Rock-dragon habitat was recorded within the Survey Area. These results are consistent with the SDM which indicated that habitat classified as highly suitable for the Yinnetharra Rock-dragon does not occur in the Survey Area. Given this, the species is considered unlikely to occur within the Survey Area.
9. Three habitats totalling 8.6% of the Survey Area were classified as having high SRE potential as they contained multiple microhabitat features and were of limited extent. These comprise Rocky Outcropping (3.1%), Major Drainage (4.7%) and Rocky Hill (0.8%). The majority of the Survey Area (67.1%) is comprised of habitats which are considered to have limited potential to support SREs



10. In total, 13 taxa (70 specimens) from Short Range Endemic (SRE) Invertebrate fauna target groups were collected during the Detailed Survey. The most abundant taxon was *Buddelundia* "Yin01" which was recorded 27 times from three locations. Of the 13 taxa collected, 11 were undescribed morphospecies and assessed as potential SRE taxa due to insufficient geographical context. This reflects the lack of SRE surveys which have been conducted in the region. Of these 11 morphospecies, three taxa were identified as more likely to represent SRE species based on their occurrence in only high value SRE habitat (Rocky Outcropping and Major Drainage). This included *Aname* 'Yin01' (mygalomorph spider), *Lychas* 'bituberculatus complex Yin01' (scorpion), and *Urodacus* 'Yin01' (scorpion). While *Lychas* 'bituberculatus complex Yin01', and *Urodacus* 'Yin01' were each recorded from three locations across two habitat types, *Aname* 'Yin01' was only recorded from one location within Rocky Outcropping habitat. Additionally, four taxa were only known from one specimen, including *Kwonkan* 'Yin03', *Lychas* 'harveyi complex Yin02', *Indolpium* 'Yin01', and *Buddelundia* 'Yin02'.
11. The fauna assemblages within the Survey Area were sampled at systematic trapping sites. Species accumulation curves of reptiles, birds and mammals indicated that between 73% to 100% of these fauna assemblages were recorded during the Detailed Survey. All accumulation curves of each group began to reach an asymptote, indicating that sampling was largely sufficient. The species accumulation curves suggest that additional survey effort would not significantly increase the number of species recorded in the Survey Area. Most taxonomic groups expected within the Survey Area were represented and the species richness for each fauna group was similar to that of a previous surveys completed in the area. However, it is acknowledged that additional systematic survey effort may result in additional bird species being detected. Additional mammal, avifauna, and herpetofauna species were recorded within the Survey Area in addition to systematic sampling via targeted and opportunistic survey methods that were not captured in the species accumulation curves.
12. In summary, the species assemblages recorded during the Detailed Survey were comparable to those of a previous survey undertaken in the vicinity of the Survey Area. One significant terrestrial vertebrate fauna species, listed as a MNES (the Southern Whiteface) was recorded within the Survey Area and one species (the Peregrine Falcon) is considered likely to occur within the Survey Area as suitable nesting habitat (Major Drainage) and foraging habitat (all habitats) is present. The Southern Whiteface records consisted of two individuals, displaying behaviour indicative of nesting (flying in and out of a hollow) within Minor Drainage Line habitat and eight detections on acoustic recorder at three locations. Critical habitat (areas that are necessary for activities such as foraging, breeding, roosting) for the species within the Survey Area occurs within the following broad fauna habitats; Major Drainage, Minor Drainage, and Mulga Woodland.



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Appendices



Appendix A Text Codes and Terms Used to Describe Significant Fauna

The Environmental Factor Guideline for Terrestrial Fauna (EPA 2016b) states that terrestrial fauna may be significant for a range of reasons, including: being identified as a threatened or priority species; species with restricted distribution; degree of historical impact from threatening processes and providing an important function required to maintain the ecological integrity of a significant ecosystem.

Those fauna defined as threatened and priority are legislated protection under the EPBC Act and/or the BC Act, or by being listed on the DBCA Priority Species List. This appendix presents a summary of the different rankings and listings used to describe conservation status. Some categories such as 'extinct', 'extinct in the wild' and 'conservation dependent' (EPBC Act) are not represented here, as the table includes only the information needed to fully understand the codes presented in the preceding report. Refer to the relevant legislation for a full description of all codes in use, as well as their associated criteria.

Table A 1: Categories used under the EPBC Act

Status	Code	Description
Critically Endangered	Cr	Taxa considered to be facing an extremely high risk of extinction in the wild in the immediate future
Endangered	En	Taxa considered to be facing a very high risk of extinction in the wild in the near future
Vulnerable	Vu	Taxa considered to be facing a high risk of extinction in the wild in the medium-term future
Migratory	Mi	Species that migrate to, over and within Australia and its external territories

Table A 2: Conservation Codes used under the BC Act

Status	Code	Description
Critically Endangered	Cr	Taxa rare or likely to become extinct, as critically endangered taxa
Endangered	En	Taxa rare or likely to become extinct, as endangered taxa
Vulnerable	Vu	Taxa rare or likely to become extinct, as vulnerable taxa
Presumed Extinct	Ex	Taxa presumed to be extinct
Migratory	IA	Birds subject to international agreements relating to the protection of migratory birds
Conservation Dependent	Cd	Taxa of special conservation need, being species dependent on ongoing conservation intervention
Special Protection	OS	Taxa in need of special protection



Table A 3: Priority Fauna descriptions under the BC Act

Status	Code	Description
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.



Appendix B Vertebrate Fauna Identified from the Desktop Assessment and Field Survey

Table B 1: Database searches undertaken and surveys reviewed for the desktop assessment, and field surveys undertaken within the Survey Area.

Symbol	Name	Reference
Database Searches		
A	DBCA Threatened and Priority Fauna	DBCA (2022)
B	Protected Matters Search Tool	DoAWE (2023)
C	NatureMap	DBCA (2023c)
D	Atlas of Living Australia- Custom Fauna Database Search	ALA (2023b)
E	Birdlife Australia	Birdlife Australia (2023a)
Literature Review		
F	Yangibana Project Biological Assessment: Terrestrial Fauna	ecoscape (2016)
Stantec Survey		
G	Yinnetharra Detailed Terrestrial Vertebrate Fauna and SRE Invertebrate Fauna Survey	-



Table B 2: Vertebrate fauna identified from the desktop assessment and recorded during the field survey.

Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
Amphibia										
Hylidae										
<i>Cyclorana maini</i>	Sheep Frog						x			
<i>Cyclorana occidentalis</i>	Western Water-holding Frog						x		x	
<i>Litoria rubella</i>	Little Red Tree Frog					x	x		x	
Limnodynastidae										
<i>Neobatrachus aquilonius</i>	Northern Burrowing Frog						x			
<i>Neobatrachus fulvus</i>	Tawny Trilling Frog						x			
<i>Neobatrachus pelobatoides</i>	Humming Frog						x			
<i>Neobatrachus sutor</i>	Shoemaker Frog						x			
<i>Neobatrachus wilsmorei</i>	Plonking Frog						x			
<i>Platyplectrum spenceri</i>	Centralian Burrowing Frog					x	x		x	x
Myobatrachidae										
<i>Pseudophryne douglasi</i>	Gorge Toadlet						x			
<i>Uperoleia russelli</i>	Northwest Toadlet						x		x	
Aves										
Acanthizidae										
<i>Acanthiza apicalis</i>	Inland Thornbill					x	x	x		
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill					x	x	x	x	
<i>Acanthiza iredalei</i>	Slender-billed Thornbill						x	x		
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill						x	x		x
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill					x	x	x	x	x
<i>Aphelocephala leucopsis</i>	Southern Whiteface		Vu		x	x	x	x		x
<i>Aphelocephala nigricincta</i>	Banded Whiteface						x	x		x
<i>Calamanthus campestris</i>	Rufous Fieldwren						x	x		x
<i>Gerygone fusca</i>	Western Gerygone					x	x	x		x
<i>Pyrrholaemus brunneus</i>	Redthroat					x	x	x	x	x



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Smicronis brevirostris</i>	Weebill					x	x	x	x	x
Accipitridae										
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk					x	x	x		
<i>Accipiter fasciatus</i>	Brown Goshawk						x	x	x	
<i>Aquila audax</i>	Wedge-tailed Eagle					x	x	x	x	x
<i>Circus approximans</i>	Swamp Harrier								x	
<i>Circus assimilis</i>	Spotted Harrier					x	x	x	x	
<i>Erythrotriorchis radiatus</i>	Red Goshawk	Vu	En		x					
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle						x			
<i>Haliastur sphenurus</i>	Whistling Kite					x	x	x	x	x
<i>Hamirostra isura</i>	Square-tailed Kite						x			
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard					x	x	x		x
<i>Hieraaetus morphnoides</i>	Little Eagle						x	x		x
<i>Milvus migrans</i>	Black Kite					x	x	x		
<i>Elanus axillaris</i>	Black-shouldered Kite						x	x		
Acrocephalidae										
<i>Acrocephalus australis</i>	Australian Reed Warbler						x	x		
Aegothelidae										
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar					x	x	x	x	x
Alaudidae										
<i>Mirafra javanica</i>	Horsfield's Bushlark						x	x	x	
Alcedinidae										
<i>Dacelo leachii</i>	Blue-winged Kookaburra					x	x	x	x	x
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher					x	x	x	x	
<i>Todiramphus sanctus</i>	Sacred Kingfisher					x	x	x	x	
Anatidae										
<i>Anas gracilis</i>	Grey Teal					x	x	x	x	
<i>Anas superciliosa</i>	Pacific Black Duck					x	x	x	x	



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Aythya australis</i>	Hardhead					x	x	x		
<i>Chenonetta jubata</i>	Australian Wood Duck					x	x	x	x	
<i>Cygnus atratus</i>	Black Swan					x	x	x	x	
<i>Dendrocygna arcuata</i>	Wandering Whistling Duck						x	x		
<i>Dendrocygna eytoni</i>	Plumed Whistling Duck						x			
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck						x			
<i>Tadorna tadornoides</i>	Australian Shelduck						x			
Anhingidae										
<i>Anhinga novaehollandiae</i>	Australasian Darter					x	x	x	x	
Apodidae										
<i>Apus pacificus</i>	Fork-tailed Swift	IA	Mi	x	x		x	x		
Ardeidae										
<i>Egretta garzetta</i>	Little Egret						x	x	x	
<i>Ardea alba</i>	Great Egret					x	x	x	x	
<i>Egretta novaehollandiae</i>	White-faced Heron					x	x	x	x	
<i>Ardea pacifica</i>	White-necked Heron					x	x	x	x	
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron						x	x	x	
Artamidae										
<i>Artamus cinereus</i>	Black-faced Woodswallow					x	x	x	x	x
<i>Artamus minor</i>	Little Woodswallow						x	x		x
<i>Artamus personatus</i>	Masked Woodswallow					x	x	x		x
<i>Cracticus nigrogularis</i>	Pied Butcherbird					x	x	x	x	x
<i>Gymnorhina tibicen</i>	Australian Magpie					x	x	x	x	x
<i>Cracticus torquatus</i>	Grey Butcherbird					x		x	x	x
Burhinidae										
<i>Burhinus grallarius</i>	Bush Stone-curlew					x	x	x	x	x
Cacatuidae										
<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo						x	x		



