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FORTESCUE METALS GROUP LIMITED

BONNEY DOWNS:

TERRESTRIAL VERTEBRATE FAUNA SURVEY CONSOLIDATION

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EXECUTIVE SUMMARY

Fortescue Ltd (Fortescue) is proposing to develop a wind generation hub at Bonney Downs Station, located approximately 140 km north of Newman in the Pilbara region of Western Australia, along with an associated transmission line (PEC 8) to Fortescue's Cloudbreak and Christmas Creek mines. Fortescue commissioned Ecologia Environment (*ecologia*) to consolidate the results of detailed and targeted terrestrial vertebrate fauna surveys and the first year of a two year Bird and Bat Site Utilisation Survey (BBSUS) study undertaken within the Bonney Downs study area (hereafter referred to as the 'study area').

Fauna Habitat

Ten broad fauna habitat types were identified within the study area: Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways), Plain (stony/gibber), Plain (cracking clays), Woodland (open), Woodland (closed), Drainage Line/River/Creek (major), Drainage Line/River/Creek (minor), Hill/Ranges/Plateaux, Granite Outcrops (flat dome) and Gorges/Gullies. Although the extent of the Woodland (open) and Woodland (closed) habitats is restricted within the study area, these habitat types are not confined to the study area and is generally well represented at a local and regional level. Granite Outcrops are of restricted extent within the study area and broader region and may provide microhabitats for significant fauna at both a local and regional scale. All other habitat types identified within the study area are generally considered common and widespread in the Pilbara.

Fauna Assemblage

A total of 237 species have been recorded within the study area including 31 mammals (20 non-volant species and eleven bats), 82 reptiles, 118 birds, two fish and four amphibians. Three introduced species were recorded during the surveys including European cattle, cat and house mouse.

Significant Fauna

Nine significant fauna species were recorded within the study area, including:

- Northern quoll (*Dasyurus hallucatus*) – Endangered EPBC Act and BC Act.
- Grey falcon (*Falco hypoleucos*) – Vulnerable EPBC Act and BC Act.
- Pilbara leaf-nosed bat (*Rhinonicteris aurantia* [Pilbara form]) - Vulnerable EPBC Act and BC Act.
- Ghost bat (*Macroderma gigas*) - Vulnerable EPBC Act and BC Act.
- Pilbara olive python (*Liasis olivaceus barroni*) - Vulnerable EPBC Act and BC Act.
- Gane's blind snake (*Anilios ganei*) – Priority 1.
- Brush-tailed mulgara (*Dasycercus blythi)* – Priority 4.
- Western pebble mound mouse (*Pseudomys chapmani)* – Priority 4.
- Northern short-tailed mouse (*Leggadina lakedownensis)* – Priority 4.

The greater bilby (*Macrotis lagotis* [Vulnerable]) has historically been recorded within the study area; however, both records are associated with vague localities and unknown accuracy. No primary or secondary evidence of the species was recorded during the current surveys and limited suitable habitat occurs within the study area. Based on the general absence of suitable habitat, absence of evidence and questionable accuracy of the record locations, this species is considered unlikely to occur within the study area.

The grey falcon (*Falco hypoleucos* [VU]) was recorded on 10 occasions during the Bonney Downs North fauna surveys and BBSUS, with an additional record obtained during the Bonney Downs South surveys. A maximum of two individuals have been recorded at any given time, suggesting

that at least one pair of birds are regularly utilising habitat within the study area. The species may overfly and forage within all habitat types and Drainage Line/River/Creek (major) habitat within the study area may provide critical breeding and foraging habitat for the grey falcon.

The northern quoll (*Dasyurus hallucatus* [EN]) was recorded at 13 sites at Bonney Downs North, with spot pattern analysis identifying at least eight individuals. A total of nine northern quoll individuals (seven males, two females) were trapped across four systematic sites at Bonney Downs North. One additional individual was recorded on a motion camera trap deployed at Bonney Downs South, with utilisation of the southern half of the study area appearing to represent transient presence rather than permanent occupancy. A high-density population occurs within the northern half of the study area, with a low-density population recorded in the south. Critical habitat for the northern quoll occurs in the northern half of the study area, encompassing the Rocky Escarpment, Gorges/Gullies, Drainage Line/River/Creek and Hills/Ranges/Plateaux habitat types. Additionally, rocky habitats (Rocky Escarpments and Granite Outcrops) and Drainage Line/River/Creek (major and minor) habitat in the southern half of the study area may be utilised by the species during dispersal and foraging activities.

Echolocation calls belonging to the Pilbara leaf-nosed bat (*Rhinonicteris aurantia* (Pilbara form) [VU]) were recorded at 19 sites throughout the study area, with low activity rates recorded across the site. Utilisation of habitat within the study area appears to be restricted to foraging and transit during the dry season and very low activity was detected in the post-wet season. No suitable roosting habitat was recorded during the current surveys; however, rocky habitats within the study area may provide nocturnal refugia and foraging opportunities. No low-time calls indicative of a nearby roost site have been recorded to date.

The ghost bat (*Macroderma gigas* [VU]) was recorded at a single acoustic lure site (BDGB03) within the Bonney Downs North study area in March 2024. The species was not recorded at Bonney Downs South. The ghost bat has the potential to use all habitat types while foraging and Rocky Escarpments, Hills/Ranges/Plateaux and Gorges/Gullies within the study area may provide roosting habitat and nocturnal shelter. No suitable roost caves or secondary evidence of the species were recorded in rocky habitat types.

The Pilbara olive python (*Liasis olivaceus barroni* [VU]) was recorded on two occasions at Bonney Downs North, with a single individual observed during nocturnal spotlighting activities and a second individual captured in a cage trap. Both animals were recorded in the Drainage Line/River/Creek (major) habitat type. No Pilbara olive pythons were recorded during the Bonney Downs South surveys, a previous record of the species within this area was identified during the database assessment. Permanent and semi-permanent pools associated with Bonney Creek, Bonney Pools, the Nullagine River and the Coongan River provide suitable aquatic habitat for the Pilbara olive python.

A total of 12 mounds belonging to the western pebble-mound mouse (*Pseudomys chapmani* [P4]) were recorded across the study area in Plain (stony/gibber), Hills/Ranges/Plateaux and Rocky Escarpments habitat types. The brush-tailed mulgara (*Dasycercus blythi* [P4]) was recorded on a single occasion within the Plain (stony/gibber) habitat type which provides suitable substrates for burrowing. The Gane's blind snake (*Anilios ganei* [P1]) was recorded on a single occasion within the Plain (stony/gibber) habitat type at Bonney Downs North and was not recorded at Bonney Downs South. The short-tailed mouse was recorded on eight occasions within the Plain (cracking clay) and Drainage Line/River/Creek (minor) habitat types across the study area.

The long-tailed dunnart (*Sminthopsis longicaudata* [P4]) and peregrine falcon (*Falco peregrinus* [OS]) are considered highly likely to occur within the study area, despite neither species being recorded in the surveys.

Ten Migratory birds and two Threatened birds (common greenshank [EN/MI] and Australian painted snipe [EN]) were classified as moderately likely to occur within (or overfly) the study area and may temporarily utilise waterbodies within the survey area. Critical habitat required by these species does not occur within the study area.

Although the night parrot (*Pezoporus occidentalis* [CR/EN]) was not recorded during the current surveys, patches of long unburnt *Triodia longiceps* within the Plain (stony/gibber) habitat type represent potential roosting habitat for the species. DBCA fire mapping indicates that 15,706.37 ha (19.3%) of Plain (stony/gibber) habitat within the survey area has not been burnt within the past 25 years, with 5,645.39 ha (24.5%) of potential *Triodia longiceps* vegetation within the survey area appears to have not been burnt within the past 25 years. Many areas of vegetation identified as potentially encompassing long-unburnt *Triodia longiceps* were associated with major drainage lines and are considered unlikely to provide suitable roosting habitat for the night parrot due to the presence of large trees and shrubs.

Plain (cracking clays) habitat in the vicinity of long-unburnt *Triodia longiceps* patches may provide foraging habitat (seasonal grasses and herbs) for the night parrot (if present). Fresh water sources within the survey area may be utilised by the night parrot (if present), including agricultural dams and troughs, permanent and semi-permanent pools (including Bonnie Pools) and major drainage lines (during periods of seasonal inundation).

TABLE OF CONTENTS

TABLES

FIGURES

MAPS

APPENDICES

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Fortescue Limited (Fortescue) is investigating decarbonisation options to achieve carbon neutrality across existing and future operations by 2030. One of the sites being considered for renewable energy generation is the Bonney Downs Wind Generation Project, which will comprise a proposed wind generation hub, along with associated transmission lines (PEC 8) running from the project area to Fortescue's Cloudbreak and Christmas Creek mines.

Detailed and targeted terrestrial vertebrate fauna surveys were completed at Bonney Downs North (three-phase detailed and two-phase targeted survey) and Bonney Downs South (two-phase detailed and targeted survey). Following the completion of the surveys, Fortescue commissioned Ecologia Environment (*ecologia*) to consolidate the results of these assessments into a single report covering the entire Bonney Downs Wind Generation Project (hereafter referred to as the "study area"). The study area comprises approximately 102,802.56 ha and is located approximately 140 km north of Newman, in the Pilbara region of Western Australia (WA) (Map 1).

1.2 SURVEY OBJECTIVES

This report consolidates results from the Bonney Downs North Terrestrial Vertebrate Fauna Assessment (ecologia, 2024a) and Bonney Downs South Terrestrial Vertebrate Fauna Assessment (Spectrum Ecology, 2024). Additional results from the first year of Bird and Bat Site Utilisation Surveys (BBSUS) were incorporated as relevant, as these surveys overlap the current study area. Consolidation of terrestrial fauna and fauna habitat mapping data associated with these reports was also undertaken as part of the current consolidation report.

1.3 LEGISLATIVE AND REGULATORY FRAMEWORK

The survey was designed and undertaken to comply with the following statutory legislation and policies (definitions can be seen in Appendix A):

- *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act);
- *Biodiversity Conservation Act* 2016 (BC Act); and
- *Environmental Protection Act* 1986 (EP Act).

The assessments complied with all necessary Environmental Protection Authority (EPA), Commonwealth and client-specific guidelines, including but not limited to:

- Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020);
- Environmental Protection Authority (EPA) Environmental Factor Guideline: Terrestrial Fauna (EPA, 2016);
- Survey Guidelines for Australia's Threatened Mammals (DSEWPaC, 2011a), Bats (DSEWPaC, 2010), Birds (DEWHA, 2010a), Frogs (DEWHA, 2010b) and Reptiles (DSEWPaC, 2011b);
- Guidelines for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia (DBCA, 2017a);
- EPBC Act Referral Guideline for the Endangered Northern Quoll (Commonwealth of Australia 2016); and
- Interim Guideline for Preliminary Surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia (DBCA, 2017b).

119.3667°E
119.6°E
119.8333°E
120.0667°E
120.3°E
120.5333°E
21.1667°S
21.4°S
21.6333°S
21.8667°S
22.1°S
22.3333°S
MARBLE BAR
PIL01
PIL02
PIL02
PIL01

- Study area
- Ecologia - Vertebrate Fauna Assessment (2024) survey area
- Spectrum - Vertebrate Fauna Assessment (2024) survey area
- Ecologia - Bird and Bat Utilisation Assessment (2024) survey area

IBRA 7 subregion

- PIL01: Chichester
- PIL02: Fortescue
- State roads
- Towns

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 17 February 2025
Coordinate System: GCS GDA 1994

Map 1: Location of the study area.

Earthstar Geographics

0 7 10 20 40
Kilometers

2 REGIONAL AND BIOLOGICAL CONTEXT

A review of background environmental information for the study area was conducted, including, but not limited to, climate (Bureau of Meteorology, BOM), biogeography (IBRA 7) (DSEWPaC, 2012), soil-landscape systems (land systems) (DPIRD, 2016), the Surface Geology of Australia 1:1M spatial dataset (Geoscience Australia, 2012), the Atlas of Australian Soils (Northcote et al., 1960-1968), and pre-European native vegetation of Western Australia (Shepherd, Beeston, & Hopkins, 2002).

2.1 CLIMATE

The study area is located in the Pilbara region of Western Australia (WA) and experiences an arid-tropical climate with two distinct seasons: a hot summer from October to April and a mild winter from May to September. Temperatures are generally high, with summer temperatures frequently approaching 40°C. Light frosts occasionally occur inland during the winter months of July and August. Maximum daytime temperatures frequently exceed 40°C between November and January, and minimum temperatures can drop below 14°C between June and August.

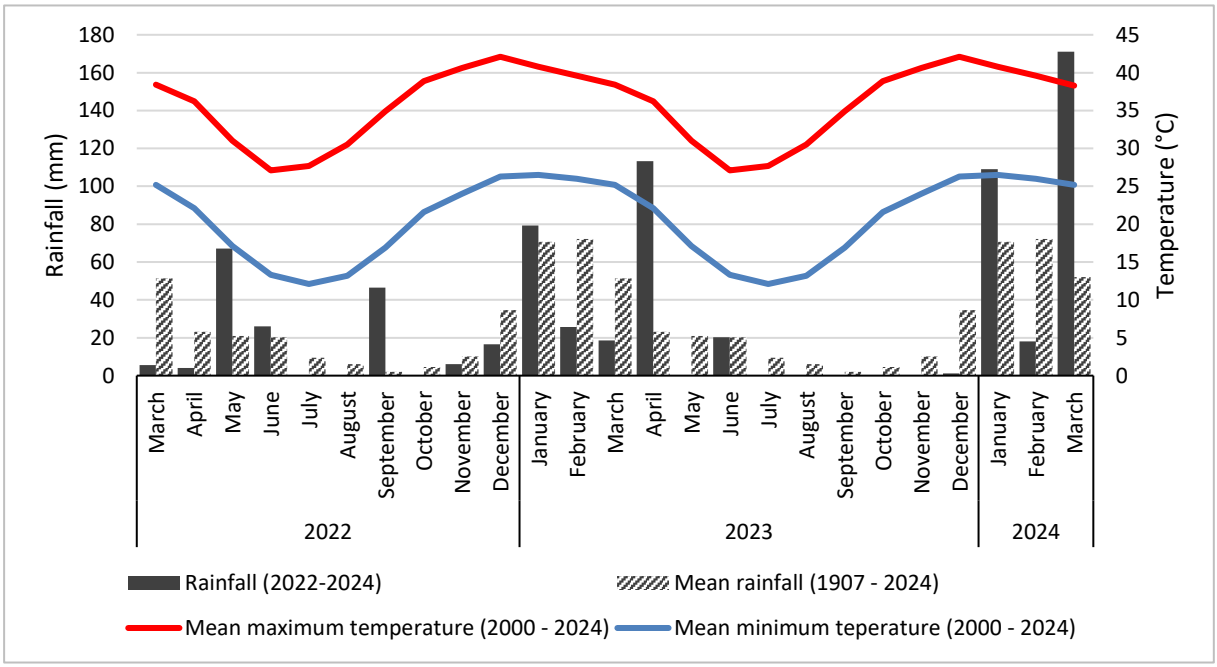


Figure 1: Climate data from Bonney Downs (rainfall) and Marble Bar (temperature).