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Eolophus roseicapilla</i>	Galah					x	x	x	x	x
<i>Cacatua sanguinea</i>	Little Corella					x	x	x	x	x
<i>Calyptorhynchus banksii</i>	Red-tailed Black Cockatoo							x		
<i>Nymphicus hollandicus</i>	Cockatiel					x	x	x	x	x
Campephagidae										
<i>Coracina maxima</i>	Ground Cuckoo-shrike						x		x	
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike					x	x	x	x	x
<i>Lalage tricolor</i>	White-winged Triller						x	x	x	
Caprimulgidae										
<i>Eurostopodus argus</i>	Spotted Nightjar					x	x	x	x	x
Casuariidae										
<i>Dromaius novaehollandiae</i>	Emu					x	x	x		x
Charadriidae										
<i>Charadrius melanops</i>	Black-fronted Dotterel					x	x	x	x	
<i>Charadrius veredus</i>	Oriental Plover	IA	Mi		x					
<i>Erythrogonys cinctus</i>	Red-kneed Dotterel						x	x		
<i>Peltohyas australis</i>	Inland Dotterel						x	x		
<i>Vanellus tricolor</i>	Banded Lapwing					x	x	x	x	
Cinclosoma										
<i>Cinclosoma marginatum</i>	Western Quail-thrush					x	x	x	x	x
Climacteridae										
<i>Climacteris affinis</i>	White-browed Treecreeper						x			
<i>Climacteris melanura</i>	Black-tailed Treecreeper						x	x		
Columbidae										
<i>Columba livia</i>	*Domestic Pigeon						x	x		
<i>Geopelia cuneata</i>	Diamond Dove					x	x	x	x	x
<i>Geopelia striata</i>	Peaceful Dove					x	x	x		
<i>Geophaps plumifera</i>	Spinifex Pigeon					x	x	x	x	x



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Ocyphaps lophotes</i>	Crested Pigeon					x	x	x	x	x
<i>Phaps chalcoptera</i>	Common Bronzewing					x	x	x	x	x
<i>Phaps histrionica</i>	Flock Bronzewing						x			
Corvidae										
<i>Corvus bennetti</i>	Little Crow					x	x	x	x	x
<i>Corvus orru</i>	Torresian Crow					x	x	x	x	x
Cuculidae										
<i>Heteroscenes pallidus</i>	Pallid Cuckoo						x	x	x	
<i>Chalcites basalís</i>	Horsfield's Bronze Cuckoo						x	x		x
<i>Chalcites lucidus</i>	Shining Bronze Cuckoo						x			
<i>Chalcites osculans</i>	Black-eared Cuckoo					x	x	x	x	x
Dicaeidae										
<i>Dicaeum hirundinaceum</i>	Mistletoebird						x	x		
Estrildidae										
<i>Emblema pictum</i>	Painted Finch						x	x	x	x
<i>Neochmia ruficauda</i>	Star Finch						x	x		
<i>Taeniopygia guttata</i>	Zebra Finch					x	x	x	x	x
Falconidae										
<i>Falco berigora</i>	Brown Falcon					x	x	x	x	x
<i>Falco cenchroides</i>	Nankeen Kestrel					x	x	x	x	x
<i>Falco hypoleucos</i>	Grey Falcon	Vu	Vu	x	x		x	x	x	
<i>Falco longipennis</i>	Australian Hobby						x	x	x	x
<i>Falco peregrinus</i>	Peregrine Falcon	OS		x		x	x	x		
<i>Falco subniger</i>	Black Falcon						x			
Hirundinidae										
<i>Cheramoeca leucosternus</i>	White-backed Swallow					x	x	x		
<i>Hirundo neoxena</i>	Welcome Swallow						x	x		
<i>Hirundo rustica</i>	Barn Swallow	IA	Mi		x					



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Petrochelidon ariel</i>	Fairy Martin					x	x	x	x	x
<i>Petrochelidon nigricans</i>	Tree Martin					x	x	x	x	x
Locustellidae										
<i>Megalurus cruralis</i>	Brown Songlark					x	x	x	x	x
<i>Megalurus gramineus</i>	Little Grassbird								x	
<i>Megalurus mathewsi</i>	Rufous Songlark					x	x	x	x	x
Maluridae										
<i>Malurus assimilis</i>	Purple-backed Fairy-wren					x	x	x	x	x
<i>Malurus leucopterus</i>	White-winged Fairy-wren					x	x	x	x	x
<i>Malurus splendens</i>	Splendid Fairy-wren					x	x	x		x
<i>Stipiturus ruficeps</i>	Rufous-crowned Emu-wren						x	x		
Megapodiidae										
<i>Leipoa ocellata</i>	Malleefowl	Vu	Vu	x						
Meliphagidae										
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater					x	x	x	x	x
<i>Certhionyx variegatus</i>	Pied Honeyeater						x	x		
<i>Epthianura aurifrons</i>	Orange Chat						x	x		
<i>Epthianura tricolor</i>	Crimson Chat					x	x	x	x	
<i>Gavicalis virescens</i>	Singing Honeyeater					x	x	x	x	x
<i>Lacustroica whitei</i>	Grey Honeyeater						x	x		
<i>Lichmera indistincta</i>	Brown Honeyeater					x	x	x		x
<i>Manorina flavigula</i>	Yellow-throated Miner					x	x	x	x	x
<i>Ptilotula keartlandi</i>	Grey-headed Honeyeater					x	x	x		x
<i>Ptilotula penicillatus</i>	White-plumed Honeyeater					x	x	x	x	x
<i>Ptilotula plumulus</i>	Grey-fronted Honeyeater							x		
<i>Purnella albifrons</i>	White-fronted Honeyeater						x	x		x
<i>Sugomel niger</i>	Black Honeyeater					x	x	x	x	
Meropidae										



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Merops ornatus</i>	Rainbow Bee-eater					x	x	x	x	x
Monarchidae										
<i>Grallina cyanoleuca</i>	Magpie-lark					x	x	x	x	x
Motacillidae										
<i>Anthus australis</i>	Australian Pipit						x	x		x
<i>Motacilla cinerea</i>	Grey Wagtail	IA	Mi		x					
<i>Motacilla flava</i>	Yellow Wagtail	IA	Mi		x					
Neosittidae										
<i>Daphoenositta chrysoptera</i>	Varied Sittella						x	x		x
Oreoicidae										
<i>Oreoica gutturalis</i>	Crested Bellbird					x	x	x	x	x
Otididae										
<i>Ardeotis australis</i>	Australian Bustard					x	x	x	x	x
Pachycephalidae										
<i>Colluricincla harmonica</i>	Grey Shrike-thrush					x	x	x		x
<i>Pachycephala rufiventris</i>	Rufous Whistler					x	x	x	x	x
Pardalotidae										
<i>Pardalotus rubricatus</i>	Red-browed Pardalote						x	x	x	
<i>Pardalotus striatus</i>	Striated Pardalote					x	x	x		
Pelecanidae										
<i>Pelecanus conspicillatus</i>	Australian Pelican					x	x	x		
Petroicidae										
<i>Melanodryas cucullata</i>	Hooded Robin					x	x	x	x	x
<i>Microeca fascinans</i>	Jacky Winter							x		
<i>Petroica goodenovii</i>	Red-capped Robin					x	x	x	x	x
Phalacrocoracidae										
<i>Phalacrocorax carbo</i>	Great Cormorant						x	x	x	
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant					x	x	x	x	



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant					x	x	x	x	
<i>Phalacrocorax varius</i>	Pied Cormorant						x			
Phasianidae										
<i>Coturnix pectoralis</i>	Stubble Quail					x	x	x		
<i>Coturnix ypsilophora</i>	Brown Quail						x			
Podargidae										
<i>Podargus strigoides</i>	Tawny Frogmouth						x	x		x
Podicipedidae										
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe					x	x	x		
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe					x	x	x		
Pomatostomidae										
<i>Pomatostomus superciliosus</i>	White-browed Babbler					x	x	x	x	x
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler					x	x	x	x	x
Psittaculidae										
<i>Melopsittacus undulatus</i>	Budgerigar					x	x	x	x	x
<i>Neopsephotus bourkii</i>	Bourke's Parrot					x	x	x		
<i>Pezoporus occidentalis</i>	Night Parrot	Cr	En		x					
<i>Psephotellus varius</i>	Mulga Parrot						x	x		
<i>Barnardius zonarius</i>	Australian Ringneck					x	x	x	x	x
Psophodidae										
<i>Psophodes occidentalis</i>	Western Wedgebill						x	x		
Ptilonorhynchidae										
<i>Chlamydera guttata</i>	Western Bowerbird						x	x		x
Rallidae										
<i>Fulica atra</i>	Eurasian Coot					x	x	x		
<i>Tribonyx ventralis</i>	Black-tailed Native-hen					x	x	x		
Recurvirostridae										
<i>Himantopus himantopus</i>	Black-winged Stilt						x			



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
Rhipiduridae										
<i>Rhipidura albiscapa</i>	Grey Fantail						x	x		
<i>Rhipidura leucophrys</i>	Willie Wagtail					x	x	x	x	x
Rostratulidae										
<i>Rostratula australis</i>	Australian Painted Snipe	EN, IA	En		x					
Scolopacidae										
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	IA	Mi		x		x			
<i>Calidris ferruginea</i>	Curlew Sandpiper	Cr; IA	Cr; Mi		x					
<i>Calidris melanotos</i>	Pectoral Sandpiper	IA	Mi		x					
<i>Actitis hypoleucos</i>	Common Sandpiper	IA	Mi		x		x	x		
<i>Tringa nebularia</i>	Common Greenshank	IA	Mi	x			x	x		
Strigidae										
<i>Ninox boobook</i>	Boobook Owl					x	x	x	x	x
<i>Ninox connivens</i>	Barking Owl						x	x		
Threskiornithidae										
<i>Platalea flavipes</i>	Yellow-billed Spoonbill					x	x	x		
<i>Threskiornis spinicollis</i>	Straw-necked Ibis					x	x	x	x	
Turnicidae										
<i>Turnix velox</i>	Little Button-quail						x	x	x	
Tytonidae										
<i>Tyto alba</i>	Barn Owl						x	x		x
Mammalia										
Bovidae										
<i>Bos taurus</i>	*European Cattle					x			x	x
Camelidae										
<i>Camelus dromedarius</i>	*Camel						x			
Canidae										
<i>Canis dingo</i>	Dingo					x	x			x



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Canis lupus</i>	*Dog					x	x		x	
Dasyuridae										
<i>Dasyurus hallucatus</i>	Northern Quoll	En	En		x					
<i>Phascogale calura</i>	Red-tailed Phascogale	CD	Vu	x						
<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus						x		x	x
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart	P4		x			x		x	
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart					x	x		x	x
Emballonuridae										
<i>Taphozous georgianus</i>	Common Sheathtail-bat					x	x			
<i>Taphozous hilli</i>	Hill's Sheathtail-bat						x		x	x
Equidae										
<i>Equus caballus</i>	*Horse					x			x	
Felidae										
<i>Felis catus</i>	*Cat						x		x	x
Leporidae										
<i>Oryctolagus cuniculus</i>	*Rabbit						x			x
Macropodidae										
<i>Osphranter robustus</i>	Euro								x	x
<i>Osphranter rufus</i>	Red Kangaroo					x	x		x	x
<i>Petrogale lateralis lateralis</i>	Black-footed Rock-wallaby	En	En	x			x			
<i>Petrogale rothschildi</i>	Rothschild's Rock-wallaby						x			
Megadermatidae										
<i>Macroderma gigas</i>	Ghost Bat	Vu	Vu		x					
Molossidae										
<i>Austronomus australis</i>	White-striped Freetail-bat								x	x
<i>Chaerephon jobensis</i>	Greater Northern Freetail-bat						x		x	x
<i>Ozimops lumsdenae</i>	Northern Freetail-bat									x
Muridae										



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Mus musculus</i>	*House Mouse					x	x		x	x
<i>Notomys alexis</i>	Spinifex Hopping-mouse						x			
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P4		x		x			x	
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse					x	x		x	x
<i>Zyzomys argurus</i>	Common Rock-rat						x			x
Rhinonycteridae										
<i>Rhinonycteris aurantius Pilbara form</i>	Pilbara Leaf-nosed Bat	Vu	Vu		x					
Tachyglossidae										
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna									x
Thylacomyidae										
<i>Macrotis lagotis</i>	Bilby	Vu	Vu	x		x				
Vespertilionidae										
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat						x		x	x
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat								x	x
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat								x	x
<i>Scotorepens greyii</i>	Little Broad-nosed Bat						x		x	x
<i>Vespadelus baverstocki</i>	Inland Forest Bat									x
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat					x	x		x	x
Reptilia										
Agamidae										
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon					x	x			x
<i>Ctenophorus isolepis</i>	Military Dragon						x			
<i>Ctenophorus nuchalis</i>	Central Netted Dragon					x	x			x
<i>Ctenophorus reticulatus</i>	Western Netted Dragon					x	x			x
<i>Ctenophorus rubens</i>	Red Dragon						x			
<i>Ctenophorus yinnietharra</i>	Yinnietharra Rock- Dragon	Vu	Vu	x	x	x	x			x*
<i>Diporiphora amphiboluroides</i>						x	x			
<i>Gowidon longirostris</i>	Long-nosed Dragon					x	x			x



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Moloch horridus</i>	Thorny Devil						x			
<i>Pogona minor</i>							x			x
<i>Tympanocryptis cephalus</i>	Coastal Pebble-mimic Dragon					x				
<i>Tympanocryptis gigas</i>	Gascoyne Pebble-mimic Dragon						x			x
Carphodactylidae										
<i>Nephrurus levis</i>							x			
<i>Nephrurus vertebralis</i>							x			
<i>Nephrurus cinctus</i>	Northern Banded Knob-tailed Gecko					x	x			
Chelidae										
<i>Chelodina steindachneri</i>	Flat-shelled Turtle					x	x		x	
Diplodactylidae										
<i>Diplodactylus bilybara</i>	Western Fat-tailed Gecko						x		x	x
<i>Diplodactylus pulcher</i>									x	
<i>Lucasium squarrosom</i>							x			
<i>Lucasium stenodactylus</i>	Western Sandplain Gecko								x	x
<i>Rhynchoedura ornata</i>	Western Beaked Gecko						x			x
<i>Strophurus strophurus</i>							x			
<i>Strophurus wellingtonae</i>							x			
<i>Strophurus wilsoni</i>							x			
Elapidae										
<i>Brachyuropsis approximans</i>						x	x			
<i>Demansia psammophis</i>	Yellow-faced Whipsnake						x			
<i>Pseudechis australis</i>	Mulga Snake						x			
<i>Pseudonaja mengdeni</i>	Western Brown Snake						x		x	
<i>Pseudonaja modesta</i>	Ringed Brown Snake						x			
<i>Simoselaps bertholdi</i>	Jan's Banded Snake					x	x		x	x
<i>Suta fasciata</i>	Rosen's Snake					x	x			
<i>Suta punctata</i>	Spotted Snake						x			



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Demansia reticulata</i>	Yellow-faced Whipsnake					x			x	
Gekkonidae										
<i>Gehyra punctata</i>						x			x	
<i>Gehyra variegata</i>						x	x		x	x
<i>Heteronotia binoei</i>	Bynoe's Gecko					x	x		x	x
<i>Gehyra crypta</i>	Western cryptic gehyra						x			
<i>Gehyra finipunctata</i>	Small-spotted mid-west rock gehyra						x			
<i>Gehyra micra</i>	Small Pilbara spotted rock gehyra						x			x
<i>Gehyra polka</i>	Large-spotted mid-west rock gehyra						x			x
Pygopodidae										
<i>Delma tincta</i>							x			x
<i>Pygopus nigriceps</i>							x			
Pythonidae										
<i>Antaresia perthensis</i>	Pygmy Python					x	x			
<i>Aspidites melanocephalus</i>	Black-headed Python						x			
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	Vu	Vu				x			
Scincidae										
<i>Ctenotus inornatus</i>							x		x	
<i>Ctenotus leonhardii</i>						x	x			x
<i>Ctenotus rutilans</i>							x			
<i>Ctenotus schomburgkii</i>						x	x		x	x
<i>Ctenotus severus</i>						x				x
<i>Ctenotus uber</i>						x	x		x	x
<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink					x	x			x
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	Vu	En		x					
<i>Eremiascincus pallidus</i>	Western Narrow-banded Skink						x			
<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer								x	



Species	Common Name	Listing		A	B	C	D	E	F	G
		BC	EPBC							
<i>Lerista gascoynensis</i>							x			
<i>Lerista macropisthopus</i>						x	x		x	
<i>Lerista muelleri</i>							x			
<i>Lerista nichollsi</i>										x
<i>Lerista petersoni</i>						x	x		x	
<i>Lerista rolfei</i>						x	x		x	x
<i>Lerista stictopleura</i>							x			
<i>Lerista timida</i>						x	x			
<i>Lerista uniduo</i>						x	x			
<i>Menetia greyii</i>						x	x		x	
<i>Morethia ruficauda</i>						x	x		x	x
<i>Notoscincus ornatus</i>						x	x		x	
Typhlopidae										
<i>Anilius grypus</i>						x	x		x	x
<i>Anilius hamatus</i>							x			x
Varanidae										
<i>Varanus acanthurus</i>	Spiny-tailed Monitor					x	x		x	
<i>Varanus caudolineatus</i>						x	x		x	x
<i>Varanus giganteus</i>	Perentie								x	
<i>Varanus gilleni</i>	Pygmy Mulga Monitor						x			
<i>Varanus gouldii</i>	Sand Monitor						x			x
<i>Varanus panoptes</i>	Yellow-spotted Monitor					x	x		x	x
<i>Varanus tristis</i>	Racehorse Monitor					x	x			x

*Species was only recorded outside of the Survey Area



Appendix C Significant Species Unlikely to Occur or Considered Irrelevant to the Survey Area

A total of 12 significant species are considered unlikely to occur within the Survey Area. In addition, 11 species were excluded from the likelihood of occurrence assessment (Table 5-5) as the Survey Area is outside their current range and known distribution. These species comprise:

- Northern Quoll (*Dasyurus hallucatus*; En, En): outside the species known distribution range (van Dyck and Strahan 2008).
- Black-footed Rock-Wallaby (*Petrogale lateralis lateralis*; En, En): outside the species known distribution (DBCA 2017)
- Bilby (*Macrotis lagotis*; Vu, Vu): species records are historic, Survey Area is outside current range (DCCEEW 2023b).
- Ghost Bat (*Macroderma gigas*; Vu, Vu): outside the species' known distribution (Bat Call 2021a; van Dyck *et al.* 2013).
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia* [Pilbara form]; Vu, Vu): outside the species' known distribution (Bat Call 2021b).
- Red-tailed Phascogale (*Phascogale calura*; Vu, CD): species records are historic, Survey Area is outside current range (DBCA 2022; Short and Hide 2012).
- Red Goshawk (*Erythrotriorchis radiatus*; En, Vu): outside the species' known distribution (MacColl *et al.* 2023).
- Grey Wagtail (*Motacilla cinerea*; Mi, IA): outside the species' known distribution (Menkhorst *et al.* 2019).
- Yellow Wagtail (*Motacilla flava*; Mi, IA): outside the species' known distribution (Menkhorst *et al.* 2019).
- Western Spiny-tailed Skink (*Egernia stokesii badia*; En, Vu): outside the species' known distribution (Wilson and Swan 2021).
- Pilbara Olive Python (*Liasis olivaceus barroni*; Vu;Vu): outside the species' known distribution (Wilson and Swan 2021).

These 11 species are not considered relevant within the context of this Survey, based on the criteria outlined in Section 3.2.3. Species considered unlikely to occur are summarised in Table C 1.



Table C 1: Significant species identified in the desktop assessment that are unlikely to occur or considered irrelevant to the Survey Area.

Common name (<i>Scientific name</i>)	Listing		Key threats and reason for listing	Habitat and ecology	Likelihood of occurrence and reason for likelihood
	EPBC Act	BC Act			
Birds					
Night Parrot (<i>Pezoporus occidentalis</i>)	En	Cr	Little is known about the species, however key threats (not an exclusive list) in the vicinity of the Survey Area are likely to include predation by feral cats and potentially foxes, inappropriate fire regimes and the loss or degradation of habitat (DotE 2016a; DPaW 2017b; NESP 2019).	<p>Known to inhabit treeless or sparsely wooded long unburnt spinifex hummock plains (Pyke and Ehrlich 2014). Roosts in dense clumps of vegetation (usually spinifex), particularly in association with suitable foraging vegetation such as chenopods or diverse seeding vegetation (DPaW 2017b; Murphy <i>et al.</i> 2017b; Pyke and Ehrlich 2014).</p> <p>Critical habitat comprises breeding, roosting habitat, foraging habitat and water sources within 50 km of known breeding/roosting habitats (Appendix F). Supporting habitat consists of flyways and other foraging habitats (Appendix F).</p> <ul style="list-style-type: none"> No areas of critical or supporting habitat were identified within the Survey Area. 	<p>Unlikely</p> <p>The species has not been historically recorded within 100 km of the Survey Area. The Survey Area occurs within the species' known distribution range (Leseberg <i>et al.</i> 2021), however there is no critical habitat (old growth (often >50 years unburnt) or supporting habitat (hummock grasslands and paleo-drainage features) found within the Survey Area or in the vicinity of the Survey Area (Appendix F).</p>
Australian Painted-snipe (<i>Rostratula australis</i>)	En	En	Main threat involves the loss or alteration of wetlands, largely wetland drainage and water diversion for agriculture and reservoirs (DotE 2020).	<p>Inhabits shallow freshwater wetlands, typically with tussocks, sedges, rushes or reeds (DotE 2020). Breeding habitats include shallow wetlands with bare patches of wet mud near upper vegetation cover (DotE 2020).</p> <p>Critical habitat comprises any habitat where the species is known or likely to occur or areas that may be periodically</p>	<p>Unlikely</p> <p>The species has not been historically recorded within 100 km of the Survey Area and no critical habitat occurs within the Survey Area (Birdlife Australia 2023b; DBCA 2023a). The Survey Area occurs outside the species known distribution range; however,</p>



Common name (<i>Scientific name</i>)	Listing		Key threats and reason for listing	Habitat and ecology	Likelihood of occurrence and reason for likelihood
	EPBC Act	BC Act			
				<p>occupied when conditions are favourable (Appendix F). Supporting habitat is not well defined.</p> <ul style="list-style-type: none"> The Survey Area does not contain critical habitat for this species. 	<p>migration patterns are poorly known (DotEE 2019b).</p>
Malleefowl (<i>Leipoa ocellata</i>)	Vu	Vu	<p>The major threats to the species include, habitat clearing, fragmentation and isolation, habitat alteration by non-native herbivores, predation by Red foxes and to a lesser extent, fire and climate change (Benshemesh 2007).</p>	<p>Knowledge of habitat preferences is limited, however the species tends to inhabit arid or semi- arid shrublands or woodlands dominated by long unburnt mallee, and may also occur in areas dominated by <i>Acacia</i> sp., wandoo, marri or mallee (Benshemesh 2007). Substrates tend to be sandy loams and loamy sands with an abundance of leaf litter for mound construction and may contain gravel or lateritic fragments (Benshemesh 2007; Parsons 2008)</p> <p>The Survey Area does not contain critical or supporting habitat for the species (Appendix F).</p>	<p>Unlikely</p> <p>The species was recorded approximately 83 km southwest of the Survey Area in 1998 (DBCA 2023a). The Survey Area occurs outside of the species distribution range (Benshemesh 2007), and no critical or supporting habitat and/or substrate for mound building occurs within the Survey Area.</p>
Curlew Sandpiper (<i>Calidris ferruginea</i>)	Mi & Cr	Cr	<p>Species migratory between Australia and Siberia, and through much of Asia. Therefore, protected under international agreements CAMBA, JAMBA and ROKAMBA. Habitat loss and degradation are the largest threats to the species, particularly the availability of foraging and roosting sites required for successful</p>	<p>Species commonly associated with shallow aquatic habitats, including wetlands, marshes, sewage ponds, river and creekline flats, tidal flats or grassy edges of wetlands (Menkhorst <i>et al.</i> 2017).</p> <p>Critical habitat comprises breeding and roosting habitat (Appendix F). Supporting habitat consists of foraging habitat (Appendix F).</p> <p>The species does not breed in Australia.</p>	<p>Unlikely</p> <p>The species has not been historically recorded within 100 km of the Survey Area (Birdlife Australia 2023b; DBCA 2023a). The Survey Area is within the species distribution range, however it does not contain any critical or supporting habitat for the species.</p>