2.2 IBRA 7 BIOREGIONS

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies the Australian continent into regions or bioregions on the basis of similar geology, landform, vegetation, fauna and climate characteristics (DSEWPC, 2012). The study area is situated entirely within the Pilbara bioregion according to IBRA 7 (DSEWPC, 2012). The Pilbara region is further divided into four subregions: Hamersley (PIL03), Fortescue Plains (PIL02), Chichester (PIL01) and Roebourne (PIL04). The majority of the study area (97.83%) intersects the Chichester subregion, with a small portion (2.17%) intersecting the Fortescue Plains subregion (Map 1, Table 1).

The Chichester subregion (PIL01) comprises the northern section of the Pilbara Cration. Undulating Archaean granite and basalt plains include significant areas of basaltic ranges. Plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* (formerly *Triodia pungens*) hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on ranges. The climate is semi-desert-tropical and receives 300mm of rainfall annually. Drainage

occurs to the north via numerous rivers (e.g. De Grey, Oakover, Nullagine, Shaw, Yule, Sherlock). Subregional area is 9,044,560 ha (Kendrick and McKenzie 2001).

The Fortescue subregion is characterised by alluvial plains and river frontage. Extensive salt marsh, mulga-bunch grass, and short grass communities on alluvial plains in the east. Deeply incised gorge systems in the western (lower) part of the drainage. River gum woodlands fringe the drainage lines. Northern limit of mulga (*Acacia aneura*). An extensive calcrete aquifer (originating within a palaeo-drainage valley) feeds numerous permanent springs in the central Fortescue, supporting large permanent wetlands with extensive stands of river gum and cadjeput *Melaleuca* woodlands. Climatic conditions are semi desert tropical, with average rainfall of 300mm, falling mainly in summer cyclonic events. Drainage occurs to the north-west. Subregional area is 2,041,914 ha.

Table 1: IBRA subregions within the study area.

IBRA subregion	Extent within the study area (ha)	Extent within study area (%)
Chichester	100,571.08	97.83
Fortescue	2,231.47	2.17

2.3 LAND SYSTEMS

In 2016 the Department of Primary Industries and Regional Development (DPIRD) consolidated soil-landscape mapping of Western Australia from two technical reports created by the Department of Agriculture and Food (Department of Agriculture Resource Management Technical Reports RMTR No. 280 (Purdie, Tille, & Schoknecht, 2016) and RMTR No. 313 (Tille, 2006). The resulting spatial dataset, *Soil-landscape mapping covering Western Australia at the best available scale (Version 05.01)* (DPIRD, 2016), is a compilation of various surveys at different scales varying between 1:20,000 and 1:3,000,000. Mapping conforms to a nested hierarchy established to deal with the varying levels of information resulting from the variety of scales in mapping to provide soil-landscape data for all Western Australia.

Sixteen land systems are associated with the study area, with the majority (55.67%) comprised of the Rocklea Land System (Map 2, Table 2). The Rocklea Land System is characterised by basalt hills, plateaux, lower slopes and stony plains, supporting hard spinifex and scattered shrubs.

2.4 SURFACE GEOLOGY OF AUSTRALIA

The Surface Geology of Australia 1:1,000,000 scale spatial dataset is a seamless national coverage of outcrop and surficial geology (Geoscience Australia, 2012). Seventeen surface geological units are associated with the study area (Table 3, Map 3).

The Kylena Formation, a geological unit consisting of sediments derived from basalt, andesite, dacite, rhyolite and dolerite accounts for 43.21% of the study area.

2.5 ATLAS OF AUSTRALIAN SOILS

The Atlas of Australian Soils (Northcote et al., 1960-1968) was compiled by the CSIRO in the 1960's to provide a consistent national description of Australia's soils. The original maps used scales from 1:250,000 to 1:500,000. In 1991 the National Resource Information Centre used these maps to create the Digital Atlas of Australian Soils which describes over 14,000 soil units and their distribution across Australia.

Five soil types of the Atlas of Australian Soils are associated with the study area (Table 4, Map 4). The majority of the study area (71.9%) is comprised of Oa11, which is characterised by stony pediments and hills.

2.6 VEGETATION

The Western Australian Land Use and Vegetation Data Project (Shepherd et al., 2002) produced a 1:250,000 scale digital spatial dataset of the pre-European native vegetation of Western Australia, compiled from previous vegetation mapping exercises, primarily by J.S. Beard from 1964 to 1981, with updates reflecting the National Vegetation Information System (NVIS) standards. Six vegetation associations (18, 29, 82, 93, 173 and 562) are mapped within the study area (Table 5, Map 5). Most of the study area (96.86%) is comprised of vegetation association 173, characterised by *Triodia wiseana* hummock grassland and low *Eucalyptus* steppe.

The pre-European and current extent of each vegetation association is available from the Statewide Vegetation Statistics dataset (Government of Western Australia, 2018). The National Objectives and Targets for Biodiversity Conservation 2001-2005 (DEH, 2001) recognise that the retention of 30% or more of the pre-clearing extent of an ecological community is necessary if Australia's biological diversity is to be protected, as this is the threshold below which species loss appears to accelerate exponentially (EPA, 2000). Vegetation associations at less than 30% of their pre-European extent are classified as either 'Vulnerable' (10-30%) or 'Endangered' (< 10 %) (DER, 2014). The current extent of vegetation associations within the study area are all well above this 30% threshold (Table 5) and are classified as 'Least concern' (DER, 2014).

Table 2: Land systems within the study area.

Land system	Description	Extent within the survey area (ha)	Extent within survey area (%)
Bonney Land System	Low rounded hills and undulating stony plains supporting soft spinifex grasslands.	17,775.6	17.29
Capricorn Land System	Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.	6,299.16	6.13
Elimunna Land System	Stony plains on basalt supporting sparse acacia and cassia shrublands and patchy tussock grasslands.	292.56	0.28
Granitic Land System	Rugged granitic hills supporting shrubby hard and soft spinifex grasslands.	77.65	0.08
Jamindie Land System	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey.	629.53	0.61
Laterite Land System	Low lateritic plateaux, mesas, buttes and gravelly rises and plains supporting sparse mulga shrublands.	878.33	0.85
Macroy Land System	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex shrubby grasslands.	28.02	0.03
McKay Land System	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.	5,726.3	5.57
Newman Land System	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.	305.14	0.3
River Land System	Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	498.98	0.49
Robe Land System	Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands.	4,313.96	4.2
Rocklea Land System	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	57,234.89	55.67
Spearhole Land System	Gently undulating gravelly hardpan plains and dissected slopes supporting groved mulga shrublands and hard spinifex.	273.99	0.27
Talga Land System	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.	557.07	0.54
Turee Land System	Stony alluvial plains with gilgaied and non-gilgaied surfaces supporting tussock grasslands and grassy shrublands of mulga and snakewood.	35.39	0.03
Wona Land System	Basalt upland gilgai plains supporting Roebourne Plains grass and Mitchell grass tussock grasslands, minor hard spinifex grasslands or annual grasslands/herbfields.	7,876.02	7.66

Table 3: Surface geology associated with the study area (Geoscience Australia 2012).

Map symbol	Surface geological unit	Description	Extent within study area (ha)	Extent within study area (%)
Abfk	Kylena Formation	Basalt, andesite, dacite, high-Mg basalt, rhyolite; basaltic agglomerate; dolerite; grey carbonate rock with microbial laminations and stromatolites; sandstone; pillow breccia; tuff, limestone, conglomerate	17,111.22	16.64
Abfm	Maddina Formation	Massive, vesicular and amygdaloidal basalt, basaltic andesite, and andesite, minor dacite, dolerite sills; bedded lapilli, vitric, crystal and lithic tuff, volcaniclastic siltstone, shale, chert, sandstone, dolomite.	44,418.97	43.21
Abfr	Mount Roe Basalt	Massive, porphyritic, vesicular, amygdaloidal and doleritic basalt; some high-Mg basalt, agglomerate, volcanic breccia, tuff, mafic wacke, shale, polymictic conglomerate and sandstone, siliceous limestone and dolomite.	3,231.11	3.14
Abke	Euro Basalt	Basalt, chert, dolerite, komatiitic basalt, komatiite, amphibolite, basaltic fragmental rock, gabbro, ultramafic to mafic schist, carbonate rock, felsic tuff, shale, sandstone, quartzite, metapyroxenite, serpentinite	1,356.79	1.32
Acg	Gorge Creek Group	Chert, ferruginous chert, banded iron formation, jaspilite; minor siltstone, shale, sandstone, pebbly sandstone, quartzite, polymictic conglomerate, felsic volcaniclastic rock, basalt, ultramafic schist, mafic schist	663.88	0.65
Agnb	Bamboo Springs Monzogranite	Coarsely K-feldspar porphyritic monzogranite with a strong synmagmatic foliation defined by aligned K-feldspar phenocrysts.	73.53	0.07
Agro	Bonney Downs Monzogranite	Monzogranite and leucomonzongranite, sparsely porphyritic and muscovite-bearing, locally abundant xenoliths of granitic gneiss and greenstone.	83.09	0.08
Anbig	Golden Eagle Orthogneiss	Layered orthogneiss derived from tonalite, granodiorite, monzogranite and pegmatite; layers and lenses of amphibolite and ultramafic schist; foliated granite, granitic gneiss, mingled metasedimentary and metavolcanic xenoliths and granite.	10.38	0.01
Awfh	Hardey Formation	Sandstone, siltstone, shale, lithic wacke, mudstone, arkose, calcareous beds, conglomerate; porphyry, porphyry breccia; quartzite; dacitic to rhyolitic lavas; quartz-feldspar-mica schist; boulder breccia; basalt; felsic pyroclastics, ultramafic lava.	5,116.60	4.98
Awfj	Jeerinah Formation	Shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.	1,646.27	1.60
Awft	Tumbiana Formation	Pisolitic tuff, siliceous limestone and dolomite, mudstone, tuffaceous shale, siltstone, sandstone, volcaniclastic sandstone and siltstone, calcareous sandstone, local basalt and basaltic breccia, chert, local conglomerate, shale, jasper.	10,089.79	9.81

Map symbol	Surface geological unit	Description	Extent within study area (ha)	Extent within study area (%)
Awk	Kelly Group	Felsic tuffaceous sandstone, quartz sandstone, siltstone, shale, chert, banded iron formation, schist, tuff, conglomerate, rhyolite, basalt, serpentinised peridotite; local dolerite sills; intrusive porphyry and microgranite; metamorphosed.	214.80	0.21
Awu	Sulphur Springs Group	Felsic to mafic volcanics and volcaniclastic rocks, chert, volcaniclastic sandstone, greywacke, shale, basalt, komatiitic basalt, amphibolite, mafic and ultramafic schist, banded iron formation, quartz-carbonate rock, siltstone.	823.14	0.80
Czl	ferruginous duricrust 38498	Ferruginous duricrust, laterite; pisolitic, nodular, vuggy; may include massive to pisolitic ferruginous subsoil, mottled clays, magnesite, reworked products of ferruginous and siliceous duricrusts, calcrete, gossan; residual ferruginous saprolite.	279.47	0.27
Czlr	Robe Pisolite	Pisolitic, oolitic and massive limonite, minor terrigenous siliciclastic material, goethite and hematite deposits; developed along palaeodrainage lines; dissected by present day drainage.	9,649.05	9.39
Qa	alluvium 38485	Channel and flood plain alluvium; gravel, sand, silt, clay; may be locally calcreted.	306.31	0.30
Qrc	colluvium 38491	Colluvium and/or residual deposits, sheetwash, talus, scree; boulder, gravel, sand; may include minor alluvial or sand plain deposits, local calcrete and reworked laterite.	7,728.17	7.52

Table 4: Atlas of Australian Soil units associated with the study area (Northcote *et al*. 1960-1968).

Map symbol	Description	Extent within study area (ha)	Extent within study area (%)
Gf1	Steep ranges on basic lavas along with dolomites, tuff, banded iron formations, and dolerite dykes, with some narrow valley plains and high-level gently undulating areas of limited extent. The soils are generally shallow and stony and there are large areas without soil cover: chief soils are brown loams (Um6.23) along with significant areas of earthy loams (Um5.51). (Dr2.33) soils occur on lower slopes, with (Uf6.71) and (Ug5.37) on valley floors.	1,634.60	1.59
Oa11	Dissected stony pediments and hills occurring at the foot of unit Gf1; some residuals of more resistant rocks occur as mesas. On deeply dissected areas lime is released from weathering of more basic rocks: chief soils are hard alkaline red soils (Dr2.13) and other (Dr) soils. There are also shallow (Um5.51) and (Uc) soils associated with rock outcrop; some cracking clays (Ug5.37) on pediments associated with basic rocks; and some shallow calcareous loam soils (Um1.2).	73,915.56	71.90
Gf1	Steep ranges on basic lavas along with dolomites, tuff, banded iron formations, and dolerite dykes, with some narrow valley plains and high-level gently undulating areas of limited extent. The soils are generally shallow and stony and there are large areas without soil cover: chief soils are brown loams (Um6.23) along with significant areas of earthy loams (Um5.51). (Dr2.33) soils occur on lower slopes, with (Uf6.71) and (Ug5.37) on valley floors.	13,425.31	13.06
Oc70	Dissected pediments and low stony hills associated with cherts, jaspilites, and iron ore formations; much coarse surface gravel: the chief soils are hard alkaline red soils (Dr2.33) along with some (Dr2.32) and (Um5.52) soils.	11,614.81	11.30
Fb8	Plains: chief soils are deep earthy loams (Um5.52) together with some areas of clay soils (Uf6.71) and (Ug5.37)	1,663.97	1.62
Mz25	Plains associated with the Fortescue valley; there is a surface cover of stony gravels close to the ranges and hills: chief soils are acid red earths (Gn2.11) with some neutral red earths (Gn2.12); red-brown hardpan is absent. Associated are areas of calcareous earths (Gc) and loams (Um1) on calcrete (kunkar) and some hard red (Dr) soils around creek lines.	548.31	0.53

Table 5: Vegetation associations of the study area.

Shepherd et al. (2002) vegetation association	Description	Pre-European extent within Pilbara IBRA region (ha)	Percentage remaining within Pilbara IBRA region	Current percentage protected for conservation within Pilbara IBRA region	Extent within study area (ha)	Extent within study area (%)
18	Low woodland; mulga (Acacia aneura)	676,556.72	99.30	16.76	616.50	0.60
29	Sparse low woodland; mulga, discontinuous in scattered groups	1,133,219.76	99.87	1.91	736.86	0.72
82	Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*	2,563,583.23	99.50	10.26	884.52	0.86
93	Hummock grasslands, shrub steppe; kanji over soft spinifex	3,042,114.27	99.88	0.44	17.46	0.02
173	Hummock grasslands, shrub steppe; kanji over soft spinifex & *Triodia wiseana* on basalt	1,752,520.89	99.72	7.49	99,576.62	96.86
562	Mosaic: Low woodland; mulga in valleys / Hummock grasslands, open low tree-steppe; snappy gum over Triodia wiseana	103,606.82	100.00	16.76	970.59	0.94

2.7 LAND USE, LAND TENURE, CONSERVATION RESERVES, ENVIRONMENTALLY SENSITIVE AREAS AND NATIONALLY IMPORTANT WETLANDS

The Department of Climate Change, Energy, the Environment and Water (DCCEEW) and the DBCA's legislated lands and waters database were queried for Ramsar Wetlands, Nationally Important Wetlands, and DBCA managed lands and waters occurring within the study area. The Fortescue Marsh Nationally Important Wetland occurs within a 50 km radius of the study area (Map 6).