Common name (<i>Scientific name</i>)	Listing		Key threats and reason for listing	Habitat and ecology	Likelihood of occurrence and reason for likelihood
	EPBC Act	BC Act			
			migration and breeding (DotEE 2019a).	<ul style="list-style-type: none"> The Survey Area does not contain critical or supporting habitat for this species. 	
Barn Swallow (<i>Hirundo rustica</i>)	Mi	IA	A past and current threat to the Barn Swallow is loss of habitat. Historically, pesticides were responsible for a significant decrease in population numbers in Israel during the 1950s (DotEE 2019a).	Tend to inhabit coastal lowlands, particularly near towns, cities and particularly near water (DotEE 2019a). Also forage over open habitats, particularly areas with a high density of insects such as wetlands (Menkhorst <i>et al.</i> 2017). Critical and supporting habitat is not defined for non-MNES species. The Survey Area does not contain suitable habitat for this species.	Unlikely The species has not been historically recorded within 100 km of the Survey Area. The Survey Area contains no suitable habitat and only occurs in the species irregular range (Menkhorst <i>et al.</i> 2019).
Five migratory shorebirds: <ul style="list-style-type: none"> Pectoral Sandpiper (<i>Calidris melanotos</i>) Oriental Plover (<i>Charadrius veredus</i>) Common Greenshank (<i>Tringa nebularia</i>) Common Sandpiper (<i>Actitis hypoleucos</i>) Sharp-tailed Sandpiper (<i>Calidris acuminata</i>) 	Mi	IA	Species migratory between Australia and Siberia, and through much of Asia. Therefore, protected under international agreements CAMBA, JAMBA and ROKAMBA. Habitat loss and degradation are the largest threats to the species, particularly the availability of foraging and roosting sites required for successful migration and breeding (DotEE 2019a).	<p>These species are commonly associated with shallow aquatic habitats, including wetlands, marshes, sewage ponds, river and creekline flats, tidal flats or grassy edges of wetlands (Menkhorst <i>et al.</i> 2017).</p> <p>The Survey Area does not support important habitat for migratory species (DoE 2013) (Appendix F).</p> <p>These species do not breed in Australia, however during periods of inundation, these species may utilise the Major Drainage Line habitat for foraging.</p>	Unlikely The Pectoral Sandpiper, Oriental Plover, Common Sandpiper and Sharp-tailed Sandpiper have not been historically recorded within 100 km of the Survey Area (DBCA 2023a). The Common Greenshank has been historically recorded at three locations within 100 km of the Survey Area. The most recent record (2000) is located approximately 54 km north of the Survey Area (DBCA 2023a).
Reptiles					
Yinnietharra Rock- Dragon (<i>Ctenophorus yinnietharra</i>)	Vu	Vu	The main threats identified include habitat degradation by cattle grazing and boulder harvesting. Due to the	The species occurs in tall open shrublands, inhabiting granite outcrops which are often less than 1 m ² in area (Cogger <i>et al.</i> 1993; DEWHA 2011). It is a	Unlikely The species has been historically recorded, with 36 species records occurring within 100 km of the



Common name (<i>Scientific name</i>)	Listing		Key threats and reason for listing	Habitat and ecology	Likelihood of occurrence and reason for likelihood
	EPBC Act	BC Act			
			<p>Yinnietharra Rock Dragon's small population size, it is vulnerable to any stochastic events which may impact the species (DEWHA 2008).</p>	<p>habitat specialist and appears to be restricted to granite outcrops of one origin – Archean gneissic biotite granites and granodiorite (Cogger <i>et al.</i> 1993). Critical and supporting habitat is not defined for the Yinnietharra Rock Dragon.</p> <p>During the Targeted Survey (Appendix G) four key characteristics of suitable Yinnietharra Rock Dragon habitat were identified. These comprise:</p> <ol style="list-style-type: none"> 1. Substrate – Primarily gravel (1-4 cm) but may be pebble sized (5-10 cm) quartz and granite on sandy clay soils. Rock cover is sparse compared to dense quartz plain habitat that commonly occurs in the surrounding region. 2. Presence of granite outcrops – Species requires low weathered granite outcrops. 3. Size of granite outcrops – Majority (>90%) of outcrops present are only 0.5 to 1 m in height and less than 2 m in length. 4. Density of granite outcrops – Outcrops are sparsely distributed, often separated by distances of 50 – 100 m. <p>Applying these criteria, there was no suitable Yinnietharra Rock- Dragon habitat observed within the Survey Area.</p>	<p>Survey Area. Of those, 28 are within 20 km of the Survey Area (DBCA 2023a). The most recent record is from 2006 and located approximately 76 km north west of the Survey Area (DBCA 2023a). The species is considered unlikely to occur as based on the results of the SDM and ground truthing from the Targeted Yinnietharra Rock- Dragon survey, no suitable Yinnietharra Rock- Dragon habitat occurs within the Survey Area.</p>



Appendix D Target Group SRE taxa Identified from the Desktop Assessment



Table D 1: Target group SRE invertebrate taxa identified by the desktop assessment and likelihood of occurring within the Survey Area.

Name	Source	Habitats defined within source report	Likelihood of occurring within the Survey Area	Similar habitat present	Nearest record (km)
Mygalomorph spiders					
<i>Synothele</i> sp. B14	(ecoscape 2016)	<ul style="list-style-type: none"> Undulating stony hills of ironstone and quartz 	Low	Yes	>50
<i>Aganippe</i> sp. 21	(ecoscape 2016)	<ul style="list-style-type: none"> Undulating sandy plain of clay/loam soil with occasional calcrete and quartz pebbles 	Low	Yes	>50
<i>Aname</i> sp. B19	(ecoscape 2016)	<ul style="list-style-type: none"> Sparse Acacia shrubland on undulating stony hills of quartz, granite, and ironstone. Acacia woodland on minor creekline 	Low	Yes	>50
<i>Conothele</i> `MYG581`	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	97.0
<i>Conothele</i> `MYG583`	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	96.7
<i>Gaius villosus</i>	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	102.0
<i>Bungulla keigheryi</i>	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	97.0
<i>Bungulla bidgemia</i>	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	96.7
<i>Bungulla bertmaini</i>	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Moderate	Unknown	24.4
`MYGAAB` `MYG482`	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	97.0
<i>Euoplos</i> `hoggi-group`	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Moderate	Unknown	24.4
Scorpions					



Name	Source	Habitats defined within source report	Likelihood of occurring within the Survey Area	Similar habitat present	Nearest record (km)
<i>Lychas</i> 'harveyi'	(ecoscape 2016)	<ul style="list-style-type: none"> Many habitats including minor creekline, rocky plain and hill, and sandy plain. 	Low	Yes	>50
<i>Lychas</i> hairy tail' group	(ecoscape 2016)	<ul style="list-style-type: none"> Sparse Acacia shrubland on undulating stony hills of calcrete and quartz 	Low	Yes	>50
<i>Lychas</i> 'multipunctatus' group	(ecoscape 2016)	<ul style="list-style-type: none"> <i>Eremophila spp.</i> sparse shrubland on undulating stony hills of quartz stones, occasional granite rocks, and ironstone. 	Low	Yes	>50
<i>Urodacus hartmeyer</i>	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	96.0
<i>Urodacus</i> 'armatus'	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	75.9
<i>Urodacus</i> hoplurus	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	High	Unknown	5.8
<i>Urodacus novaehollandiae</i>	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	131.1
<i>Urodacus</i> 'SCO011, waldburg'	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	80.0
<i>Urodacus</i> 'saipem 2'	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	93.7
<i>Urodacus</i> 'SCO014, saipem 1'	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	125.3
Pseudoscorpiones					
<i>Beierolpium</i> 8/2	(ecoscape 2016)	<ul style="list-style-type: none"> <i>Eremophila spp.</i> sparse shrubland on undulating stony hills of quartz and ironstone. 	Low	Yes	>50
<i>Beierolpium</i> 'sp. 8/4'	(WAM 2023a)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	58.2



Name	Source	Habitats defined within source report	Likelihood of occurring within the Survey Area	Similar habitat present	Nearest record (km)
<i>Beierolpium` sp. 8/3 small`</i>	(WAM 2023a)	<ul style="list-style-type: none"> Acacia shrubland on quartz outcrop 	Low	Yes	83.4
<i>Beierolpium` sp. 8/3 lge`</i>	(WAM 2023a)	<ul style="list-style-type: none"> Acacia shrubland in creekline 	Low	Yes	81.2
<i>Beierolpium` sp. 8/4 medium`</i>	(WAM 2023a)	<ul style="list-style-type: none"> Acacia shrubland in creekline 	Low	Yes	81.2
<i>Xenolpium` PSE068`</i>	(WAM 2023a)	<ul style="list-style-type: none"> Acacia shrubland on Laterite ridge 	Low	Yes	80.8
Indolpium sp. B20	(ecoscape 2016)	<ul style="list-style-type: none"> Rocky plains and hills 	Low	Yes	>50
Indolpium sp. B21	(ecoscape 2016)	<ul style="list-style-type: none"> Sandy plain 	Low	Yes	>50
Linnaeolpium sp. B04	(ecoscape 2016)	<ul style="list-style-type: none"> Rocky plains and hills 	Low	Yes	>50
Snails					
<i>Plectorhagada gascoynensis</i>	(WAM 2023b)	<ul style="list-style-type: none"> Callytharra formation limestone 	Low	No	97.1
<i>Pupoides cf. beltianus</i>	(WAM 2023b)	<ul style="list-style-type: none"> Rocky outcrop 	Low	Yes	83.4
<i>Pupoides contrarius</i>	(ecoscape 2016)	<ul style="list-style-type: none"> Rocky plains and hills, sandy plain 	Low	Yes	>50
<i>Plectorhagada carcharias</i>	(WAM 2023b)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	85.5


Slaters




Name	Source	Habitats defined within source report	Likelihood of occurring within the Survey Area	Similar habitat present	Nearest record (km)
<i>Pygolabis gascoyne</i>	(WAM 2023c)	<ul style="list-style-type: none"> Not specified 	Low	Unknown	63.1
<i>Acanthodillo</i> sp. B16	(ecoscape 2016)	<ul style="list-style-type: none"> Undulating sandy plain of clay/loam soil with occasional calcrete and quartz pebbles 	Low	Yes	>50
<i>Buddelundia</i> sp. B58	(ecoscape 2016)	<ul style="list-style-type: none"> Many habitats including minor creekline, rocky plain and hill, and sandy plain. 	Low	Yes	>50
<i>Buddelundia</i> sp. B59	(ecoscape 2016)	<ul style="list-style-type: none"> <i>Eremophila</i> spp. sparse shrubland on undulating stony hills of quartz and ironstone. 	Low	Yes	>50
<i>Buddelundia</i> sp. B60	(ecoscape 2016)	<ul style="list-style-type: none"> Undulating sandy plain of clay/loam soil with occasional calcrete and quartz pebbles 	Low	Yes	>50
<i>Cubaris</i> sp. B07	(ecoscape 2016)	<ul style="list-style-type: none"> <i>Eremophila</i> spp. sparse shrubland on undulating stony hills of quartz and ironstone. 	Low	Yes	>50
Millipedes					
<i>Polyxenidae</i> sp. B14	(ecoscape 2016)	<ul style="list-style-type: none"> Sparse Acacia shrubland on undulating stony hills of quartz, granite, and ironstone. Acacia woodland on minor creekline 	Low	Yes	>50
<i>Synxenidae</i> sp. B08	(ecoscape 2016)	<ul style="list-style-type: none"> Many habitats including minor creekline, rocky plain and hill, and sandy plain 	Low	Yes	>50
Centipedes					
<i>Orphnaeus</i> nr <i>brevilabiatus</i>	(ecoscape 2016)	<ul style="list-style-type: none"> Undulating sandy plain of clay/loam soil with occasional calcrete and quartz pebbles 	Low	Yes	>50


Appendix E Fauna Habitat Assessments




Site	Name	H-01	<div style="text-align: center; background-color: black; color: white; padding: 5px;">Site Photograph</div> 	
	Habitat Type	Stony plain		
	Landform	Stony plain		
Habitat Features	Slope	Flat (0°)		
	Aspect	N/A		
	Woody Debris	Rare		
	Tree Hollows (>50 cm)	None		
Condition	Condition	Very Good		
	Disturbance Type	Cattle grazing, Road/Access tracks		
	Fire Age	No Evidence		
Ground Cover	Rock	Evenly spread		
	Soil	Scarce		
	Leaf Litter	Scarce		
Rocks	Type	Quartz		Vegetation description
	Size	Pebbles (5-10cm)		
	Outcropping	None		
Soil	Type	Sandy Clay Loam	<i>Acacia xiphophylla</i> and <i>Acacia cuspidifolia</i> tall open shrubland over <i>Senna</i> sp. <i>meekatharra</i> (E. Bailey 1-26) and <i>Eremophila cuneifolia</i> scattered shrubs over <i>Sclerolaena densiflora</i> and <i>Sclerolaena cuneata</i> very open herbland.	
	Colour	Red/brown		




Site	Name	H-02	<div style="text-align: center;">Site Photograph</div> 	
	Habitat Type	Mulga woodland		
	Landform	Sandy stony plain		
Habitat Features	Slope	Flat (0°)		
	Aspect	N/A		
	Woody Debris	Common		
	Tree Hollows (>50 cm)	Common		
Condition	Condition	Very Good		
	Disturbance Type	Cattle grazing		
	Fire Age	No Evidence		
Ground Cover	Rock	Scarce		
	Soil	Evenly spread		
	Leaf Litter	Many large patches		
Rocks	Type	Quartz		Vegetation description
	Size	Small Rocks (11-20cm)		
	Outcropping	None		
Soil	Type	Sandy Clay Loam	<i>Acacia incurvaneura</i> and <i>Acacia kempeana</i> low woodland over <i>Acacia tetragonophylla</i> , <i>Senna artemisioides</i> subsp. <i>helmsii</i> and <i>Ptilotus obovatus</i> var. <i>obovatus</i> open shrubland over <i>Digitaria brownii</i> and <i>Aristida contorta</i> open tussock grassland.	
	Colour	Red/brown		


Site	Name	H-03	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Grass Sand plain	
	Landform	Sand plain	
Habitat Features	Slope	Flat (0°)	
	Aspect	N/A	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	None discernible	
	Soil	Evenly spread	
	Leaf Litter	Few small patches	
Rocks	Type	None discernible	
	Size	Negligible	
	Outcropping	None	
Soil	Type	Sandy Loam	<div style="text-align: center;">Vegetation description</div> <p><i>Acacia curryana</i> and <i>Acacia kempiana</i> tall open shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> open shrubland over <i>Aristida holathera</i> var. <i>holathera</i>, <i>Aristida contorta</i> and *<i>Cenchrus ciliaris</i> open tussock grassland.</p>
	Colour	Red/brown	




Site	Name	H-04	<div style="text-align: center;">Site Photograph</div> 	
	Habitat Type	Drainage line		
	Landform	Major drainage line		
Habitat Features	Slope	Low (1-20°)		
	Aspect	West		
	Woody Debris	Common		
	Tree Hollows (>50 cm)	Common		
Condition	Condition	Very Good		
	Disturbance Type	Cattle grazing, Weed invasion		
	Fire Age	No Evidence		
Ground Cover	Rock	None discernible		
	Soil	Evenly spread		
	Leaf Litter	Many small patches		
Rocks	Type	None discernible		Vegetation description
	Size	Negligible		
	Outcropping	None		
Soil	Type	Sandy Clay Loam	<i>Acacia kempeana</i> and <i>Acacia fuscanera</i> tall shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubs over <i>Aristida contorta</i> , <i>Eriachne aristidea</i> and * <i>Cenchrus ciliaris</i> open tussock grassland.	
	Colour	Red/brown		




Site	Name	H-05	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Rocky ridge and outcropping	
	Landform	Granite outcrops	
Habitat Features	Slope	Moderately inclined (21-45°)	
	Aspect	East	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	Rare	
Condition	Condition	Very Good	
	Disturbance Type	Weed invasion	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Many small patches	
	Leaf Litter	Scarce	
Rocks	Type	Granite	<div style="text-align: center;">Vegetation description</div> <p><i>Acacia tetragonophylla</i> tall open shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubland over <i>Aristida contorta</i>, *<i>Cenchrus ciliaris</i> and <i>Cymbopogon ambiguus</i> very open tussock grassland.</p>
	Size	Boulders (>61cm)	
	Outcropping	Extensive outcropping	
Soil	Type	Sandy Loam	
	Colour	Brown	

Site	Name	H-06	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Outcropping/ stony rise	
	Landform	Granite outcrops/ domes	
Habitat Features	Slope	Moderately inclined (21-45°)	
	Aspect	West	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	None Discernible	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Scarce	
	Leaf Litter	Scarce	
Rocks	Type	Granite	Vegetation description
	Size	Boulders (>61cm)	
	Outcropping	Extensive outcropping	
Soil	Type	Sandy Clay Loam	<i>Acacia tetragonophylla</i> tall open shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubland over <i>Aristida contorta</i> , * <i>Cenchrus ciliaris</i> and <i>Cymbopogon ambiguus</i> very open tussock grassland.
	Colour	Brown	




Site	Name	H-07	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Stony plain	
	Landform	Stony plain	
Habitat Features	Slope	Flat (0°)	
	Aspect	N/A	
	Woody Debris	None	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Excellent	
	Disturbance Type	None Discernible	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Evenly spread	
	Leaf Litter	Scarce	
Rocks	Type	Quartz	
	Size	Pebbles (5-10cm)	
	Outcropping	Limited outcropping	
Soil	Type	Sandy Clay Loam	<i>Eremophila fraseri</i> subsp. <i>Fraseri</i> scattered tall shrubs over <i>Eremophila reticulata</i> and <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubs over <i>Aristida contorta</i> open tussock grassland.
	Colour	Red/brown	




Site	Name	H-08	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Rocky ridge and outcropping	
	Landform	Breakaway	
Habitat Features	Slope	Moderately inclined (21-45°)	
	Aspect	South-east	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Scarce	
	Leaf Litter	None discernible	
Rocks	Type	Quartz	
	Size	Pebbles (5-10cm)	
	Outcropping	Moderate outcropping	
Soil	Type	Sandy Clay Loam	
	Colour	Red/brown	




Site	Name	H-09	<p style="text-align: center;">Site Photograph</p> 
	Habitat Type	Low hills	
	Landform	Undulating low hills	
Habitat Features	Slope	Low (1-20°)	
	Aspect	South	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	Rare	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Few small patches	
	Leaf Litter	Scarce	
Rocks	Type	Quartz	
	Size	Pebbles (5-10cm)	
	Outcropping	Limited outcropping	
Soil	Type	Sandy Clay Loam	<i>Hakea preissii</i> and <i>Acacia cuspidifolia</i> scattered tall shrubs over <i>Acacia synchronicia</i> , <i>Eremophila cuneifolia</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> open shrubland over <i>Sclerolaena cuneata</i> and <i>Sclerolaena densiflora</i> scattered herbs.
	Colour	Red/brown	




Site	Name	H-10	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Drainage line	
	Landform	Major drainage line	
Habitat Features	Slope	Low (1-20°)	
	Aspect	West	
	Woody Debris	Very common	
	Tree Hollows (>50 cm)	Very common	
Condition	Condition	Very Good	
	Disturbance Type	Weed invasion, Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Few large patches	
	Soil	Many large patches	
	Leaf Litter	Many large patches	
Rocks	Type	Mixed granite and quartz	
	Size	Pebbles (5-10cm)	
	Outcropping	Minor outcropping	
Soil	Type	Sand	<div style="text-align: center;">Vegetation description</div> <p><i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i> and <i>Acacia citrinoviridis</i> woodland over <i>Cyperus vaginatus</i> very open sedgeland over *<i>Cenchrus ciliaris</i> open tussock grassland.</p>
	Colour	Brown	




Site	Name	H-11	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Alluvial plain/flood plain	
	Landform	Drainage area floodplain	
Habitat Features	Slope	Flat (0°)	
	Aspect	N/A	
	Woody Debris	Moderate	
Condition	Tree Hollows (>50 cm)	Rare	
	Condition	Very Good	
	Disturbance Type	Cattle grazing, Road/Access tracks	
Ground Cover	Fire Age	No Evidence	
	Rock	None discernible	
	Soil	Few small patches	
Rocks	Leaf Litter	Few small patches	
	Type	None discernible	
	Size	Negligible	
Soil	Outcropping	None	<div style="text-align: center;">Vegetation description</div> <p><i>Acacia cuspidifolia</i> and tall open shrubland over <i>Rhagodia eremaea</i> scattered shrubs over <i>Frankenia setosa</i> low open shrubland.</p>
	Colour	Red/brown	




Site	Name	H-12	<div style="text-align: center;">Site Photograph</div> 	
	Habitat Type	Drainage line		
	Landform	Minor drainage line		
Habitat Features	Slope	Low (1-20°)		
	Aspect	South-west		
	Woody Debris	Moderate		
	Tree Hollows (>50 cm)	Rare		
Condition	Condition	Very Good		
	Disturbance Type	Weed invasion, Mining exploration		
	Fire Age	No Evidence		
Ground Cover	Rock	Evenly spread		
	Soil	Many large patches		
	Leaf Litter	Scarce		
Rocks	Type	Quartz		Vegetation description
	Size	Small Rocks (11-20cm)		
	Outcropping	None		
Soil	Type	Sandy Loam	<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> tall open shrubland over <i>Rhagodia eremaea</i> , <i>Acacia synchronica</i> and <i>Senna artemisioides</i> subsp. <i>helmsii</i> shrubland over * <i>Cenchrus ciliaris</i> scattered tussock grasses.	
	Colour	Red/brown		




Site	Name	H-13	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Stony plain	
	Landform	Stony plain	
Habitat Features	Slope	Low (1-20°)	
	Aspect	North	
	Woody Debris	None	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Evenly spread	
	Leaf Litter	Scarce	
Rocks	Type	Quartz	
	Size	Pebbles (5-10cm)	
	Outcropping	Minor outcropping	
Soil	Type	Sandy Clay Loam	<i>Eremophila fraseri</i> subsp. <i>fraseri</i> scattered tall shrubs over <i>Eremophila reticulata</i> and <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubs over <i>Aristida contorta</i> open tussock grassland.
	Colour	Red/brown	




Site	Name	H-14	<div style="text-align: center; background-color: black; color: white; padding: 5px;">Site Photograph</div> 
	Habitat Type	Sandy Shrubland	
	Landform	Sand plain	
Habitat Features	Slope	Flat (0°)	
	Aspect	N/A	
	Woody Debris	Moderate	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing, Weed invasion	
	Fire Age	No Evidence	
Ground Cover	Rock	None discernible	
	Soil	Evenly spread	
	Leaf Litter	Few small patches	
Rocks	Type	None discernible	
	Size	Negligible	
	Outcropping	None	
Soil	Type	Sandy Clay Loam	<div style="text-align: center; background-color: black; color: white; padding: 5px;">Vegetation description</div> <p><i>Acacia curryana</i> and <i>Acacia kempiana</i> tall open shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> open shrubland over <i>Aristida holathera</i> var. <i>holathera</i>, <i>Aristida contorta</i> and *<i>Cenchrus ciliaris</i> open tussock grassland.</p>
	Colour	Red/orange	