Pastoral activities associated with Bonney Downs station along with mining tenements (numerous mines and exploration tenements) are the dominant land uses in the vicinity of the study area. Three major water courses intersect the study area including the Nullagine River, the Coongan River and Bonney Creek, with numerous permanent water bodies including Bonney Pools. Permanent and semi-permanent water sources within the study area provide important seasonal habitat for a wide range of vertebrate fauna taxa. The pastoral dam at Bonney Downs Station may be utilised for short periods of time by Migratory species as a temporary layover location; however, it does not provide long-term suitable foraging habitat for these species.

119.7°E
119.8°E
119.9°E
120°E
120.1°E
21.9°S
22°S
22.1°S
22.2°S
22.3°S
22.4°S

Divide Land System
Taylor Land System
Capricorn Land System
Talga Land System
Black Land System
Mosquito Land System
Robe Land System
Macroy Land System
River Land System
Rocklea Land System
Wona Land System
Granitic Land System
Bonney Land System
Laterite Land System
Spearhole Land System
McKay Land System
Elimunna Land System
Jurrawarrina Land System
Pindering Land System
Jamindie Land System
Newman Land System
Turee Land System
Boolgeeda Land System
Cowra Land System

Survey area

Land system

- Black Land System
- Bonney Land System
- Boolgeeda Land System
- Capricorn Land System
- Cowra Land System
- Divide Land System
- Elimunna Land System
- Granitic Land System
- Jamindie Land System
- Jurrawarrina Land System
- Laterite Land System
- Macroy Land System
- Marsh Land System
- McKay Land System
- Mosquito Land System
- Newman Land System
- Pindering Land System
- River Land System
- Robe Land System
- Rocklea Land System
- Spearhole Land System
- Talga Land System
- Taylor Land System
- Turee Land System
- Wona Land System

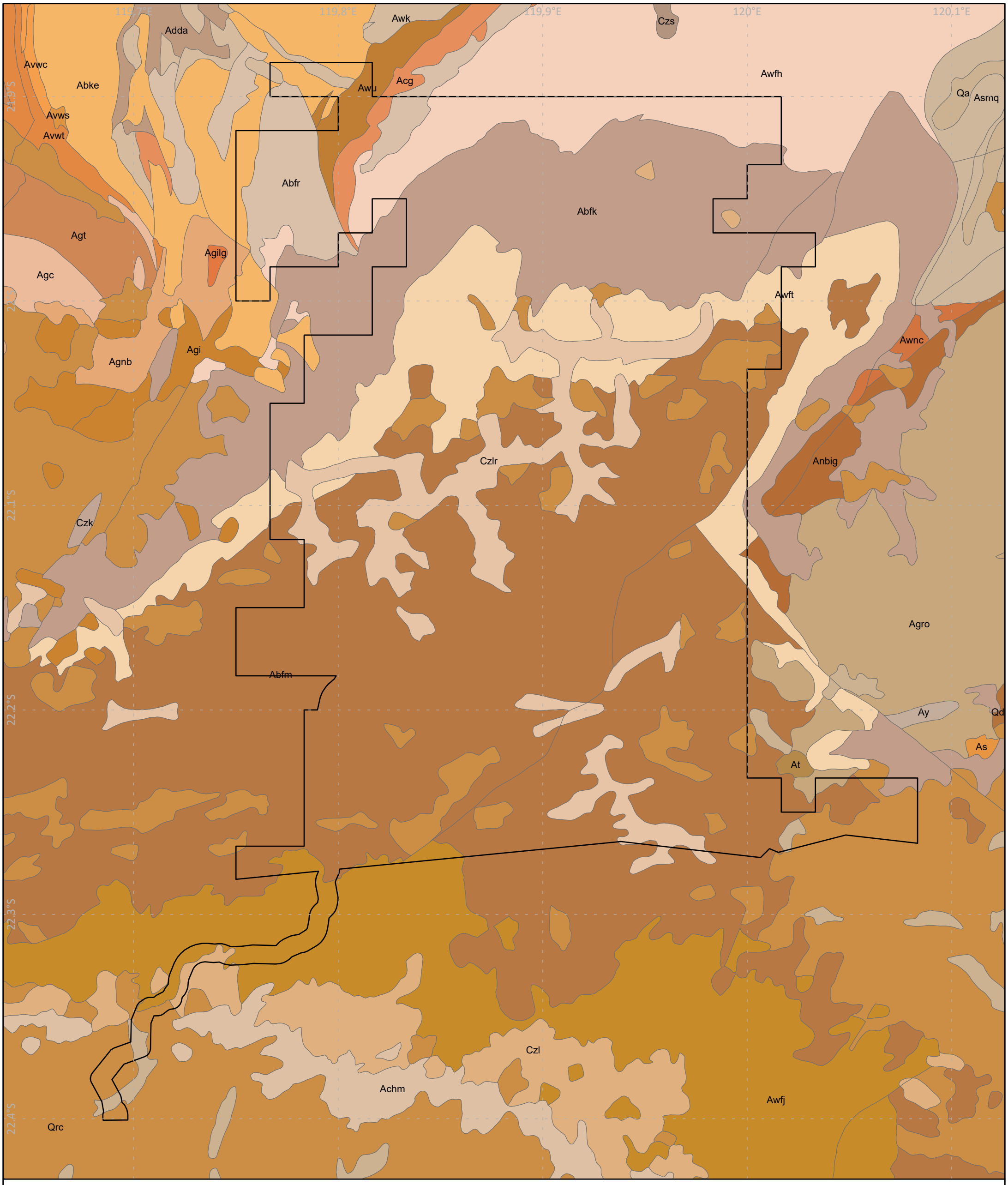
ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 2 December 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 2: Land systems (DPIRD 2016).

0 2 4 6 10 Kilometers

Earthstar Geographics



Study area

Surface geology unit

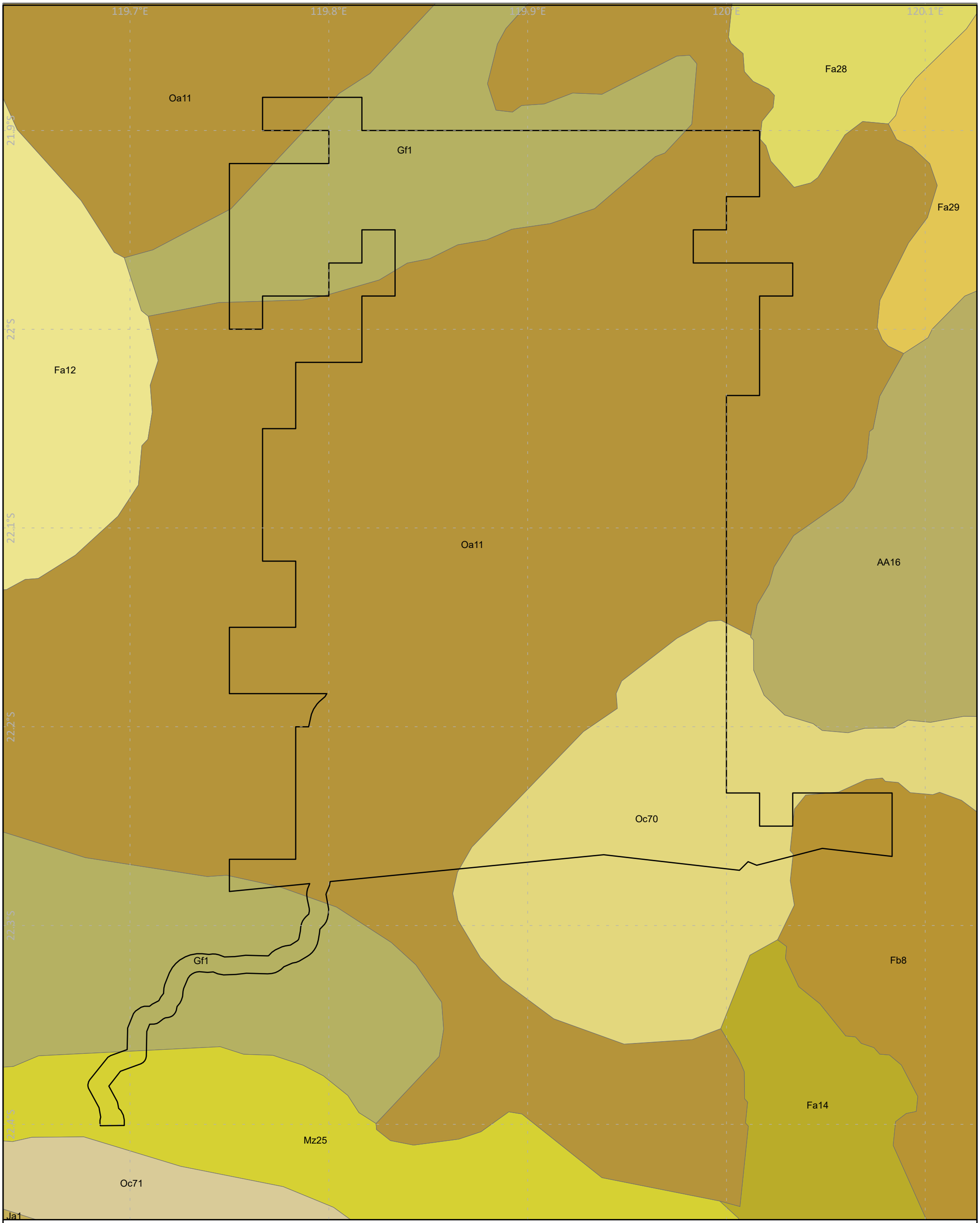
- Abfk: Kylena Formation
- Abfm: Maddina Formation
- Abfr: Mount Roe Basalt
- Abke: Euro Basalt
- Acg: Gorge Creek Group
- Achm: Marra Mamba Iron Formation
- Adda: Dalton Suite
- Agc: Callina Supersuite
- Agi: Sisters Supersuite
- Agilg: Mulgandinnah Monzogranite
- Agnb: Bamboo Springs Monzogranite
- Agro: Bonney Downs Monzogranite
- Agt: Tambina Supersuite
- Anbig: Golden Eagle Orthogneiss
- As: siliciclastic sedimentary rocks 74321
- Asmq: Mosquito Creek Formation
- At: amphibolite 74324
- Avwc: Coongan Subgroup
- Avws: Salgash Subgroup
- Avwt: Talga Talga Subgroup
- Awfh: Hardey Formation
- Awfj: Jeerinah Formation
- Awft: Tumbiana Formation
- Awk: Kelly Group
- Awnc: Coondamar Formation
- Awu: Sulphur Springs Group
- Ay: pelitic schist, quartzite 74460
- Czims: Millstream Formation
- Czk: calcrete 38497
- Czl: ferruginous duricrust 38498
- Czlr: Robe Pisolite
- Czs: sand plain 38499
- Qa: alluvium 38485
- Qd: dunes 38496
- Qrc: colluvium 38491

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 2 December 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 2: Surface geology (1:1,000,000) of the study area (Geoscience Australia, 2012).

0 2 4 6 10 Kilometers



Study area

Soil map unit

- AA16
- Fa12
- Fa14
- Fa28
- Fa29
- Fb8
- Gf1
- Ja1
- Mz25
- Oa11
- Oc70
- Oc71

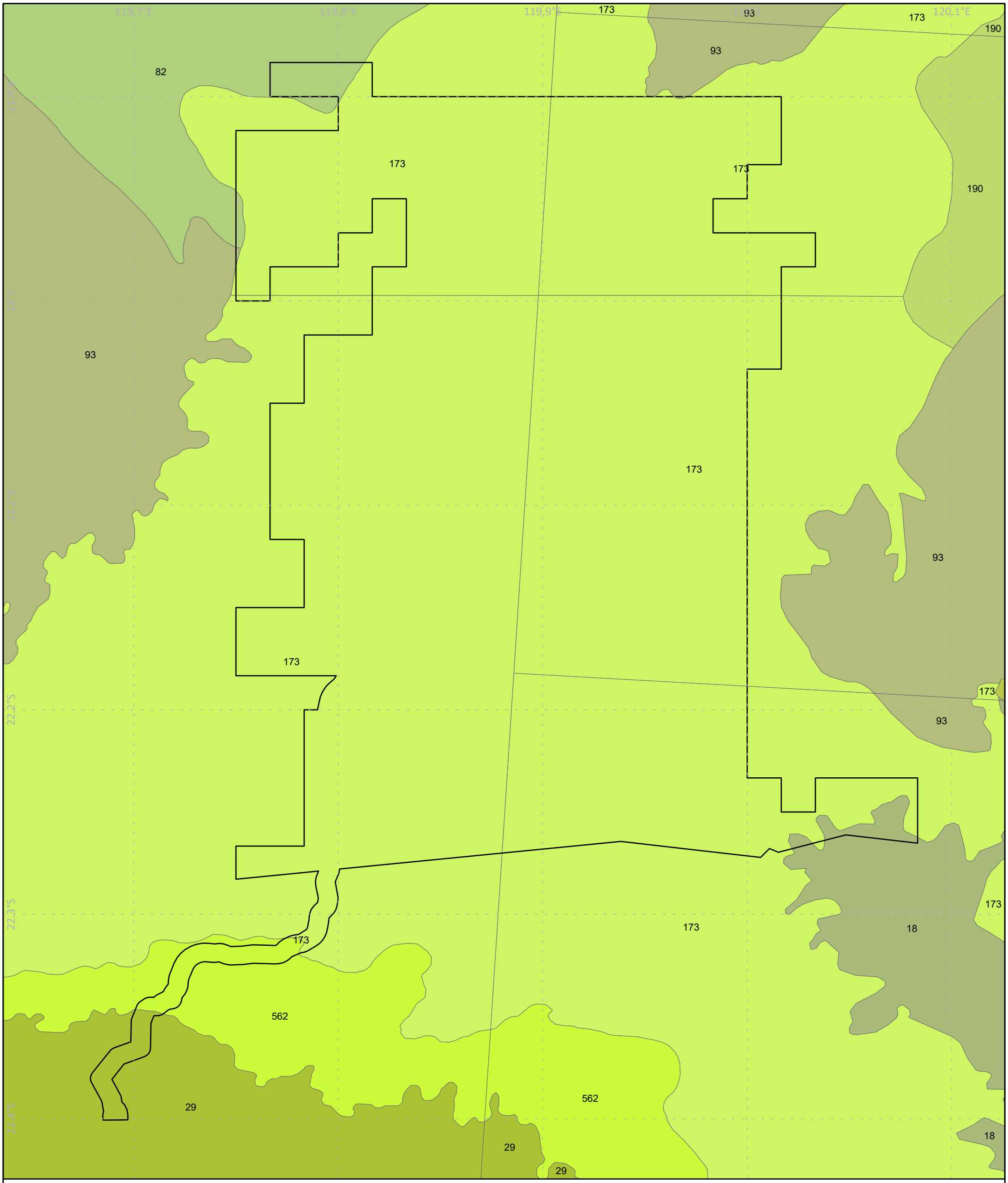
ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 2 December 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 4: Atlas of Australian Soils map units associated with the study area (Northcote et al., 1960-1968).