Site	Name	H-15	<div style="text-align: center; background-color: black; color: white; padding: 2px;">Site Photograph</div> 	
	Habitat Type	Stony plain		
	Landform	Stony plain		
Habitat Features	Slope	Flat (0°)		
	Aspect	N/A		
	Woody Debris	Rare		
	Tree Hollows (>50 cm)	None		
Condition	Condition	Very Good		
	Disturbance Type	Mining exploration, Cattle grazing		
	Fire Age	Recent (0-2yrs)		
Ground Cover	Rock	Evenly spread		
	Soil	Evenly spread		
	Leaf Litter	Scarce		
Rocks	Type	Quartz		Vegetation description
	Size	Pebbles (5-10cm)		
	Outcropping	None		
Soil	Type	Sandy Clay	<i>Acacia xiphophylla</i> over <i>Acacia synchronicia</i> , <i>Senna</i> sp. <i>meekatharra</i> (E. Bailey 1-26) and <i>Eremophila cuneifolia</i> open shrubland over <i>Sclerolaena densiflora</i> scattered herbs.	
	Colour	Brown		




Site	Name	H-16	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Low hills	
	Landform	Undulating low hills	
Habitat Features	Slope	Low (1-20°)	
	Aspect	South	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Excellent	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Scarce	
	Leaf Litter	Scarce	
Rocks	Type	Granite	
	Size	Pebbles (5-10cm)	
	Outcropping	Moderate outcropping	
Soil	Type	Sandy Clay Loam	<i>Acacia tetragonophylla</i> tall open shrubland over <i>Senna glutinosa</i> subsp. <i>luerssenii</i> and <i>Eremophila cuneifolia</i> open shrubland over <i>Aristida contorta</i> open tussock grassland.
	Colour	Red/brown	




Site	Name	H-17	<p style="text-align: center;">Site Photograph</p> 
	Habitat Type	Outcropping/stony rise	
	Landform	Granite outcrops domes	
Habitat Features	Slope	Moderately inclined (21-45°)	
	Aspect	N/A	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing, Weed invasion	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Few small patches	
	Leaf Litter	Scarce	
Rocks	Type	Granite	
	Size	Boulders (>61cm)	
	Outcropping	Extensive outcropping	
Soil	Type	Sandy Loam	
	Colour	Brown	




Site	Name	H-18	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Mulga woodland	
	Landform	Sandy stony plain	
Habitat Features	Slope	Flat (0°)	
	Aspect	N/A	
	Woody Debris	Moderate	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Scarce	
	Soil	Few small patches	
	Leaf Litter	Few small patches	
Rocks	Type	Quartz	
	Size	Pebbles (5-10cm)	
	Outcropping	None	
Soil	Type	Sandy Clay Loam	<div style="text-align: center;">Vegetation description</div> <p><i>Acacia incurvaneura</i> and <i>Acacia kempeana</i> low woodland over <i>Acacia tetragonophylla</i>, <i>Senna artemisioides</i> subsp. <i>helmsii</i> and <i>Ptilotus obovatus</i> var. <i>obovatus</i> open shrubland over <i>Digitaria brownii</i> and <i>Aristida contorta</i> open tussock grassland.</p>
	Colour	Red/brown	




Site	Name	H-19	<div style="text-align: center;">Site Photograph</div> 	
	Habitat Type	Rocky foothills		
	Landform	Hillslope		
Habitat Features	Slope	Low (1-20°)		
	Aspect	East		
	Woody Debris	Rare		
Tree Hollows (>50 cm)	None			
Condition	Condition	Very Good		
	Disturbance Type	Cattle grazing, Road/Access tracks		
	Fire Age	No Evidence		
Ground Cover	Rock	Evenly spread		
	Soil	Few small patches		
	Leaf Litter	Scarce		
Rocks	Type	Quartz		Vegetation description
	Size	Pebbles (5-10cm)		
	Outcropping	Limited outcropping		
Soil	Type	Silt Loam	<i>Acacia xiphophylla</i> and <i>Acacia cuspidifolia</i> tall open shrubland over <i>Senna</i> sp. Meekatharra (E. Bailey 1-26) and <i>Eremophila cuneifolia</i> scattered shrubs over <i>Sclerolaena densiflora</i> and <i>Sclerolaena cuneata</i> very open herbland.	
	Colour	Red/brown		




Site	Name	H-20	<div style="text-align: center; background-color: black; color: white; padding: 5px;">Site Photograph</div> 
	Habitat Type	Alluvial Plain	
	Landform	Drainage area floodplain	
Habitat Features	Slope	Flat (0°)	
	Aspect	N/A	
	Woody Debris	Moderate	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Degraded	
	Disturbance Type	Cattle grazing, Road/Access tracks, Weed invasion	
	Fire Age	No Evidence	
Ground Cover	Rock	None discernible	
	Soil	Evenly spread	
	Leaf Litter	Few small patches	
Rocks	Type	None discernible	Vegetation description
	Size	Negligible	
	Outcropping	None	
Soil	Type	Sandy Loam	<p><i>Acacia cuspidifolia</i> and tall open shrubland over <i>Rhagodia eremaea</i> scattered shrubs over <i>Frankenia setosa</i> low open shrubland.</p>
	Colour	Red/brown	




Site	Name	H-21	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Granite outcrops on Stony Plain	
	Landform	Stony plain	
Habitat Features	Slope	Low (1-20°)	
	Aspect	North-west	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Many small patches	
	Soil	Many large patches	
	Leaf Litter	Few small patches	
Rocks	Type	Granite & Quartz	Vegetation description
	Size	Pebbles (5-10cm)	
	Outcropping	Moderate outcropping	
Soil	Type	Sandy Clay Loam	<i>Acacia curryana</i> , <i>Eremophila exilifolia</i> and <i>Senna artemisioides</i> subsp. <i>helmsii</i> open shrubland over <i>Aristida contorta</i> very open tussock grassland.
	Colour	Red/brown	




Site	Name	H-22	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Drainage line	
	Landform	Medium drainage line	
Habitat Features	Slope	Low (1-20°)	
	Aspect	West	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	Rare	
Condition	Condition	Good	
	Disturbance Type	Cattle grazing, Weed invasion	
	Fire Age	No Evidence	
Ground Cover	Rock	None discernible	
	Soil	Many large patches	
	Leaf Litter	Many small patches	
Rocks	Type	None discernible	Vegetation description
	Size	Negligible	
	Outcropping	None	
Soil	Type	Sandy Clay Loam	<i>Acacia kempeana</i> and <i>Acacia fusca</i> tall shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubs over <i>Aristida contorta</i> , <i>Eriachne aristidea</i> and * <i>Cenchrus ciliaris</i> open tussock grassland.
	Colour	Red/brown	




Site	Name	H-23	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Drainage line	
	Landform	Minor drainage line	
Habitat Features	Slope	Flat (0°)	
	Aspect	N/A	
	Woody Debris	Moderate	
	Tree Hollows (>50 cm)	Rare	
Condition	Condition	Very Good	
	Disturbance Type	Weed invasion, Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	None discernible	
	Soil	Evenly spread	
	Leaf Litter	Many small patches	
Rocks	Type	None discernible	Vegetation description
	Size	Negligible	
	Outcropping	None	
Soil	Type	Sandy Loam	<i>Acacia kempeana</i> and <i>Acacia fusca</i> tall shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubs over <i>Aristida contorta</i> , <i>Eriachne aristidea</i> and * <i>Cenchrus ciliaris</i> open tussock grassland.
	Colour	Red/brown	




Site	Name	H-24	<div style="text-align: center;">Site Photograph</div> 	
	Habitat Type	Outcropping/stony rise		
	Landform	Undulating low hills		
Habitat Features	Slope	Moderately inclined (21-45°)		
	Aspect	North		
	Woody Debris	Rare		
	Tree Hollows (>50 cm)	None		
Condition	Condition	Excellent		
	Disturbance Type	Cattle grazing		
	Fire Age	No Evidence		
Ground Cover	Rock	Evenly spread		
	Soil	Scarce		
	Leaf Litter	None discernible		
Rocks	Type	Quartz		Vegetation description
	Size	Pebbles (5-10cm)		
	Outcropping	Limited outcropping		
Soil	Type	Sandy Clay Loam	<i>Hakea preissii</i> and <i>Acacia cuspidifolia</i> scattered tall shrubs over <i>Acacia synchronicia</i> , <i>Eremophila cuneifolia</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> open shrubland over <i>Sclerolaena cuneata</i> and <i>Sclerolaena densiflora</i> scattered herbs.	
	Colour	Red/brown		




Site	Name	H-25	<div style="text-align: center;">Site Photograph</div> 	
	Habitat Type	Drainage line		
	Landform	Major drainage line		
Habitat Features	Slope	Low (1-20°)		
	Aspect	South-west		
	Woody Debris	Moderate		
	Tree Hollows (>50 cm)	Common		
Condition	Condition	Good		
	Disturbance Type	Cattle grazing, Weed invasion		
	Fire Age	No Evidence		
Ground Cover	Rock	Few small patches		
	Soil	Many large patches		
	Leaf Litter	Many small patches		
Rocks	Type	Quartz		<div style="text-align: center;">Vegetation description</div> <p><i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i> and <i>Acacia citrinoviridis</i> woodland over <i>Cyperus vaginatus</i> very open sedgeland over *<i>Cenchrus ciliaris</i> open tussock grassland.</p>
	Size	Gravel (1-4cm)		
	Outcropping	None		
Soil	Type	Sand		
	Colour	Red/brown		




Site	Name	H-26	<div style="text-align: center;">Site Photograph</div> 	
	Habitat Type	Outcropping/stony rise		
	Landform	Granite outcrop		
Habitat Features	Slope	Moderately inclined (21-45°)		
	Aspect	North-west		
	Woody Debris	Rare		
	Tree Hollows (>50 cm)	None		
Condition	Condition	Excellent		
	Disturbance Type	Cattle grazing, Weed invasion		
	Fire Age	No Evidence		
Ground Cover	Rock	Evenly spread		
	Soil	Evenly spread		
	Leaf Litter	Scarce		
Rocks	Type	Granite		Vegetation description
	Size	Small Rocks (11-20cm)		
	Outcropping	Major outcropping		
Soil	Type	Sandy Clay Loam	<i>Acacia curryana</i> , <i>Eremophila exilifolia</i> and <i>Senna artemisioides</i> subsp. <i>helmsii</i> open shrubland over <i>Aristida contorta</i> very open tussock grassland.	
	Colour	Red/brown		




Site	Name	H-27	<div style="text-align: center;">Site Photograph</div> 	
	Habitat Type	Outcropping/stony rise		
	Landform	Undulating low hills		
Habitat Features	Slope	Low (1-20°)		
	Aspect	South		
	Woody Debris	None		
	Tree Hollows (>50 cm)	None		
Condition	Condition	Very Good		
	Disturbance Type	Mining exploration, Cattle grazing		
	Fire Age	No Evidence		
Ground Cover	Rock	Evenly spread		
	Soil	Evenly spread		
	Leaf Litter	Scarce		
Rocks	Type	Granite		Vegetation description
	Size	Small Rocks (11-20cm)		
	Outcropping	Moderate outcropping		
Soil	Type	Sandy Clay Loam	<i>Acacia curryana</i> , <i>Eremophila exilifolia</i> and <i>Senna artemisioides</i> subsp. <i>helmsii</i> open shrubland over <i>Aristida contorta</i> very open tussock grassland.	
	Colour	Red/brown		




Site	Name	H-28	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Outcropping/stony rise	
	Landform	Hillslope	
Habitat Features	Slope	Moderately inclined (21-45°)	
	Aspect	North-east	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Mining exploration, Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Evenly spread	
	Leaf Litter	Scarce	
Rocks	Type	Granite	
	Size	Small Rocks (11-20cm)	
	Outcropping	Minor outcropping	
Soil	Type	Sandy Loam	<div style="text-align: center;">Vegetation description</div> <p><i>Acacia tetragonophylla</i> tall open shrubland over <i>Senna glutinosa</i> subsp. <i>luerssenii</i> and <i>Eremophila cuneifolia</i> open shrubland over <i>Aristida contorta</i> open tussock grassland.</p>
	Colour	Red/brown	




Site	Name	H-29	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Stony plain	
	Landform	Stony plain	
Habitat Features	Slope	Low (1-20°)	
	Aspect	South-east	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	Rare	
Condition	Condition	Very Good	
	Disturbance Type	Road/Access tracks	
	Fire Age	Very Old (10+ yrs.)	
Ground Cover	Rock	Evenly spread	
	Soil	Few small patches	
	Leaf Litter	Few small patches	
Rocks	Type	Granite	
	Size	Pebbles (5-10cm)	
	Outcropping	None	
Soil	Type	Sandy Clay Loam	<i>Acacia xiphophylla</i> over <i>Acacia synchronica</i> , <i>Senna</i> sp. <i>meekatharra</i> (E. Bailey 1-26) and <i>Eremophila cuneifolia</i> open shrubland over <i>Sclerolaena densiflora</i> scattered herbs.
	Colour	Red/brown	




Site	Name	H-30	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Stony plain	
	Landform	Stony plain	
Habitat Features	Slope	Low (1-20°)	
	Aspect	South-west	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Evenly spread	
	Leaf Litter	Few small patches	
Rocks	Type	Quartz	
	Size	Gravel (1-4cm)	
	Outcropping	None	
Soil	Type	Sandy Clay Loam	<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i> open shrubland over <i>Aristida contorta</i> open tussock grassland.
	Colour	Red/brown	




Site	Name	H-31	<div style="text-align: center;">Site Photograph</div> 	
	Habitat Type	Drainage line		
	Landform	Minor drainage line		
Habitat Features	Slope	Low (1-20°)		
	Aspect	North-east		
	Woody Debris	Rare		
	Tree Hollows (>50 cm)	Moderate		
Condition	Condition	Good		
	Disturbance Type	Cattle grazing, Weed invasion		
	Fire Age	No Evidence		
Ground Cover	Rock	Few small patches		
	Soil	Many large patches		
	Leaf Litter	Many small patches		
Rocks	Type	Quartz		Vegetation description
	Size	Gravel (1-4cm)		
	Outcropping	None		
Soil	Type	Sand	<i>Acacia kempeana</i> and <i>Acacia fuscanaura</i> tall shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubs over <i>Aristida contorta</i> , <i>Eriachne aristidea</i> and <i>Cenchrus ciliaris</i> open tussock grassland.	
	Colour	Red/brown		




Site	Name	H-32	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Stony plain	
	Landform	Stony plain	
Habitat Features	Slope	Low (1-20°)	
	Aspect	South	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Evenly spread	
	Leaf Litter	Scarce	
Rocks	Type	Granite	
	Size	Small Rocks (11-20cm)	
	Outcropping	None	
Soil	Type	Sandy Clay Loam	<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i> open shrubland over <i>Aristida contorta</i> open tussock grassland.
	Colour	Red/brown	




Site	Name	H-33	<div style="text-align: center; background-color: black; color: white; padding: 5px;">Site Photograph</div> 
	Habitat Type	Stony plain	
	Landform	Stony plain	
Habitat Features	Slope	Low (1-20°)	
	Aspect	N/A	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing, Road/Access tracks	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Evenly spread	
	Leaf Litter	Scarce	
Rocks	Type	Quartz	Vegetation description
	Size	Pebbles (5-10cm)	
	Outcropping	Moderate outcropping	
Soil	Type	Sandy Clay Loam	<i>Acacia xiphophylla</i> over <i>Acacia synchronicia</i> , <i>Senna</i> sp. <i>meekatharra</i> (E. Bailey 1-26) and <i>Eremophila cuneifolia</i> open shrubland over <i>Sclerolaena densiflora</i> scattered herbs.
	Colour	Red/brown	




Site	Name	H-Site A	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Drainage line	
	Landform	Major drainage line	
Habitat Features	Slope	Low (1-20°)	
	Aspect	South-east	
	Woody Debris	Common	
	Tree Hollows (>50 cm)	Moderate	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing, Weed invasion	
	Fire Age	No Evidence	
Ground Cover	Rock	None discernible	
	Soil	Many large patches	
	Leaf Litter	Many small patches	
Rocks	Type	None discernible	
	Size	Negligible	
	Outcropping	None	
Soil	Type	Loamy Sand	<div style="text-align: center;">Vegetation description</div> <p><i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i> and <i>Acacia citrinoviridis</i> woodland over <i>Cyperus vaginatus</i> very open sedgeland over *<i>Cenchrus ciliaris</i> open tussock grassland.</p>
	Colour	Orange	




Site	Name	H-Site B	<div style="text-align: center; background-color: black; color: white; padding: 5px;">Site Photograph</div> 	
	Habitat Type	Stony plain		
	Landform	Stony plain		
Habitat Features	Slope	Low (1-20°)		
	Aspect	N/A		
	Woody Debris	Rare		
	Tree Hollows (>50 cm)	None		
Condition	Condition	Very Good		
	Disturbance Type	Mining exploration, Road/Access tracks		
	Fire Age	No Evidence		
Ground Cover	Rock	Evenly spread		
	Soil	Evenly spread		
	Leaf Litter	Scarce		
Rocks	Type	Quartz		Vegetation description
	Size	Pebbles (5-10cm)		
	Outcropping	None		
Soil	Type	Sandy Clay Loam	<i>Acacia cuspidifolia</i> tall open shrubland over <i>Atriplex codonocarpa</i> and <i>Sclerolaena densiflora</i> scattered chenopods.	
	Colour	Brown		




Site	Name	H-Site C	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Rocky foothills	
	Landform	Undulating low hills	
Habitat Features	Slope	Low (1-20°)	
	Aspect	South-east	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	Rare	
Condition	Condition	Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Many large patches	
	Soil	Many small patches	
	Leaf Litter	Few small patches	
Rocks	Type	Calcrete	
	Size	Pebbles (5-10cm)	
	Outcropping	Limited outcropping	
Soil	Type	Sandy Clay Loam	<div style="text-align: center;">Vegetation description</div> <p><i>Acacia aptaneura</i> tall open shrubland over <i>Senna glutinosa</i> subsp. <i>luerssenii</i> scattered shrubs over <i>Enneapogon caerulescens</i> very open tussock grassland.</p>
	Colour	Grey	




Site	Name	H-Site D	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Alluvial Plain	
	Landform	Drainage area floodplain	
Habitat Features	Slope	Flat (0°)	
	Aspect	N/A	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Few small patches	
	Soil	Evenly spread	
	Leaf Litter	Scarce	
Rocks	Type	Quartz	Vegetation description
	Size	Pebbles (5-10cm)	
	Outcropping	None	
Soil	Type	Sandy Clay	<i>Acacia cuspidifolia</i> and tall open shrubland over <i>Rhagodia eremaea</i> scattered shrubs over <i>Frankenia setosa</i> low open shrubland.
	Colour	Orange	




Site	Name	H-Site E	<div style="text-align: center;">Site Photograph</div> 	
	Habitat Type	Drainage line		
	Landform	Minor drainage line		
Habitat Features	Slope	Low (1-20°)		
	Aspect	N/A		
	Woody Debris	Common		
	Tree Hollows (>50 cm)	Moderate		
Condition	Condition	Very Good		
	Disturbance Type	Cattle grazing, Road/Access tracks, Weed invasion		
	Fire Age	No Evidence		
Ground Cover	Rock	Many small patches		
	Soil	Evenly spread		
	Leaf Litter	Many small patches		
Rocks	Type	Granite		Vegetation description
	Size	Pebbles (5-10cm)		
	Outcropping	Negligible		
Soil	Type	Sandy Loam		<i>Acacia kempeana</i> and <i>Acacia fuscaneura</i> tall shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubs over <i>Aristida contorta</i> , <i>Eriachne aristidea</i> and * <i>Cenchrus ciliaris</i> open tussock grassland.
	Colour	Brown		




Site	Name	H-Site F	<p style="text-align: center;">Site Photograph</p> 
	Habitat Type	Low Hills	
	Landform	Undulating low hills	
Habitat Features	Slope	Low (1-20°)	
	Aspect	East	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	Very Old (10+ yrs.)	
Ground Cover	Rock	Evenly spread	
	Soil	Many small patches	
	Leaf Litter	Few small patches	
Rocks	Type	Quartz	
	Size	Pebbles (5-10cm)	
	Outcropping	Limited outcropping	
Soil	Type	Sandy Clay Loam	<p style="text-align: center;">Vegetation description</p> <p><i>Hakea preissii</i> and <i>Acacia cuspidifolia</i> scattered tall shrubs over <i>Acacia synchronicia</i>, <i>Eremophila cuneifolia</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> open shrubland over <i>Sclerolaena cuneata</i> and <i>Sclerolaena densiflora</i> scattered herbs.</p>
	Colour	Orange	



Site	Name	H-Site G	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Rocky ridge and outcropping	
	Landform	Granite outcrops domes	
Habitat Features	Slope	Moderately inclined (21-45°)	
	Aspect	South-east	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	None	
Condition	Condition	Very Good	
	Disturbance Type	None Discernible	
	Fire Age	No Evidence	
Ground Cover	Rock	Many large patches	
	Soil	Many small patches	
	Leaf Litter	Few small patches	
Rocks	Type	Granite	Vegetation description
	Size	Small Rocks (11-20cm)	
	Outcropping	Extensive outcropping	
Soil	Type	Sandy Loam	<i>Acacia tetragonophylla</i> tall open shrubland over <i>Senna artemisioides</i> subsp. <i>helmsii</i> scattered shrubland over <i>Aristida contorta</i> , * <i>Cenchrus ciliaris</i> and <i>Cymbopogon ambiguus</i> very open tussock grassland.
	Colour	Orange	



Site	Name	H-Site H	<div style="text-align: center;">Site Photograph</div> 
	Habitat Type	Stony plain	
	Landform	Stony plain	
Habitat Features	Slope	Low (1-20°)	
	Aspect	N/A	
	Woody Debris	Rare	
	Tree Hollows (>50 cm)	Rare	
Condition	Condition	Very Good	
	Disturbance Type	Cattle grazing	
	Fire Age	No Evidence	
Ground Cover	Rock	Evenly spread	
	Soil	Evenly spread	
	Leaf Litter	Scarce	
Rocks	Type	Quartz	
	Size	Pebbles (5-10cm)	
	Outcropping	Limited outcropping	
Soil	Type	Sandy Loam	<i>Senna artemisioides</i> subsp. <i>helmsii</i> , <i>Eremophila fraseri</i> subsp. <i>fraseri</i> and <i>Acacia tetragonophylla</i> open shrubland, over <i>Corchorus crozophorifolius</i> and <i>Indigofera decipiens</i> over <i>Aristida contorta</i> , * <i>Cenchrus ciliaris</i> and <i>Eriachne aristidea</i> tussock grassland.
	Colour	Red/brown	



Appendix F MNES Assessment Criteria for Critical and Supporting Habitat

Table F 1: MNES assessment criteria applied to species which were assessed in the Likelihood of Occurrence Table in Section 5.4 and Table C-1.