0 2 4 6 10 Kilometers

Earthstar Geographics



Study area

Vegetation association

- 18: Low woodland; mulga (Acacia aneura)
- 29: Sparse low woodland; mulga, discontinuous in scattered groups
- 82: Hummock grasslands, low tree steppe; snappy gum over Triodia wiseana
- 93: Hummock grasslands, shrub steppe; kanji over soft spinifex
- 111: Hummock grasslands, shrub steppe; Eucalyptus gamophylla over hard spinifex
- 173: Hummock grasslands, shrub steppe; kanji over soft spinifex & Triodia wiseana on basalt
- 190: Hummock grasslands, sparse shrub steppe; Acacia bivenosa & A. trachycarpa over hard spinifex, Triodia wiseana, Very poor rocky country on gneiss
- 562: Mosaic: Low woodland; mulga in valleys / Hummock grasslands, open low tree-steppe; snappy gum over Triodia wiseana

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 2 December 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 5: Pre-European vegetation associations of the study area (Shepherd et al., 2002).

0 2 4 6 10 Kilometers

118.6667°E
119.25°E
119.8333°E
120.4167°E
21.1667°S
21.75°S
22.3333°S
22.9167°S
23.5°S
24.0833°S

Mungaroona Range Nature Reserve
Karijinni (Hamersley Range) Gorges
Fortescue Marshes
Mt Bruce Coolibah - Lignum Flats
Karijini National Park
Lake Disappointment (Savory Creek) System

Study area
40km buffer

Nationally Important Wetlands
- Fortescue Marshes
- Karijinni (Hamersley Range) Gorges
- Lake Disappointment (Savory Creek) System
- Mt Bruce Coolibah - Lignum Flats

DBCA managed lands and waters
- Un-named
- Karijini National Park
- Mungaroona Range Nature Reserve

Environmentally sensitive area
- Un-named ESA

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 2 December 2024
Coordinate System: GCS GDA 1994
Scale: 1:1,130,000 @A3

Map 6: DBCA Legislated Lands and Waters, Nationally Important Wetlands and Environmentally Sensitive Areas near the study area.

Earthstar Geographics

0 10 30 40 80 Kilometers

N

2.8 DESKTOP ASSESSMENT

The methodology adopted for the desktop assessment was in accordance with the Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020). Searches of the databases listed in Table 6 along with a review of relevant survey data was undertaken to identify vertebrate fauna and significant species previously recorded within 40 kilometres (km) of the study area (the "study area"). As DBCA and Fortescue database search buffers are determined based on the availability of significant fauna records in the local area, the buffers utilised for these databases (100 km) differs to those applied for other databases. Habitat preferences were sourced, where available, from relevant taxonomic literature or Threatened Species Profiles (SPRATs). The presence of potentially suitable habitat within the study area was determined using broad landforms, soils, and vegetation associations in comparison to cited preferred habitat (if available) for each species.

Table 6: Databases queried for the desktop study.

Database	Search details
DCCEEW Protected Matters Database	Records of matters of national significance under the EPBC Act within 40 km of the study area.
DBCA Threatened and Priority Fauna Database	Fauna records within 100 km of the study area
BirdLife Australia's Birdata Database	All bird records within 40 km of the study area.
Atlas of Living Australia (ALA) Database	All fauna records within 40 km of the study area.
Index of Biodiversity Surveys for Assessments (IBSA) Database	All IBSA vertebrate fauna surveys within 100 km of the study area.
Fortescue Internal Fauna Databases	All fauna records within 40 km of the study area.

Results of database searches and the literature review were compiled, and significant species were identified. The criteria listed in Table 7 were then applied to determine the likelihood of occurrence of these species within the study area. Additional consideration was given to the age and locality of the record, recent taxonomic species revisions and modelled species distributions.

Table 7: Criteria used to assess the likelihood of occurrence of significant species and communities.

Rating	Criterion
Recorded	The species has been recorded within the study area previously or during the current survey.
High (likely to occur)	The species is likely to occur within the study area as suitable habitat is known to be present and there are existing records very close to the study area (within ca. 5-15 km, depending on species mobility).
Moderate (possibly occurs)	The species may occur within the study area as there are existing records in the vicinity of the study area, and suitable habitat is likely to be present; OR The species may occur within the study area as there is insufficient information available to exclude the possibility of occurrence.
Low (unlikely to occur)	The species is unlikely to occur within the study area as suitable habitat is not present or is not likely to be present; OR Suitable habitat is present within the study area, but the taxon has not been recorded despite reasonable survey effort.
Does not occur	The species is recognised as being locally extinct or extinct in the wild and does not occur within the study area; OR Records identified through database searches are associated with a listed subspecies which does not occur within the region.

2.8.1 Database Searches

According to database searches, 305 fauna species have the potential to occur within 40 km of the study area, comprising 30 mammals (three introduced), 178 birds, 89 reptiles and eight amphibians (Appendix B). A summary outlining the results of database searches within the study area can be seen in Table 8 and a regional species summary table outlining the faunal assemblages recorded during detailed fauna surveys in the vicinity of the study area is provided in Appendix C.

Table 8: Summary of fauna database search results within the study area (Appendix B).

Database	Mammals	Birds	Reptiles	Amphibians	Fish
Atlas of Living Australia (ALA)	25 (3)	161	86	8	0
DBCA Threatened and Priority Fauna Search	8	13	3	0	0
Fortescue Significant Fauna Databases	5	12	1	0	0
Birdlife Australia Birdata	0	149	0	0	0
DCCEEW Protected Matters Search	4	18	1	0	0

2.8.2 Significant Fauna

DBCA Threatened and Priority fauna and Fortescue internal database search results identified 34 significant species comprising 21 birds, 10 mammals and three reptiles occurring within 100 km of the study area (Map 7). To accord with DBCA's decision to redact night parrot records from Threatened and Priority database search extracts, both records of the night parrot have been excluded from spatial mapping associated with this report.

DBCA database search results identified records of two species which represent likely taxonomic misidentifications. Two records of the crest-tailed mulgara (*Dasycercus cristicauda,* Priority 4) and two historical records of the barking owl (southwest subpop.) (*Ninox connivens connivens*, Priority 3) are associated with species which do not occur within the region and are instead considered to represent records of the brush-tailed mulgara (*Dasycercus blythi*, Priority 4) and the barking owl (*Ninox connivens peninsularis*, unlisted) respectively.

The EPBC Act Protected Matters Report identified four additional species (great desert skink, red goshawk, curlew sandpiper and yellow wagtail) with the potential to occur within the study area (Appendix B). Species listed as Marine under the EPBC Act have been excluded from the significant fauna likelihood of occurrence assessment as the study area does not encompass marine habitats and these species are generally common and widespread.

119°E
119.5°E
120°E
120.5°E
121°E
21°S
21.5°S
22°S
22.5°S
23°S

Study area
Survey area

DBCA database

EPBC: Endangered
- Northern quoll
- Australian painted snipe

EPBC: Endangered & Migratory
- Southern giant petrel
- Common greenshank

EPBC: Vulnerable
- Greater bilby
- Ghost bat
- Pilbara olive python
- Pilbara leaf-nosed bat
- Grey falcon

EPBC: Vulnerable; Priority 4
- Princess parrot

EPBC: Vulnerable & Migratory
- Sharp-tailed sandpiper

Priority 1
- Gane's blind snake
- Pin-striped finesnout Ctenotus

Priority 3
- Barking owl (southwest subpopulation)

Priority 4
- Western pebble-mound mouse
- Brush-tailed mulgara
- Crest-tailed mulgara
- Mulgara
- Spectacled hare-wallaby (mainland)
- Northern short-tailed mouse
- Sminthopsis longicaudata

EPBC: Migratory
- Fork-tailed swift
- Common sandpiper
- Red-necked stint
- Oriental plover
- Gull-billed tern
- Caspian tern
- Grey wagtail
- Osprey
- Glossy ibis
- Wood sandpiper
- Marsh sandpiper

BC: Other Specially Protected
- Peregrine falcon

FMG database

EPBC: Endangered
- Northern quoll

EPBC: Vulnerable
- Grey falcon
- Ghost Bat
- Pilbara Olive Python
- Pilbara Leaf-nosed bat
- Greater Bilby

EPBC: Endangered & Migratory
- Common Greenshank

EPBC: Vulnerable & Migratory
- Sharp-tailed Sandpiper

Priority 1
- Gane's blind snake

Priority 4
- Western pebble-mound mouse
- Long-tailed Dunnart
- Brush-tailed mulgara
- Northern short-tailed mouse

EPBC: Migratory
- Caspian Tern
- Wood Sandpiper
- Common Sandpiper
- Oriental Plover
- Red-necked Stint
- Gull-billed Tern
- Fork-tailed Swift
- Glossy Ibis

BC: Other Specially Protected
- Peregrine falcon

ecologia ENVIRONMENT

Project No.: 2021
Author: DS
Created Date: 11 December 2024
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:900,000 @A3

Map 7: DBCA and FMG database significant fauna records within 100 km of the survey area.

0 8 20 30 50 Kilometers

Earthstar Geographics

2.8.3 Literature Review

The literature review identified nine multi-phase detailed vertebrate fauna assessments, nine single-phase detailed fauna surveys, 13 targeted fauna surveys, five significant fauna monitoring programs, one bat and bird site utilisation survey and three basic fauna surveys undertaken within 100 km of the study area (Table 9). Of the literature reviewed, two basic fauna and fauna habitat assessments, three significant fauna monitoring programs, one bat and bird site utilisation survey (BBSUS), three single-phase detailed and targeted surveys and two multi-phase detailed and targeted surveys were found to intersect the current study area. Both basic fauna surveys and all three single-phase detailed fauna assessments intersecting the study area were completed >10 years ago and are considered outdated for the purposes of environmental impact assessment (Table 9). These reports will not be discussed as part of the current consolidation. Locations of fauna surveys commissioned by Fortescue within 100 km of the study area are shown in Map 8.

Key findings associated with reports which were available at the time of the consolidation are outlined in Table 9, with a list of regional fauna records, including updated species names to align with the current Western Australian Museum (WAM) checklist of terrestrial vertebrates, provided in Appendix C. Asterixis indicate surveys for which the survey report and/or a comprehensive species list were unavailable at the time of the consolidation.

Multi-phase detailed fauna assessments:

- Bonney Downs North: Terrestrial Vertebrate Fauna Assessment (ecologia, 2024a);
- Bonney Downs South: Terrestrial Vertebrate Fauna Assessment (Spectrum Ecology, 2024);
- Corunna Downs Project: Terrestrial Vertebrate Fauna Survey (Stantec, 2016);
- East Hamersley Rail Terrestrial Vertebrate Fauna Assessment (*ecologia*, 2024c);
- McPhee Creek: Consolidated Terrestrial Fauna Report (Biologic, 2021);
- Mindy South: Detailed and Targeted Terrestrial Vertebrate Fauna Baseline Survey (Stantec, 2024);
- Nyidinghu Iron Ore Project Detailed Terrestrial Fauna Survey (360 Environmental, 2023);
- Nyidinghu Mine Terrestrial Vertebrate Fauna Assessment (*ecologia*, 2024d); and
- Roy Hill Iron Ore Project, Level 2 Terrestrial Vertebrate Fauna Survey (ecologia, 2009).

Single-phase detailed fauna assessments:

- Adele Flora, Fauna and SRE Survey (360 Environmental, 2021);
- Bonney Downs Rail Alignment Vertebrate Fauna Survey (Phoenix, 2011)*;
- Christmas Creek Terrestrial Vertebrate Fauna and Fauna Habitat Assessment (ENV Australia, 2012);
- Cloudbreak Level 2 Terrestrial Vertebrate Fauna Assessment (ecologia, 2011);
- Fauna Assessment - Nyidinghu Iron Ore Project (Bamford Consulting Ecologists, 2012a);
- Fauna Survey of the Proposed Iron Ore Mine, Cloud Break (Bamford Consulting Ecologists, 2005)*;
- FMG Stage A Rail Corridor Fauna Assemblage (Biota Environmental Sciences, 2004)*;
- FMG Stage B Rail (Biota Environmental Sciences, 2005)*; and
- Kutayi Project Vertebrate Fauna Survey (Spectrum Ecology, 2020)*.

Targeted significant fauna surveys:

- Adele West Targeted Flora and Fauna Survey (360 Environmental, 2022);
- Fortescue Marsh Migratory Shorebird and Waterbird Survey (Spectrum Ecology, 2022b);
- Fortescue Marsh Tenement E46/684 Level 1 Targeted Vertebrate Fauna Survey (Biologic Environmental, 2014);

- Fortescue Metals Group Cloudbreak Expansion Project - Pre Clearance Night Parrot Survey (Outback Ecology, 2013);
- Migratory Bird Habitat Survey of the Fortescue Marsh (Bennelongia Environmental Consultants, 2018);
- Night Parrot surveys at Fortescue Marsh, Western Australia: Habitat Analyses, Survey Review and Recommendations (Adaptive NRM, 2017);
- Nyidinghu Rail - Terrestrial Vertebrate Fauna and Fauna Habitat Assessment (Bamford Consulting Ecologists, 2012b);
- Roy Hill Mine and Southern Borefields Targeted Fauna Survey (Biologic, 2017a);
- Roy Hill Level 1 Targeted Vertebrate Fauna Assessment Updated (Biologic, 2018);
- Targeted Fauna Assessment of the Rail Duplication (Bamford Consulting Ecologists, 2010);
- Vegetation and Fauna Habitat Mapping of the Northern Tenement Area, Cloudbreak (Ecoscape Australia, 2016);
- Warrawoona Gold Project: VHF Bat Foraging Studies (Biologic, 2019b); and
- Warrawoona Gold Project: 2019 Significant Species Survey (Biologic, 2019a).

Significant fauna monitoring:

- Fortescue Metals Group: Annual Fauna Monitoring Program 2021 (Spectrum Ecology, 2021);
- Fortescue Metals Group: Annual Fauna Monitoring Program 2022 – Operational Sites, Nullagine and North Star (Spectrum Ecology, 2022a);
- Fortescue Metals Group: Annual Fauna Monitoring Program 2023 – Operational Sites, Nullagine and North Star (Spectrum Ecology, 2023a);
- Nyidinghu Project: Baseline Significant Fauna Monitoring (Spectrum Ecology, 2023b); and
- Fortescue Night Parrot Monitoring Procedure and Program (Adaptive NRM, 2021).

Bat and Bird Site Utilisation Surveys:

- Bonney Downs Wind Farm: Bird and Bat Site Utilisation Report -Year 1 (ecologia, 2024b).

Basic fauna and fauna habitat assessment:

- BC Iron Nullagine Project Extension Areas – Bonnie East, Warrigal North and Coongan: Assessment of Fauna Values (Bamford, 2013);
- Bonney Downs Alignment Level 1 Fauna Survey (Phoenix Environmental Sciences, 2011)*; and
- Ministers North to Yandi Corridor: Single Phase Level 2 Fauna and Detailed Flora/Vegetation Survey (Biologic, 2017b).

Table 9: Summary of literature reviewed. Green shading indicates reports included in the current consolidation.

Survey details	Proximity to study area	Mammals (introduced)	Birds	Reptiles	Amphibians	Fish	Significant fauna recorded
Single-phase detailed fauna survey							
Adele Flora, Fauna and SRE Survey (360 Environmental, 2021)	20 km	12 (2)	31	19	0	0	Western pebble-mound mouse.
Bonney Downs Rail Alignment Vertebrate Fauna Survey (Phoenix, 2011)	**Intersects**	17 (5)	62	46	4	0	Significant fauna assemblages not available.
Cloudbreak Level 2 Terrestrial Vertebrate Fauna Assessment (ecologia Environment, 2011)	<5 km	7	55	41	1	0	Western pebble-mound mouse.
Christmas Creek Terrestrial Vertebrate Fauna and Fauna Habitat Assessment (ENV Australia, 2012)	**Intersects**	12 (2)	61	45	3	0	Pilbara olive python.
Fauna Assessment - Nyidinghu Iron Ore Project (Bamford Consulting, 2012)	40 km	20 (3)	83	52	2	0	Fork-tailed swift, peregrine falcon, Pilbara olive python.
Fauna Survey of the Proposed Iron Ore Mine, Cloud Break (Bamford Consulting Ecologists, 2005)	<5 km	22 (5)	90	28	2	0	Significant fauna assemblages not available.
FMG Stage A Rail Corridor Fauna Assemblage (Biota Environmental Sciences, 2004)	<40 km	24 (5)	84	55	6	0	Significant fauna assemblages not available.
FMG Stage B Rail (Biota Environmental Sciences, 2005)	**Intersects**	22 (6)	103	42	6	0	Significant fauna assemblages not available.
Kutayi Project - Vertebrate Fauna Survey (Spectrum Ecology, 2020)	20 km	26 (5)	88	50	1	0	Significant fauna assemblages not available.
Multi-phase detailed fauna survey							
Bonney Downs North: Terrestrial Vertebrate Fauna Assessment (ecologia, in. prep.)	**Intersects**	**30 (3)**	**86**	**69**	**4**	**2**	**Northern quoll, Pilbara leaf-nosed bat, grey falcon, ghost bat, Pilbara olive python, western pebble-mound mouse, short-tailed mouse and Gane's blind snake.**
Bonney Downs South: Terrestrial Vertebrate Fauna Assessment (Spectrum Ecology, in. prep.)	**Intersects**	**25 (4)**	**96**	**58**	**2**	**0**	**Northern quoll, grey falcon, Pilbara leaf-nosed bat, brush-tailed mulgara, short-tailed mouse, western pebble-mound mouse.**

Survey details	Proximity to study area	Mammals (introduced)	Birds	Reptiles	Amphibians	Fish	Significant fauna recorded
Corunna Downs Project: Terrestrial Vertebrate Fauna Survey (Stantec, 2016)	Adjacent	32 (4)	72	66	4	0	Northern quoll, Pilbara leaf-nosed bat, ghost bat, Pilbara olive python, peregrine falcon, spectacled hare-wallaby, western pebble-mound mouse
East Hamersley Rail Terrestrial Vertebrate Fauna Assessment (ecologia, 2023)	40 km	29 (5)	36	54	1	0	Grey falcon, northern quoll, ghost bat, western pebble-mound mouse, greater bilby, brush-tailed mulgara, fork-tailed swift, Gane's blind snake, grey wagtail, gull-billed tern, eastern osprey
McPhee Creek: Consolidated Terrestrial Fauna Report (Biologic, 2021)	<50 km	31 (5)	70	60	3	0	Northern quoll, greater bilby, Pilbara leaf-nosed bat, ghost bat, long-tailed dunnart, western pebble-mound mouse, fork-tailed swift, Pilbara olive python
Mindy South: Detailed and Targeted Terrestrial Vertebrate Fauna Baseline Survey (Stantec, 2024)	50 km	33 (6)	89 (1)	70	2	0	Northern quoll, Pilbara leaf-nosed bat, ghost bat, Caspian tern and western pebble mound mouse.
Nyidinghu Iron Ore Project Detailed Terrestrial Fauna Survey (360 Environmental, 2023)	20 km	31 (6)	75	57	1	1	Gane's blind snake, ghost bat, Pilbara leaf-nosed bat, western pebble-mound mouse.
Nyidinghu Mine Terrestrial Vertebrate Fauna Assessment (ecologia, 2023)	<15 km	29 (5)	66	43	0	1	Grey falcon, western pebble-mound mouse, Pilbara leaf-nosed bat, Gane's blind snake, night parrot, fork-tailed swift, peregrine falcon, Caspian tern, Australian painted snipe, greater bilby and eastern osprey.
Roy Hill Iron Ore Project, Level 2 Terrestrial Vertebrate Fauna Survey (ecologia, 2009)	<20 km	22 (8)	75	48	3	0	Ghost bat, peregrine falcon, grey falcon, wood sandpiper and western pebble-mound mouse.
Targeted fauna survey							
Adele West Targeted Flora and Fauna Survey (360 Environmental, 2022)	20 km	11 (2)	31	8	0	0	Northern quoll, western pebble-mound mouse.
Fortescue Marsh Migratory Shorebird and Waterbird Survey (Spectrum, 2022)	<10 km	0	38	0	0	0	Gull-billed tern, Caspian tern, sharp-tailed sandpiper, common greenshank, glossy ibis.
Fortescue Marsh Tenement E46/684 Level 1 Targeted Vertebrate Fauna Survey (Biologic, 2014)	<10 km	15 (5)	18	3	0	0	No significant fauna recorded.
Fortescue Metals Group Cloudbreak Expansion Project – Pre-Clearance Night Parrot Survey (Outback Ecology, 2013)	10 km	5 (3)	72	3	3	0	No significant fauna recorded.

Survey details	Proximity to study area	Mammals (introduced)	Birds	Reptiles	Amphibians	Fish	Significant fauna recorded
Migratory Bird Habitat Survey of the Fortescue Marsh (Bennelongia Environmental Consultants, 2018)	<10 km	0	35	0	0	0	Gull-billed tern, Caspian tern, sharp-tailed sandpiper, common greenshank, marsh sandpiper, glossy ibis.
Night Parrot surveys at Fortescue Marsh, Western Australia: Habitat analyses, survey review and recommendations (Adaptive NRM, 2017)	<10 km	0	0	0	0	0	No significant fauna recorded.
Nyidinghu Rail - Terrestrial Vertebrate Fauna and Fauna Habitat Assessment (Bamford, 2012)	40 km	7 (4)	49	5	0	0	Western pebble-mound mouse.
Roy Hill Level 1 Targeted Vertebrate Fauna Assessment Updated (Biologic, 2018)	<20 km	6	2	0	0	0	Northern quoll, greater bilby, ghost bat, peregrine falcon, brush-tailed mulgara, western pebble-mound mouse, grey falcon.
Roy Hill Mine and Southern Borefields Targeted Fauna Survey (Biologic, 2020)	<20 km	1	0	0	0	0	Brush-tailed mulgara
Targeted Fauna Assessment of the Rail Duplication (Bamford Consulting, 2010)	<30 km	5	25	2	0	0	Greater bilby, brush-tailed mulgara, western pebble-mound mouse.
Warrawoona Gold Project: 2019 Significant Species Survey (Biologic, 2019)	> 50 km	2	20	1	0	0	Northern quoll, olive python, brush-tailed mulgara
Warrawoona Gold Project: VHF Bat Foraging Studies (Biologic, 2019)	>50 km	2	0	0	0	0	Pilbara leaf-nosed bat, ghost bat
Vegetation and Fauna Habitat Mapping of the Northern Tenement Area, Cloudbreak (Ecoscape, 2016)	<40 km	10 (2)	12	1	0	0	Ghost bat, northern quoll, Pilbara leaf-nosed bat, western pebble-mound mouse.
Basic fauna and fauna habitat assessment							
BC Iron Nullagine Project Extension Areas – Bonnie East, Warrigal North and Coongan: Assessment of Fauna Values (Bamford, 2013)	**Intersects**	2	8	1	1	0	Australian painted snipe, northern quoll, Pilbara leaf-nosed bat, grey falcon, western pebble-mound mouse, Pilbara olive python
Bonney Downs Alignment: Level 1 Fauna Survey (Phoenix Environmental Sciences, 2011)	**Intersects**	3 (2)	38	17	0	0	Significant fauna assemblages not available.
Ministers North to Yandi Corridor: Single Phase Level 2 Fauna and Detailed Flora/Vegetation Survey (Biologic, 2017)	>50 km	14 (1)	35	10	0	0	Western pebble-mound mouse.

Survey details	Proximity to study area	Mammals (introduced)	Birds	Reptiles	Amphibians	Fish	Significant fauna recorded
Fauna monitoring							
Fortescue Night Parrot Monitoring Procedure and Program (Adaptive NRM, 2021)	<10 km	0	1	0	0	0	Night parrot.
Nyidinghu Project: Baseline Significant Fauna Monitoring (Spectrum Ecology, 2023)	20 km	2 (1)	1	0	0	0	Night parrot, northern quoll.
Fortescue Metals Group: Annual Fauna Monitoring Program 2021 (Spectrum Ecology, 2021)	**Intersects**	**1**	**0**	**0**	**0**	**0**	**Northern quoll**
Fortescue Metals Group: Annual Fauna Monitoring Program 2022 – Operational Sites, Nullagine and North Star (Spectrum Ecology, 2022a)	**Intersects**	**1**	**0**	**0**	**0**	**0**	**Northern quoll**
Fortescue Metals Group: Annual Fauna Monitoring Program 2023 – Operational Sites, Nullagine and North Star (Spectrum Ecology, 2023a)	**Intersects**	**1**	**0**	**0**	**0**	**0**	**Northern quoll**
Bat and Bird Site Utilisation Surveys							
Bonney Downs Wind Farm: Bird and Bat Site Utilisation Report - Year 1 (ecologia, 2024b)	**Intersects**	**10**	**108**	**0**	**0**	**0**	**Grey falcon, Pilbara leaf-nosed bat.**

119°E 119,5°E 120°E 120,5°E 121°E

21°S 21,5°S 22°S 22,5°S 23°S

Study area
100km buffer

Level 1 Basic Assessment
- Christmas Creek Terrestrial Vertebrate Fauna Desktop Assessment
- Fauna Assessment, Cloud Break Airstrip, Camp and Access Road
- 11024 Christmas Creek Airstrip Flora, Vegetation & Fauna Assessment
- Solomon Project – Rail Camp Sites 1, 2 and 3, Fauna Assessment

Targeted Survey
- Fortescue Marsh Migratory Shorebird and Waterbird Survey
- Kutayi Project Targeted Night Parrot and Greater Bilby Survey
- Pilbara Transmission Project Targeted Flora and Fauna Survey
- Pre-clearance Greater Bilby and Mulgara Survey
- Targeted Surveys – Northern Quolls, Mulgara and Pilbara Olive Python
- Cloudbreak Expansion Project – Pre-clearance Night Parrot Survey
- Fauna Assessment of the Yandeyarra Area
- Vegetation and Fauna Habitat Mapping of the Northern Tenement Area, Cloudbreak
- Christmas Creek Exploration Drilling Program, Targeted Flora and Fauna Habitat Assessments Survey Report

Single-phase Detailed Survey
- Cloudbreak Level 2 Terrestrial Vertebrate Fauna Assessment
- Fauna Assessment Nyidinghu Iron Ore Project
- Christmas Creek Terrestrial Vertebrate Fauna and Fauna Habitat Assessment
- Fig Tree, Terrestrial Vertebrate Fauna Assessment

Multi-phase Detailed Survey
- Fauna Assessment of the BC Iron Nullagine Iron Ore Project
- Kutayi Project – Vertebrate Fauna Survey
- Fauna Habitats of the Proposed FMG Stage B Rail Corridor & Mindy Mindy, CC, Mt Lewin & Mt Nicholas
- Kutayi Level 2 Vertebrate Fauna Assessment
- Nyidinghu Iron Ore Project: Detailed Terrestrial Fauna Survey
- Nyidinghu Mine Terrestrial Vertebrate Fauna Assessment
- East Hamersley Rail Terrestrial Vertebrate Fauna Assessment
- Mindy South: Detailed and and Targeted Terrestrial Vertebrate Fauna Baseline Survey

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 9 December 2024
Coordinate System: GCS GDA 1994
Scale: 1:1,001,978 @A3

Map 8: Fortescue fauna surveys within 100km of the study area.

0 10 20 30 70 Kilometers

Earthstar Geographics

3 METHODOLOGY

3.1 SURVEY TIMING

The timing of two detailed fauna assessments and four fauna monitoring surveys undertaken within the study area in the past five years (2019-2024) are summarised in Table 10. A discussion of methodologies, survey timing, sampling effort and limitations associated with these reports is provided below. The current consolidation only considers surveys completed since 2019, as work completed more than five years ago is not considered relevant for Environmental Impact Assessment purposes. Additionally, surveys which only partially intersect the current study area were not included if they included few or no sampling sites within the study area, or if it was unclear whether sampling was undertaken within the study area.

3.1.1 Detailed Vertebrate Fauna Assessment

Both detailed fauna surveys included at least one survey phase undertaken within the optimal survey window (March-May) as defined by *Technical Guidelines: Terrestrial Vertebrate Fauna* (EPA, 2016). Additionally, both detailed surveys also include at least one survey phase within the optimal survey window for reptiles (September-April) as specified in the *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA, 2020).

Spectrum noted that higher-than-average rainfall was recorded in the 12-month period preceding both survey phases, with significant rainfall recorded between January and March 2024 (291 mm) (Spectrum Ecology, 2024). *ecologia* also noted higher-than-average rainfall prior to phase one survey commencement, with significant rainfall recorded in the three months prior to the phase 1 and phase 3 surveys (157.5 mm and 248.2 mm respectively). All surveys included in this consolidation had significant rainfall events immediately prior to (or during) at least one survey phase and are considered to have been undertaken during the optimal survey window for amphibian and bird surveys, as per EPA (2020).

The EPA guidelines do not stipulate an optimal timing for mammal surveys, therefore all surveys included in this consolidation are considered to be in compliance with the *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA, 2020).

3.1.2 Targeted Surveys and Significant Fauna Monitoring

Targeted northern quoll surveys included in the current consolidation were completed between May – August, in accordance with the optimal timing outlined in the EPBC Act *Referral Guideline for the Endangered Northern Quoll Dasyurus hallucatus* (Commonwealth of Australia, 2016). Annual monitoring of the northern quoll was undertaken at Nullagine between 2016-2023 in accordance with the northern quoll referral guidelines (Commonwealth of Australia, 2016) and Fortescue's NQMMP.

Targeted night parrot surveys included in the current consolidation were undertaken prior to the publication of the recent *Guidelines for Determining the Likely Presence and Habitat Usage of Night Parrot (Pezoporus occidentalis) in Western Australia* (DBCA, 2024). Night parrot surveys were undertaken in the months following significant rainfall events for both surveys included in this consolidation, which accords with the interim survey guidelines for the night parrot (DBCA, 2017b).

The *Guidelines for Surveys to Detect the Presence of Bilbies and Assess the Importance of Habitat in Western Australia* (DBCA, 2017a) do not specify an optimal window for targeted surveys for the species but instead focus on the detection of secondary evidence which may be undertaken at any time of year. No survey guidelines currently exist for the Pilbara olive python, Pilbara leaf-nosed bat, ghost bat, brush-tailed mulgara, western pebble-mound mouse or Fortescue grunter.

Table 10: Timing of detailed and targeted fauna surveys undertaken within the study area between 2019-2024. Green shading indicates detailed fauna surveys included in the current consolidation.