MNES Species: EPBC Listing	Critical habitat ¹	Supporting habitat ²	Important population ³
Yinnietharra Rock-dragon (<i>Ctenophorus yinnietharra</i>) Vu	<p>Critical and supporting habitat is not defined for the Yinnietharra Rock Dragon and additional research is required.</p> <p>General habitat: The species occurs in tall open shrublands, inhabiting granite outcrops which are often less than 1 m² in area (DEWHA 2011) Yinnietharra Rock-dragon is a habitat specialist, inhabiting granite outcrops composed of Archaean (>2.5 billion years ago) gneissic biotite granites and granodiorite. The Yinnietharra Rock-dragon has been found beneath exfoliating granite, in burrows under granite boulders, and once in a hollow Acacia log (Storr 1981).</p> <p>Additional Research to inform habitat requirements:</p> <p>A Species Distribution Model To better understand the distribution of the species, a species distribution model was developed and informed by reliable records of the species as a component of the Targeted Yinnietharra Rock-dragon Survey (Appendix G)</p> <p>Based on the findings of the Targeted Yinnietharra Rock-dragon Survey (Appendix G) and consultation with specialist herpetologist Steve Wilson, it is thought that there are four key characteristics that a habitat must have to be considered suitable for the species to occur:</p> <ol style="list-style-type: none"> 1. Substrate – Primarily gravel (1-4 cm) but may be pebble sized (5-10 cm) quartz and granite on sandy clay soils. Rock cover is sparse compared to dense quartz plain habitat that commonly occurs in the surrounding region. 2. Presence of granite outcrops – Species requires low weathered granite outcrops. 3. Size of granite outcrops – Majority (>90%) of outcrops present are only 0.5 to 1 m in height and less than 2 m in length. 4. Density of granite outcrops – Outcrops are sparsely distributed, often separated by distances of 50 – 100 m. 		An 'Important population' as defined by DoE (2013) ³ is a population that is necessary for a species' long-term survival and recovery.
Night Parrot (<i>Pezoporus occidentalis</i>): En	<p>Critical habitat consists of:</p> <ul style="list-style-type: none"> • Breeding and roosting habitat (Burbidge 2020; Murphy 2015; Murphy <i>et al.</i> 2017a; TSSC 2016) - Old growth (often >50 years unburnt) dense hummock-forming spinifex, thickets of lignum, or dense shrubby samphire that is surrounded by firebreaks created by patches of ironstone, rocky bars, salt lakes or samphire flats. • Foraging habitat (Burbidge 2020, Murphy 2015, Murphy <i>et al.</i> 2017a, TSSC 2016) -Paleo-drainage lines, ephemeral grasslands, herb-fields or samphire, gilgais, run-on areas, floodplains, or salt lake systems that support relatively high vegetative structure, seed productivity and floristic diversity that are within 10 km of breeding and roosting habitats. Gastrolith sources to aid food digestion. • Water Sources (Burbidge 2020, Murphy 2015, Murphy <i>et al.</i> 2017a, TSSC 2016)- Permanent/ephemeral water sources or areas of high soil moisture within close proximity or within 50 km of known breeding/roosting habitats. 	<p>Supporting habitat consists of:</p> <ul style="list-style-type: none"> • Flyways (Burbidge 2020) - Varying habitats from river and creek drainage systems, surrounding dune-fields, forb-grasslands on mainly ironstone gravel-covered plains, low ranges and low dissected tablelands supporting sparse shrublands, undulating stony clay plains supporting Mitchell Grass and Gidgee. • Other Foraging habitats (Hamilton <i>et al.</i> 2017; Horton <i>et al.</i> 2021; Murphy <i>et al.</i> 2017a; TSSC 2016): <ul style="list-style-type: none"> ○ Hummock grasslands (unburnt) in stony or sandplain environments. Spinifex shrublands in stony or sandy areas. ○ Paleo-drainage features in a landscape mosaic with <i>Triodia</i> spp., <i>Astrebla</i> spp. and <i>Acacia aneura</i> (Mulga) woodland. ○ Scattered trees and shrubs, Mulga (<i>Acacia aneura</i>) woodlands, and in areas dominated by <i>Triodia longiceps</i>, <i>Scerolaena</i> spp. <i>Maireana</i> spp. <i>Ptilotus</i> spp. with some <i>Acacia cambagei</i>. ○ Lateritic rises, limestone deposits, or deep reticulated sands. 	All considered important population that are necessary for the species' long-term survival and recovery.
Grey Falcon (<i>Falco hypoleucos</i>): Vu	<p>Critical breeding and roosting habitats (Schoenjahn 2013; 2018; TSSC 2020) include:</p> <ul style="list-style-type: none"> • Single or stands of tall trees, particularly <i>Eucalyptus</i> but also other tree species, including but not restricted to River Red Gum (<i>Eucalyptus camaldulensis</i>), Coolibah (<i>Eucalyptus coolabah</i>), and Red Mulga/Miniritchie (<i>Acacia cyperophylla</i>). • Major drainage lines. • Artificial nesting structures such as powerline transmission towers, communications towers, and other tall infrastructure (maintain where possible). 	<p>Supporting habitat consists of the following (Garnett <i>et al.</i> 2011b; Janse <i>et al.</i> 2015; Ley and Tynan 2016; Schoenjahn 2013; 2018; Watson 2011):</p> <ul style="list-style-type: none"> • Foraging habitat types within the species range: <ul style="list-style-type: none"> ○ Timbered and un-timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. ○ Tussock grasslands. ○ Open woodlands. ○ Open treeless area. • Watercourses (TSSC 2020)- Semi-permanent and permanent water courses and water bodies that support suitable trees for nesting and foraging opportunities that support avian prey. 	An 'Important population' as defined by DoE (2013) ³ is a population that is necessary for a species' long-term survival and recovery.

MNES Species: EPBC Listing	Critical habitat ¹	Supporting habitat ²	Important population ³
Southern Whiteface	<p>Critical habitat comprises essential foraging habitat, roosting and nesting habitat critical to the survival of the species including:</p> <ul style="list-style-type: none"> Relatively undisturbed open woodlands and shrublands with an understory of grasses or shrubs, or both. Habitat with low tree densities and an herbaceous understory litter cover which provides essential foraging habitat. Living and dead trees with hollows and crevices which are essential for roosting and nesting. 	<p>Supporting habitat consists of habitat which supports a known population, located outside the areas defined as habitat critical to the survival of the species. This includes habitat utilised for foraging and dispersal within proximity to known records within the species normal range. Southern whiteface forage almost exclusively on the ground, favouring habitat with low tree densities and an herbaceous understorey litter cover. Birds mainly feed on insects, spiders, and seeds, largely gleaned from the bare ground or leaf litter ((Antos and Bennett 2006; Antos <i>et al.</i> 2008; Higgins and Peter 2002).</p>	<p>An 'Important population' as defined by DoE (2013)³ is a population that is necessary for a species' long-term survival and recovery.</p>
Australian Painted Snipe (<i>Rostratula australis</i>): En	<ul style="list-style-type: none"> The DCCEEW <i>Draft National Recovery Plan for the Australian Painted Snipe</i> states that as a guide, habitat critical to the survival of the Australian Painted Snipe can be considered to include: <ul style="list-style-type: none"> Any habitat where the species is known or likely to occur (especially with suitable breeding habitat) within the indicative distribution map (Figure 1 in the DCCEEW Draft National Recovery Plan for the Australian Painted Snipe, <i>Rostratula australis</i> (DotEE 2019b). Any location outside the above area that may be periodically occupied by Australian Painted Snipe when conditions are favourable. Due to relatively scarce records and unpredictable movements, very little is known about the specific habitat requirements of the Australian Painted Snipe. The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DotEE 2019b). Australian painted Snipe also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass or sometimes tea-tree (<i>Melaleuca</i>) (DotEE 2019b). The Australian Painted Snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (Marchant and Higgins 1993). Australian Painted Snipe breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and mixed heights of low vegetation. Nest records are all, or nearly all, from or near small islands in freshwater wetlands, with a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover (Rogers <i>et al.</i> 2005). 	<p>Supporting habitat for this species is not well defined:</p> <ul style="list-style-type: none"> Australian Painted Snipe generally remain in dense cover when feeding, although may forage over nearby mudflats and other open areas such as ploughed land or grassland (Marchant and Higgins 1993). The species may have quite specific foraging habitat requirements, but these are not well understood and further study is required (DotEE 2019b). Feeding behaviour is likely to be different in wetlands where Australian Painted Snipe are present for breeding compared to sites that may act as refuges or stop-over sites, e.g. sewage ponds, water storages. Behaviour is likely to change depending on the height and density of wetland vegetation. 	<p>Refer to important population definition for Migratory Shorebirds.</p>
Curlew Sandpiper (<i>Calidris ferruginea</i>) Mi: Cr	<p>Critical habitat consists of areas that are necessary for activities such as foraging, breeding, roosting, or dispersal¹:</p> <ul style="list-style-type: none"> General Habitat: In Australia, curlew sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters (Higgins and Davies 1996). Roosting habitat: Curlew sandpipers roost in open situations with damp substrate, especially on bare shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons 	<p>Supporting habitat consists of habitat to support a known population, located outside the areas defined as habitat critical to the survival; (foraging/ dispersal) within proximity to known records:</p> <ul style="list-style-type: none"> Curlew sandpipers usually forage in water, near the shore or on bare wet mud at the edge of wetlands. On wet mud they forage by pecking and probing (DCCEEW 2023a). They probe in shallow water, and jab at the edge of the water where a film of water remains on the sand. They glean from mud and less commonly from the surface of water, or in drier areas above the edge of the water. 	<p>Refer to important population definition for Migratory Shorebirds.</p>



MNES Species: EPBC Listing	Critical habitat ¹	Supporting habitat ²	Important population ³
	<p>and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh (Higgins & Davies, 1996). They have also been recorded roosting in mangroves in Inverloch, Victoria (Minton & Whitelaw, 2000).</p> <ul style="list-style-type: none"> • Breeding Habitat: This species does not breed in Australia. 		
Migratory Species: Mi	<p>Significant impact criteria for migratory bird species, requires an assessment of whether the Survey Area represents 'important habitat' for a migratory species and whether the records represent 'an ecologically significant proportion' of the 'population of a migratory species'.</p> <p>An 'important habitat' for the migratory species is defined by DoE (2013) as:</p> <ul style="list-style-type: none"> • habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or • habitat that is of critical importance to the species at particular life-cycle stages; and/or • habitat utilised by a migratory species which is at the limit of the species range; and/or • habitat within an area where the species is declining. 		<p>Important population includes records that comprise "an ecologically significant proportion" of the 'population, whereby:</p> <ul style="list-style-type: none"> • Population, in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia. • As defined by DoE (2013) an ecologically significant proportion of the population of migratory species varies with each species. When assessing an ecologically significant proportion the following factors should be considered; <ul style="list-style-type: none"> ○ population status; ○ genetic distinctiveness; and ○ species-specific behavioural patterns.
Migratory Shorebirds: Mi	<p>DEE (2017) defines internationally important and nationally important habitat using a similar approach to the international criteria under the Ramsar Convention on Wetlands. Under these criteria, the DEE (2017) considers wetland habitat to be considered internationally important if it regularly supports:</p> <ul style="list-style-type: none"> • 1% of the individuals in a population of one species or subspecies of waterbird (Ramsar criteria 6); or • a total abundance of at least 20,000 waterbirds (Ramsar criteria 5). • The DEE (2017) defines 'important habitat'⁴ for migratory shorebirds if it meets the following criteria: • Is the shorebird area already identified as internationally important (i.e. identified as an internationally important wetland (RAMSAR)); and/or • Does the shorebird area support (defined differently depending on permanent or ephemeral habitat): <ul style="list-style-type: none"> ○ at least 0.1% of the flyway population of the species, as defined by Hansen <i>et al.</i> (2016); or ○ at least 2,000 migratory shorebirds; or ○ at least 15 shorebird species. 		<p>Significant impact criteria for migratory bird species requires an assessment of whether the Study Area represents an important population containing 'important habitat'⁴ for a migratory species and whether the records represent 'an ecologically significant proportion' of the 'population of a migratory species.</p> <p>As defined by DoE (2013) an ecologically significant proportion of the population of migratory species varies with each species. When assessing an ecologically significant proportion the following factors should be considered:</p> <ul style="list-style-type: none"> • populations status, • genetic distinctiveness and • species-specific behavioural patterns. <p>'Population', in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.</p>

¹Habitat Critical for the survival of a species: Habitat critical to the survival of a species or ecological community is defined by DoE (2013) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long-term evolutionary development; and/or
- for the reintroduction of populations or recovery of the species or ecological community.

²Supporting habitat:

- Habitat to support a known population, located outside the areas defined as habitat critical to the survival; (foraging/ dispersal) or as otherwise defined in guidance documents.

³Important Population: An important population is defined by DoE (2013) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: key source populations either for breeding or dispersal;

- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

⁴Important habitat for a migratory species is defined as:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species range, and/or
- habitat within an area where the species is declining.

Appendix G Targeted Yinnietharra Rock- dragon Survey Memo



Appendix H Acoustic Analysis Reports



H.1. Phase 1 Acoustic Analysis



H.2. Phase 2 Acoustic Analysis



Appendix I SRE Invertebrate Fauna Report



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