Report	Survey timing
Significant fauna monitoring	
Annual Fauna Monitoring Program 2021 (Spectrum Ecology, 2022)	**Northern quoll:** 12 June – 12 July, 2021
Annual Fauna Monitoring Program 2022 – Operational Sites, Nullagine and North Star (Spectrum Ecology, 2023)	**Northern quoll:** 29 June – 1 September, 2022
Annual Fauna Monitoring Program 2023 – Operational Sites, Nullagine and North Star (Spectrum Ecology, 2024)	**Northern quoll:** 29 June – 29 August, 2023
Multi-phase detailed fauna survey	
Bonney Downs North: Terrestrial Fauna Assessment (ecologia, 2024a)	**Phase 1:** 22 May – 2 June 2023 **Phase 2:** 9 - 19 October 2023 **Phase 3:** 16 - 28 March 2024 **Targeted:** 24 July – 2 August 2023
Bonney Downs South: Terrestrial Fauna Assessment (Spectrum Ecology, 2024)	**Phase 1:** 13 -25 October 2023 **Phase 2:** 4-14 April 2024 **Targeted camera installation:** 26 – 28 April 2024 (retrieved 46 days later)
Bird and Bat Site Utilisation Survey	
Bonney Downs Wind Farm: Bird and Bat Site Utilisation Report -Year 1 (ecologia, 2024b)	**Southward migration:** 12-19 October 2023 **Wet season:** 5-12 February 2024 **Northward migration:** 21-28 March 2024 **Dry season:** 17-24 June 2024

3.2 SITE SELECTION

Site selection was undertaken based on the indicative habitat types identified within each survey area and was in accordance with the *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020)*, which specifies that a minimum of two trapping sites should be installed within each habitat type. The abundance and significance of habitat types was taken into consideration in selecting fauna trapping sites within the survey area, with widespread and significant habitat types receiving greater systematic trapping effort. Apart from the Granite Outcrops (flat dome) and Gorges/Gullies and Woodland (open/closed) habitat types, at least two systematic sampling sites were installed within each of the remaining nine habitat types identified within the study area.

Given the limited extent of the Granite Outcrops, Gorges/Gullies, Woodland (open) and Woodland (closed) habitat types, which each represent <1.0% of the study area, the installation of a single trapping site within these habitat types is unlikely to represent a significant limitation as these habitat types are unlikely to support additional significant fauna taxa or fauna assemblages which were not recorded elsewhere. Additional targeted and active search methodologies were utilised in these habitat types to ensure a representative fauna assemblage was recorded.

Habitat types poorly represented by systematic trapping sites were sampled using additional sampling methods (motion cameras, ARUs, cage traps and spotlighting) and targeted searches, with specific focus on potentially sensitive habitats and habitat types with the potential to support significant species.

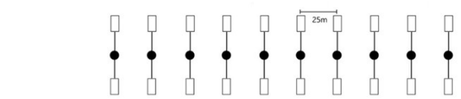
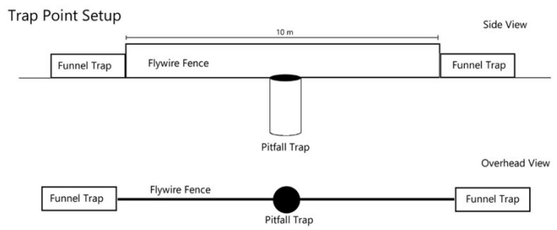
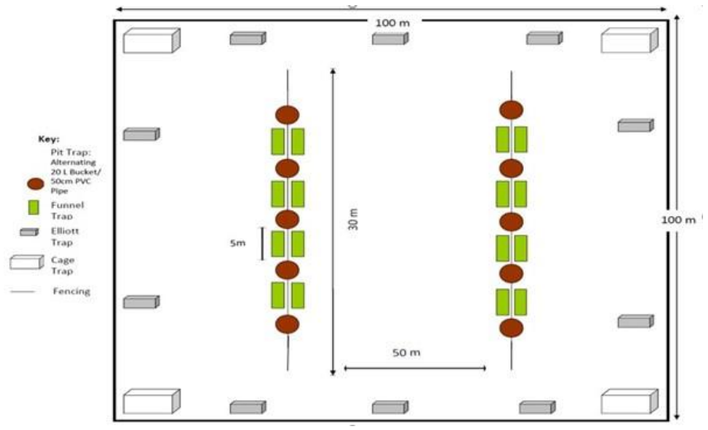
3.3 SAMPLING METHODS

All surveys were undertaken using a variety of sampling techniques, including systematic, targeted and opportunistic methodologies in accordance with *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA, 2020). Broad methods utilised during vertebrate fauna surveys undertaken at Bonney Downs are summarised in Table 11 below, with detailed methodologies provided in each respective report.

The locations of sampling sites associated with the Bonney Downs North (ecologia, 2024a), Bonney Downs South (Spectrum Ecology, 2024) and Bonney Downs BBSUS (ecologia, 2024b) are shown in Map 9-Map 13.

Table 11: Survey methodologies utilised at Bonney Downs.

Technique	Spectrum Ecology methods (Bonney South)	*ecologia* methods (Bonney North and BBSUS)	Purpose and target groups	Sites	
				North	South
Habitat assessment	Fauna habitats were described by considering landforms, land systems, geology, and vegetation. These determine the fauna assemblage and the occurrence of significant fauna at a defined location. The assessment included photographs and descriptions.	Habitat assessments were undertaken within the study areas at sites considered representative of each habitat type. Habitat assessments were also undertaken at each systematic trapping site. The following parameters were recorded: • broad habitat type; • habitat condition • digital photographs; • landform type; • soil colour, type and characteristics; • type and extent of non-vegetative surface cover; • type of vegetation in lower, middle and upper strata; • observable fire history and evidence of any disturbance; • presence and extent of leaf litter and coarse woody debris; • presence of, or distance to, water sources; • presence of significant microhabitats such as tree hollows and rocky outcrops; and • notes on suitability for hosting significant fauna.	• Habitat assessment and habitat mapping • Significant fauna habitat identification and delineation	BHA01-BHA02, BDHA1, BDHA01-BDHA04, BBD02-BBD07, BPHA01, BDBAT01	BDS HAB01- BDS HAB19
Systematic pitfall trapping site	**Pitfall traps:** 5 x 20 L bucket and 5 x 50 cm PVC pipe pitfall traps, dug into the ground to act as pitfall traps. A 10 m long, 30 cm high fence was also installed, passing across the top of each pit to direct fauna into it. **Funnel traps:** placed at the ends of each fence to capture fauna that are not readily caught in pitfall traps (20 per trapping grid). All funnel traps were covered with shades to reduce the likelihood of animals suffering from overheating. Layout of a trap site and a single trap line is shown below. Ten trapping lines per site. Traps were left open for seven nights.	**Pitfall traps:** Alternating series of 20 L buckets and 50 cm PVC pipe pitfall traps (five pits per line, 10 per site), dug into the ground to act as pitfall traps. No pits installed at sites situated on ridgelines, mesas gullies or escarpments. A 30 m long, 30 cm high fence was also installed per line, passing across the top of each pit to direct fauna into it. Shades provided to provide thermal protection and shelter for trapped animals. **Funnel traps**: placed at the ends of each fence to capture fauna that are not readily caught in pitfall traps (eight per trapping line, 16 per trapping site). At sites established within rocky habitats, additional funnel traps were used in the place of pitfall traps (10 per line, 20 per site). All funnel traps were covered with shades to reduce the likelihood of animals suffering from overheating. **Elliott traps:** five aluminium Elliott traps per line (10 per trapping site) baited with balls of 'universal bait' (oats, peanut butter and sardines). All Elliott traps were covered by shades to reduce the likelihood of animals suffering from overheating. **Cage traps:** four large, wire-framed Sheffield traps (22 cm x 22 cm x 55 cm) per line (four per trapping site) baited with balls of 'universal bait'. All cage traps were covered by shades to reduce the likelihood of animals suffering from overheating. Layout of a trap site is shown below. Two trapping lines per site. Traps were left open for at least seven nights and checked twice daily (when temperatures exceeded 26°C) within three hours of dawn and post-peak reptile activity periods.	• Baseline fauna assemblage • Mammals (small-medium sized non-volant) • Reptiles • Amphibians • Significant fauna	BDDP01- BDDP23	BDS 02- BDS 12

Technique	Spectrum Ecology methods (Bonney South)	*ecologia* methods (Bonney North and BBSUS)	Purpose and target groups	Sites	
				North	South
Systematic trapping layout	Trapping Grid Overhead View  Trap Point Setup  	 	• Baseline fauna assemblage • Mammals (small-medium sized non-volant) • Reptiles • Amphibians • Significant fauna	BDDP01-BDDP23	BDS 02- BDS 12
Targeted trapping site	**Elliott traps & cage traps**: aluminium box traps were installed in suitable habitat (rocky ridges or major creek line), baited with 'universal bait' to attract and capture smaller mammals, and re-baited as required (as a minimum every second day). All Elliott and cage traps were covered by shades to reduce the likelihood of animals suffering from overheating. Traps were left open for four nights.	N/A. This is encompassed in ecologia's systematic trapping methodology and other targeted methods detailed below.	• Mammals (small, non-volant)	N/A	BDS S1 (cages), BDS 11-E (Elliott)
Systematic bird surveys (detailed survey)	Area searches (30-minute set-time searches of 2 ha areas) were used to document the bird assemblage present at each of the systematic fauna trapping sites. During each area search an ornithologist recorded the number of individuals of each species observed while actively searching similar habitat within a 2ha area surrounding the trapping site. Survey effort was concentrated within three hours of dawn or dusk, as these times are considered optimal for recording most bird species.	Set-time surveys (20-minute set-time searches of 2 ha areas) were used to document the avifauna assemblage present at each of the systematic fauna trapping sites. During each survey the number of individuals of each species observed were recorded while actively searching similar habitat within a 2ha area surrounding the trapping site. Survey methods utilised were in accordance with systematic survey methods recommended by BirdLife Australia. All avifauna surveys are conducted within three hours of dawn and dusk, during the peak activity period for most bird species.	•Birds • Significant fauna	BDDP01-BDDP23	BDS S2-Bird, BDS 02-Bird1- BDS 12-Bird1, BDS Dam1, BDS Windmill 01, BDS Windmill 02, BDS Driving Bird1, BDS OPP Homestead, BDS OPP01, BDS OPP05, BDS OPP06, BDS OPP08- BDS OPP12, BDS OPP14, BDS OPP15, BDS OPP18- BDS OPP21
Bird and Bat Site Utilisation Surveys (BBSUS)	N/A	Bird and Bat site Utilisation Surveys (BBSUSs) were undertaken at 40 sites across the combined Bonney Downs study area concurrently with the October 2023 and March 2024 detailed fauna surveys. Thirty-minute fixed time surveys were undertaken at each site to record avifauna assemblages and behaviour and understand how each species is utilising the site. Each site was surveyed once within three hours of sunrise, once at mid-day and once within three hours of sunset (three surveys total) during each survey phase. Avifauna assemblages recorded at BBSUS sites have been incorporated into the species list for the current surveys.	• Birds • Significant fauna	BB001-BB040	
Active searches	N/A	Each systematic trapping site was actively searched for a period of 30 minutes to identify cryptic reptile and mammal species. Search methods utilised include but were not limited to sifting leaf litter, searching under and around old logs, stumps, and dead free-standing trees, investigating burrows and over-turning logs and stones.	• Mammals • Reptiles •Amphibians •Birds • Significant fauna	BDDP01-BDDP23	N/A

Technique	Spectrum Ecology methods (Bonney South)	*ecologia* methods (Bonney North and BBSUS)	Purpose and target groups	Sites	
				North	South
Opportunistic sampling/Opportunistic site/Basic site	Fauna species not recorded through other sampling methods were opportunistically sampled as encountered in the study area. Opportunistic sampling also included recording locations of significant and introduced species. Information collected at each site included some, or all of the following: • Site code, date, location, zoologist; • A photograph; • Vegetation condition and disturbances (including fire); • Landform including slope, soil, rock type, aspect; • Vegetation community type and density; and • Fauna present.	Fauna species not recorded through other sampling methods were opportunistically sampled as encountered in the study area. Opportunistic sampling also included recording locations of significant and introduced species. Opportunistic avifauna surveys were conducted at sites considered to potentially support a different avifauna assemblage to systematic trapping locations, focussing on water sources and habitats with flowering shrubs or other important foraging resources.	•Mammals •Reptiles •Amphibians •Birds •Fish • Significant fauna	Various fauna records (no set site codes)	BSD PMM01- BSD PMM03, BDS OPP02- BDS OPP04, BDS OPP17, BDS OPP 22- BDS OPP 36, BDS Camp 2, BDS Driving 1- BDS Driving 10 BDS PMM01-BDS PMM02
Targeted searches	Areas likely to support significant fauna were targeted during the survey. Areas were selected based on existing records from previous surveys, database searches, geology, aerial imagery, and vegetation mapping.	Areas likely to support significant fauna were targeted during the survey. Areas were selected based on existing records from previous surveys, database searches, geology, aerial imagery, and vegetation mapping. Supplementary search effort was undertaken in habitats likely to support significant fauna and habitats poorly represented by systematic trapping sites (due to accessibility and/or extent within the study area). Grey falcon search transects were undertaken on foot within the Drainage Line/River/Creek (major) habitat type to identify suitably sized nests or primary sightings of the species. Particular focus was given to identifying intact nests located in large eucalypts or telecommunication towers, of a suitable size and condition to be utilised by grey falcons (Schoenjahn *et al.* 2020). Targeted searches were undertaken during the grey falcon breeding season (June-November) when detectability of the species and confirmation of nest utilisation is likely to be higher (Schoenjahn *et al.* 2020). Suitable nests were recorded, and secondary evidence of recent use (if present) was documented during searches of feeding debris and mutes within the drop zone below the nest. Targeted survey effort for the grey falcon was primarily focused within Drainage Line/River/Creek (major) habitat associated with Bonnie Creek, as this habitat type represents suitable breeding and foraging habitat for the species. Cave floors were inspected for northern quoll scat, ghost bat scat/middens and olive python sloughs during targeted searches in rocky habitats. Permanent water bodies were investigated for evidence of Pilbara olive python occupancy.	• Significant fauna (grey falcon, northern quoll, ghost bat, Pilbara olive python)	134 person hours (Phase 1-3, targeted surveys)	BDS GF01-BDS GF13, BDS TAS01- BDS TAS10
Motion cameras	Motion sensitive cameras capable of recording both normal (day) and infra-red (night) images were deployed in areas of interest, such as near permanent water or in gorges, to record cryptic or targeted species not normally recorded by other survey methods. In addition, suitable habitat for significant fauna likely to occur were targeted to determine their presence or absence. Motion cameras were baited with non-food reward baits (cotton rope soaked in fish oil).	Motion sensitive cameras capable of recording both normal (day) and infra-red (night) images were deployed in areas of interest, such as near permanent water or in gorges, to record cryptic or targeted species not normally recorded by other survey methods. In addition, suitable habitat for significant fauna likely to occur were targeted to determine their presence or absence. Targeted surveys for the northern quoll were undertaken using Reconyx HC500 Hyperfire, Browning Patriot Trail and X-Trail 3CR motion cameras. Cameras were set in linear transects, spaced at intervals of 100-200m, to facilitate northern quoll population analysis and identify other cryptic nocturnal species that inhabit rocky habitats. Seven motion camera transects (BDQT01-BDT07) were deployed at Bonney Downs North during the phase one detailed survey and retrieved during the first targeted survey. An additional five transects (BDQT08-BDQT12) were deployed at Bonney Downs North on the 13th of February 2024 and retrieved during the phase three detailed fauna survey. Cameras were set specifically to target northern quolls using methods outlined in Hohnen et al.	•Mammals •Reptiles • Birds • Significant fauna	B01-B20, BDMC01- BDMC39, RC21, RC32, RC36, RC38, RC47	BSD MC1.1- BSD MC1.5, BDS MC2.1- BDS MC2.5, BDS MC3.1- BDS MC3.5, BDS MC4.1- BDS MC4.5, BCS MC5.1- BCS MC5.5, BDS MC6.1- BDS MC6.5, BDS MC7.1-BDS MC7.5, BDS MUL MC1, BDS PMM MC1

Technique	Spectrum Ecology methods (Bonney South)	*ecologia* methods (Bonney North and BBSUS)	Purpose and target groups	Sites	
				North	South
		(2013), enabling spot pattern analysis on captured individuals. Photographs were analysed post survey, and the entire suite of recorded fauna were identified. Each camera was set to record five images concurrently with no minimum time delay between triggers. Cameras were baited with a non-consumable sardine lure to encourage animals to occupy the camera's field of view and increase the number of camera trap photos available for identification purposes. All cameras were able to be triggered by movement using highly sensitive, passive infra-red motion sensors that function during the day and night.			
Ultrasonic Recording Units (ARUs)	Bat echolocation calls were recorded using Wildlife Acoustics SM4BAT ultrasonic recorders. The ARU devices record the full spectrum of calls allowing greater accuracy and sensitivity when identifying bat species. Each ARU device was programmed to record from 30 minutes pre-dusk to 30 minutes post-dawn for each night and deployed for a minimum of three nights.	Bat echolocation calls were recorded using Wildlife Acoustics SM4BAT and Titley Chorus ultrasonic recorders. The ARU devices record the full spectrum of calls allowing greater accuracy and sensitivity when identifying bat species. Each ARU device was programmed to record from 30 minutes pre-dusk to 30 minutes post-dawn for each night and deployed for a minimum of three nights. ARUs were deployed with microphones facing towards the sky at a height of at least 1m above the ground, to record bat echolocation calls in the vicinity of the device. ARUs were deployed at all systematic survey and BBSUS sites, prospective cave entrances and potential flightpaths within the study area to identify foraging and roosting habitat within the study area. Echolocation calls recorded were analysed by bat specialist Dr Kyle Armstrong. To provide an indication of site proximity to a potential roost location, the period between sunset and the first detection, and the period between the last detection and sunrise was calculated. The presence or absence of low time calls (within 20 minutes of sunset or sunrise) are used to indicate proximity of the detector to a potential roost location.	• Bats	BB001-BB040, BBD01, BDBD02-BDBD07, BDTBD01-BDTBD04, BDOPP1	BDS S2- Bat2, BDS 02- Bat1 - BDS12-Bat1, BDS Dam-Bat1, BDS Windmill 02-Bat1, BDS Homestead-Bat1, BDS TAS03-Bat1, BDS Dam-Bat2, BDS OPP1-Bat2- BDS OPP3-Bat2, BDS 06- Bat2, BDS 09- Bat2- BDS 12- Bat2, BDS OPP13-Bat1, BDS OPP16-Bat1
Ghost bat lures	N/A	Each lure consists of one portable speaker, two camera traps, two infrared spotlights and a bat detector. Portable speakers were loaded with a micro-SD card containing a sequence of sound files containing 'squabble' calls of the ghost bat (sensu Hanrahan et al. 2023), with sound files played for a 2-minute period, followed by a 2-minute period of silence. Each camera trap was programmed to record 3-minute black and white video files at high resolution continuously upon start up. Infrared spotlights were set to turn on when ambient illumination levels drop below the threshold required for quality colour video recordings. A bat detector was placed on the star picket, below the portable speaker to maximise the chance of echolocation call detection if a ghost bat approached the speaker. Each site was sampled for a single night, before the lure was relocated to a new location, ensuring that behavioural impacts associated with sampling over repeated nights are avoided. All sites sampled on the same night were located a minimum of 10km apart to avoid interference or movement of bats between sites. The distance at which ghost bats can hear the signals at night is unknown but assumed to be at least 100m (Kyle Armstrong, pers. comm.). Ghost bats can be distinguished in infrared and thermal video recordings from other bat species and insects based on the observation of any combination of the following morphological and behavioural features that provide an empirical basis for the identification: • flight pattern (four distinct behaviours classified as: 'circling' of the post containing the speaker; 'hover' in front of the speaker; 'long glide' towards the speaker; and 'drop in' whereby they would sometimes approach at c. 2 m above	• Ghost bat	BDGB01-BDGB07	N/A

Technique	Spectrum Ecology methods (Bonney South)	*ecologia* methods (Bonney North and BBSUS)	Purpose and target groups	Sites	
				North	South
		the speaker and then drop vertically towards it); • body size relative to other objects in the frame; • large ear size; • lack of a tail; • bright eyeshine of the reflected infrared light from their large eyes (infrared recordings only, though not always visible); and • corroboration with concurrently recorded diagnostic echolocation calls. All bats observed in videos are examined by single manual frame advancement to check for diagnostic features. The relatively high resolution and video frame rate provides a reasonable level of image quality.			
Ghost bat lure layout	N/A		• Ghost bat	BDGB01-BDGB07	N/A
Acoustic Recording Units (ARUs)	Wildlife Acoustics Song Meter SM4 recording units were deployed in suitable night parrot foraging habitat. Each recorder was programmed to record from 30 minutes pre-dusk to 30 minutes post-dawn for each night and deployed for six nights.	Targeted night parrot surveys were undertaken within suitable roosting (long-unburnt spinifex) and suitable foraging habitat. The surveys were undertaken in the months following significant rainfall events when breeding is more likely to occur and therefore, detectability of the species is expected to be higher. ARUs were deployed in areas supporting old, long unburnt spinifex (with particular focus on the species *Triodia longiceps*), as these areas represent prospective night parrot roosting habitat within the study area. Wildlife Acoustics Song Meter SM4 recording units were deployed in suitable foraging habitat. Each recorder was programmed to record from 30 minutes pre-dusk to 30 minutes post-dawn for each night and deployed for a minimum of six nights. As surveys were undertaken prior to the publication of the *Guidelines for determining the likely presence and habitat usage of night parrot (Pezoporus occidentalis) in Western Australia* (DBCA 2024), methodologies utilised may exhibit slight variations to those outlined in this document.	•Night parrot	BDNP01-BDNP09	BDS 01-PAR2, BDS 03-PAR2, BDS 04-PAR2, BDS 07-PAR2, BDS 10-PAR2, BDS 12-PAR2
Nocturnal spotlighting	Nocturnal spotlighting was conducted from vehicles and on foot to target the Pilbara olive-python and other cryptic, nocturnal fauna species.	Nocturnal spotlighting was conducted from vehicles and on foot to target the Pilbara olive-python and other cryptic, nocturnal fauna species.	• Reptiles • Nocturnal mammals • Nocturnal birds	76 person hours	BDS N1- BDS N7

3.4 SURVEY EFFORT

Extensive consolidated survey work has been undertaken within the study area, as shown in Table 12.

Table 12: Cumulative survey effort undertaken within the study area between 2021-2024.

Survey reference	Study area	Sampling year	Systematic trapping (pit, cage, Elliott and funnel)	Targeted cage/Elliott traps	Camera traps	Avifauna surveys	Active searches	ARU (acoustic)	ARU (ultrasonic)	Spotlighting	Ghost bat lure	Targeted searches
Ecologia Environment (ecologia, 2024a)	Bonney Downs North	2023-2024	9,260 trap nights (23 sites)	-	2,274 recording nights (64 cameras)	123 hours	94 hours	60 recording nights (nine sites)	119 recording nights (41 sites)	76 hours	7 nights (7 sites)	134 hours (falcons) + 64 hours (quolls and bats)
Spectrum Ecology (Spectrum Ecology, 2024)	Bonney Downs South	2023-2024	4,630 trap nights (11 sites)	790 trap nights (Elliott) + 224 trap nights (cage)	1,610 nights (37 cameras)	57 hours	34 hours	38 recording nights (six sites)	40 recording nights (17 sites)	23.2 hours	-	21 hours (grey falcon), 8 hours (Migratory birds), 20 hours (olive python- diurnal searches at waterbodies and gorges/gullies), 8 hours of bilby searches
Ecologia Environment (ecologia, 2024b)	Bonney Downs BBSUS	2023-2024	-	-	-	240 hours	-	-	320 recording nights (40 sites)	-	-	-
Spectrum Ecology (2024)	Nullagine	2023	-	-	600 recording nights (20 cameras)	-	-	-	-	-	-	10 hours (northern quolls)
Spectrum Ecology (2023)	Nullagine	2022	-	-	600 recording nights (20 cameras)	-	-	-	-	-	-	10 hours (northern quolls)
Spectrum Ecology (2022)	Nullagine	2021	-	-	800 recording nights (20 cameras)	-	-	-	-	-	-	10 hours (northern quolls)
Total			13,890 (34 sites)	790 trap nights (Elliott) + 224 trap nights (cage)	5,884 nights (161 cameras)	420 hours	128 hours	98 recording nights (15 sites)	479 recording nights (98 sites)	99.2 hours	7 nights (7 sites)	134 hours (falcons), 94 hours (northern quoll), 64 hours (bats), 8 hours (Migratory birds), 20 hours diurnal searches (olive python), 8 hours (bilby)

119.7°E
119.8°E
119.9°E
120°E
120.1°E
21.9°S
22°S
22.1°S
22.2°S
22.3°S
22.4°S

Survey area

Ecologia (2024) Bonney North
- Fauna: Trap Site
- Fauna: Habitat Assessment
- Fauna: Motion Camera
- Fauna: Sound Recorder
- Fauna: Ghost bat lure

Spectrum (2024) Bonney South
- Acoustic recording unit
- Bat recorder
- Habitat assessment
- Motion Camera
- Nocturnal search
- Opportunistic
- Systematic Survey
- Systematic trapping
- Targeted active search

Ecologia (2024) BBSUS
- BBSUS site

Habitat type
- Cleared
- Drainage Line/River/Creek (major)
- Drainage Line/River/Creek (minor)
- Gorges/Gullies
- Granite Outcrops (flat dome)
- Hills/Ranges/Plateaux
- Plain (Cracking clays)
- Plain (stony/gibber)
- Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)
- Woodland (closed)
- Woodland (open)

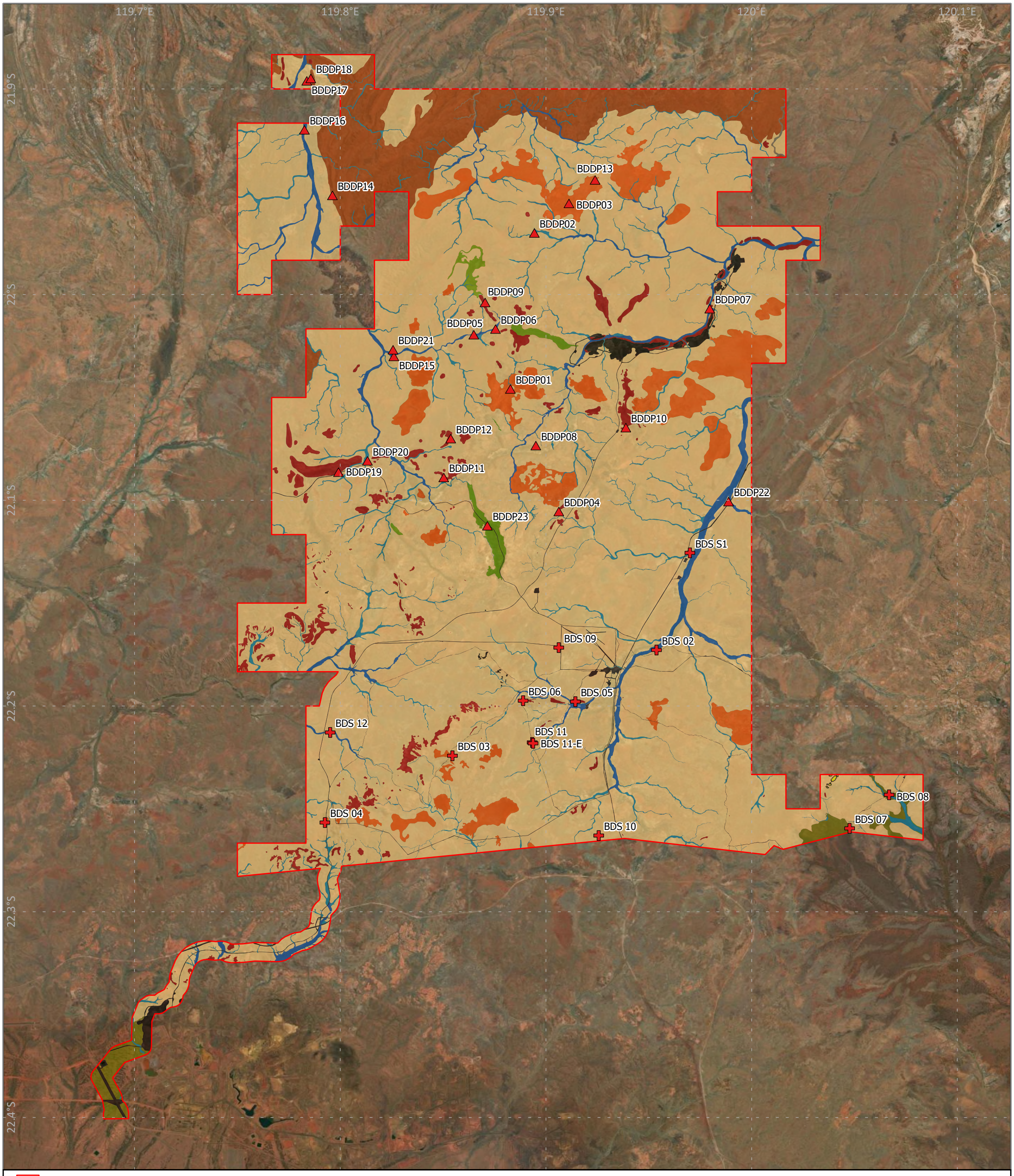
ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 4 October 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Earthstar Geographics

Map 9: Locations of all survey sites (consolidated survey effort).

0 2 4 6 10 Kilometers



Survey area

Spectrum (2024) Bonney South

Systematic trapping

Ecologia (2024) Bonney North

Fauna: Trap Site

Habitat type

- Cleared
- Drainage Line/River/Creek (major)
- Drainage Line/River/Creek (minor)
- Gorges/Gullies
- Granite Outcrops (flat dome)
- Hills/Ranges/Plateaux
- Plain (Cracking clays)
- Plain (stony/gibber)
- Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)
- Woodland (closed)
- Woodland (open)

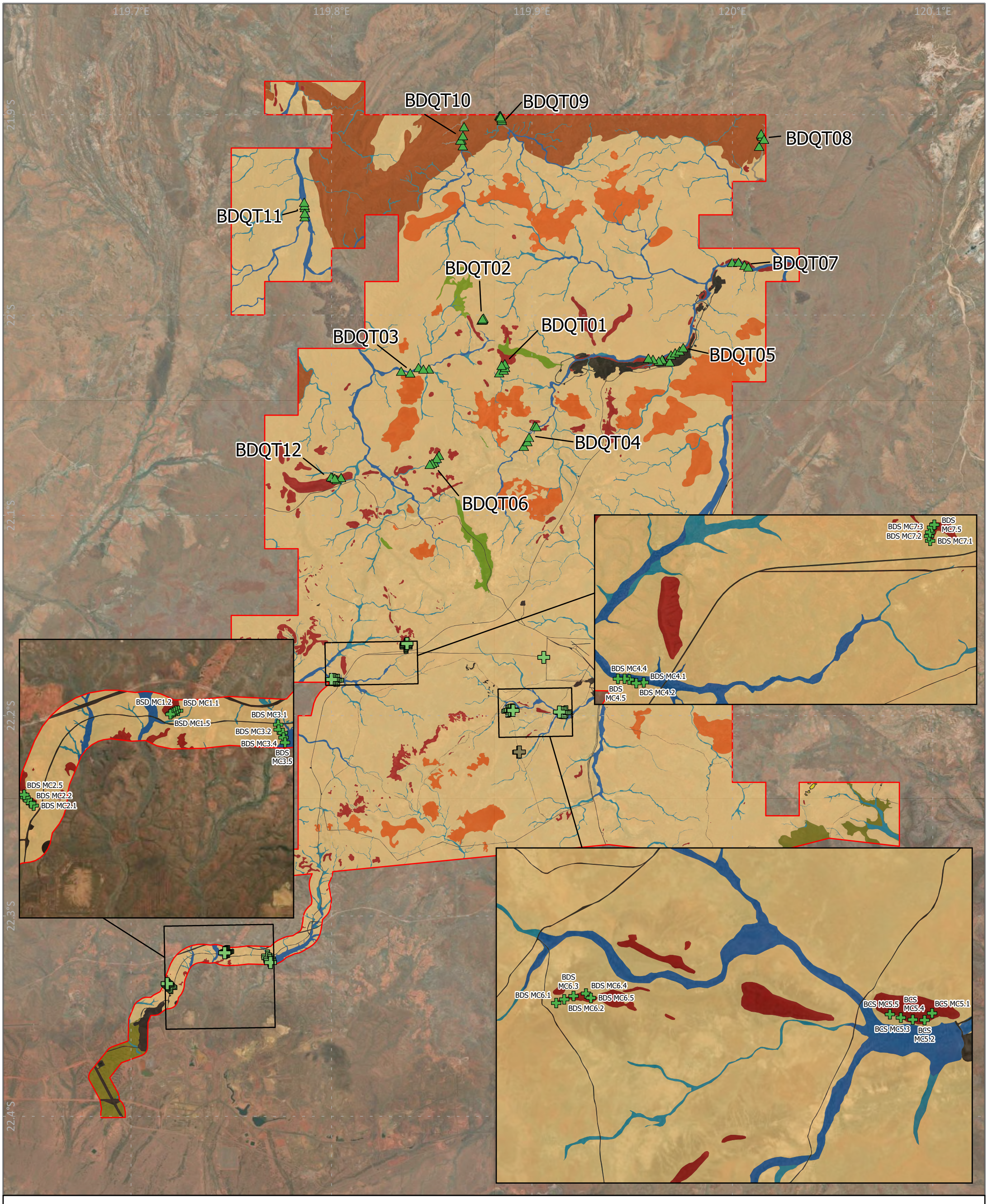
ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 4 October 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Earthstar Geographics

Map 10: Locations of systematic survey sites (consolidated survey effort).

0 2 4 6 10 Kilometers



Survey area

Ecologia (2024) Bonney North

Fauna: Motion Camera

Spectrum (2024) Bonney South

Fauna: Motion Camera

Fauna: Trap Site (Cage)

Habitat type

- Cleared
- Drainage Line/River/Creek (major)
- Drainage Line/River/Creek (minor)
- Gorges/Gullies
- Granite Outcrops (flat dome)
- Hills/Ranges/Plateaux
- Plain (Cracking clays)
- Plain (stony/gibber)
- Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)
- Woodland (closed)
- Woodland (open)

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 24 October 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 11: Locations of camera traps, cage traps and Elliott traps (consolidated survey effort).

0 2 4 6 10 Kilometers

Earthstar Geographics, Maxar

119.6667°E
119.75°E
119.8333°E
119.9167°E
120°E
120.0833°E
21.9167°S
22°S
22.0833°S
22.1667°S
22.25°S
22.3333°S

Survey area

Ecologia (2024) Bonney North
- Bat detector
- Night parrot detector
- Ghost bat lure

Spectrum (2024) Bonney South
- Bat detector
- Night parrot detector

Ecologia (2024) BBSUS
- Bat detector

Habitat type
- Cleared
- Drainage Line/River/Creek (major)
- Drainage Line/River/Creek (minor)
- Gorges/Gullies
- Granite Outcrops (flat dome)
- Hills/Ranges/Plateaux
- Plain (Cracking clays)
- Plain (stony/gibber)
- Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)
- Woodland (closed)
- Woodland (open)

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 24 October 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 12: Locations of Autonomous Recording Units (ARUs) and ghost bat lures (consolidated survey effort).

0 2 4 6 10 Kilometers

Earthstar Geographics

Survey area

Ecologia (2024) Bonney North

Grey falcon searches - walking

Stick nest

Spectrum (2024) Bonney South

Targeted active search

Ecologia (2024) BBSUS

Grey falcon searches - driving

Habitat type

Cleared

Drainage Line/River/Creek (major)

Drainage Line/River/Creek (minor)

Gorges/Gullies

Granite Outcrops (flat dome)

Hills/Ranges/Plateaux

Plain (Cracking clays)

Plain (stony/gibber)

Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)

Woodland (closed)

Woodland (open)

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 4 October 2021
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 13: Locations of targeted grey falcon searches (consolidated survey effort).

0 2 4 6 10 Kilometers

Earthstar Geographics

3.5 TAXONOMY AND NOMENCLATURE

Nomenclature for birds, mammals, reptiles and amphibians within this report is as per the WAM Checklist of the Vertebrates of Western Australia (November 2024). Key taxonomic references and field guides used for fauna identification are listed in Table 13.

Table 13: References used for identification.

Fauna group	Reference
Mammals	Menkhorst and Knight (2011), Van Dyck *et al.* (2013)
Bats	Churchill (2008), Menkhorst and Knight (2011)
Birds	Pizzey et al. (2013)
Reptiles	Cogger (2018), Wilson and Swan (2021)
Amphibians	Frog ID App (FrogID 2023)
Fish	Allen et al. (2002)

3.6 STUDY TEAM AND LICENCES

The consolidation was planned, coordinated, executed, and reported by those summarised below in Table 14

Table 14: Study team and licences.

Project staff				
Name	**Qualification**	**Experience**	**Position**	**Role**
Shaun Grein	B. Sc. Biol.; Grad. Dip. Nat. Resources; MBA	>30yrs	Managing Director/Senior Principal Scientist	Project management, QA
Tim McCabe	B.Sc. Env. Biol, Dip Proj Mngment, Cert III Vert Pest Mngment	>15 yrs	Principal Zoologist	Reporting, GIS
Claudia Elliott	B.Sc. Cons. Biol. & Zool.; MWildlifeHth	>8 yrs	Senior Zoologist	GIS, reporting
Sam Plant	B. Sc WildlifeBiol. EnvSc.; MWildlifeHth; Cert II ConsLandMngment.	>5 yrs	Zoologist	GIS, reporting

3.7 LIMITATIONS AND CONSTRAINTS

An assessment of survey-specific issues and limitations is detailed in Table 15.

Table 15: Fauna survey limitations.

Aspect	Comment	Limitation
Competency/experience of the consultant carrying out the survey.	The lead zoologists coordinating surveys included in the current consolidation have >15 years' experience and all other zoologists involved in the fauna surveys had between 1-12 years' experience working within the Pilbara region. Bat call analysis was undertaken by Dr Kyle Armstrong of Specialised Zoological (>20 yrs experience) for all projects Night parrot call analysis was undertaken by Dr Nick Leseberg of Adaptive NRM (>8 years' experience) for all projects	Nil
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	All survey scopes were well defined. Terrestrial vertebrate fauna and their habitats were mapped and described using standardised and well-established techniques and previous survey work in the vicinity of the study area were used to provide contextual information. All vertebrate fauna groups occurring within the study area were adequately sampled.	Nil
Proportion of fauna identified, recorded and/or collected.	The inventory of 237 vertebrate fauna taxa recorded within the study area represents 63.5% of the total faunal assemblage identified from database searches and surveys in the vicinity of the study area (n=373). All taxonomic groups were represented and species richness exceeded that recorded by the majority of single- and multi-phase detailed fauna surveys identified from the literature review. This is likely attributable to favourable seasonal conditions (increased rainfall) and high survey intensity.	Nil
Sources of information (previously available information as distinct from new data).	Extensive database records (public databases, DBCA Threatened and Priority fauna databases and Fortescue internal databases), were available for the area and provided adequate contextual information for the study. Spatial data and reports associated with three recent surveys and three significant fauna monitoring reports were available for the consolidation.	Nil
The proportion of the task achieved and further work which might be needed.	Planned survey works were conducted and completed. Additional survey work may be required to ensure compliance with the new night parrot guidelines published in 2024 (DBCA, 2024).	Minor
Timing/weather/season/cycle.	All surveys included at least one phase conducted during the optimal survey window (March-May) outlined in *Technical Guidelines: Terrestrial Vertebrate Fauna*. Additionally, all surveys included at least one survey phase within the optimal survey timing for reptiles (September-April) in accordance with *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*. All surveys included in the current consolidation included at least one survey phase immediately after (or during) significant rainfall events, coinciding with optimal timing for amphibians and birds. Significant fauna surveys were undertaken during the appropriate seasons, as specified by relevant guidelines and guidance statements.	Nil
Disturbances which affected results of the survey (e.g. fire, flood, accidental human intervention).	Although a small portion (0.99%) of the study area encompasses areas associated with clearing for tracks or other infrastructure, these areas were generally able to be avoided when sampling habitat within the study area. As the study area encompasses a working cattle station, cattle grazing was widespread throughout portions of the study area and may have resulted in decreased species diversity in these areas. This is considered unlikely to have had a significant impact on survey outcomes.	Nil
Intensity (in retrospect was the intensity adequate).	No systematic sampling was undertaken with the Granite Outcrop (flat dome) or Gorges/Gullies; however, as both habitat types only represents 0.10% of the study area, this is not considered a	Negligible

Aspect	Comment	Limitation
	significant limitation. Similarly, only a single trapping site was established within the Woodland (open) habitat type, due to the small extent of this habitat type within the study area (<1%). All other habitat types were represented by two or more systematic trapping sites in accordance with the *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*. Where pitfall traps were unable to be installed in rocky habitats, alternative systematic trapping methods and targeted searches were utilised to ensure the full species assemblage present was recorded.	
Completeness (e.g. was relevant area fully surveyed).	Each of the surveys included in the current consolidation were completed according to the scope of works provided by Fortescue. Relevant areas were fully surveyed.	Nil
Resources (e.g. degree of expertise available in animal identification to taxon level).	Resources were adequate to carry out the surveys and survey participants were competent in the identification of species. There were no resource issues encountered.	Nil
Remoteness and/or access problems.	Remoteness and/or access restrictions are not considered a limitation for the purposes of the current consolidation, as representative areas were able to be sampled elsewhere in the study area. A helicopter was utilised at Bonney Downs North to allow access to the northern portion of the survey area and ensure targeted sampling was undertaken in these parts of the study area. A helicopter was unable to be utilised at Bonney Downs South, due to conflicts with mustering being undertaken by pastoralists; however, representative habitat was able to be sampled, and this is only considered a minor limitation. All other areas of the study area were able to be accessed either via vehicle or on foot.	Negligible
Availability of contextual (e.g. biogeographic) information on the region.	Sufficient contextual information was available for the Pilbara region and the study area. An extensive literature review was undertaken utilising public databases and internal resources to ensure that relevant contextual information sources were identified and utilised.	Nil
Efficacy of sampling methods (i.e. any groups not sampled by survey methods).	Sampling methods are considered adequate for detailed and targeted vertebrate fauna surveys. Methods utilised were in accordance with those outlined in the *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* and relevant significant fauna survey guidelines. The fauna assemblage recorded within the study area included in the current consolidation includes all faunal groups likely to occur within the study area.	Nil

4 RESULTS AND DISCUSSION

4.1 FAUNA HABITAT

Fauna habitat assessments were undertaken to describe and map fauna habitat types with the potential to support significant fauna species within the study area. After assessing the fauna habitat types identified, based on vegetation types, soil units, and landforms present, 10 broad fauna habitat types were identified within the study area: Woodland (open), Woodland (closed), Plain (stony/gibber), Plain (cracking clays), Hills/Ranges/Plateaux, Gorges/Gullies, Granite Outcrops (flat dome), Drainage Line/River/Creek (major), Drainage Line/River/Creek (minor) and Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways) (Table 16, Map 14). An additional 0.99% of the study area was mapped as Cleared, lacking suitable habitat for terrestrial vertebrate fauna. Fauna habitat assessment data sheets are provided in Appendix E.

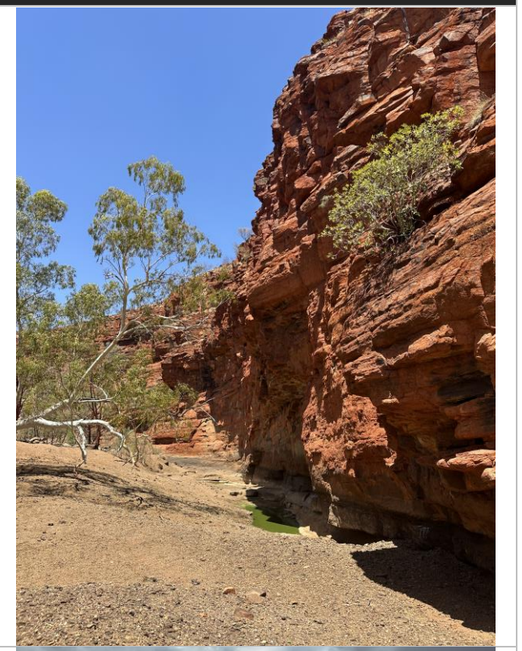
From a local perspective, habitat features that are disjunct and provide sources of shelter, food and mesic qualities required for restricted species may be considered important. The Plain (stony/gibber) (79.17%) habitat type was the dominant feature of the study area, with widespread grazing and trampling disturbances from European cattle documented throughout these areas.

Bonney Creek, Bonney Pools, the Nullagine River and the Coongan River provide seasonal habitat for amphibians and fish in addition to water sources for terrestrial fauna and aquatic birds. Ephemeral inundation of these habitats and the station dam may also provide refuge for Migratory birds travelling to the Fortescue Marsh.

Table 16: Fauna habitats identified within the study area.

Broad habitat type	Area (ha)	%	Sampling effort*	Vegetation description	Fauna suitability	Representative photos
Woodland (open)	573.492	0.56	**Habitat assessment**:** 1 site **Systematic trapping site:** 1 site **Ultrasonic ARU:** 3 devices **BBSUS:** 2 sites	Open *Acacia aptaneura* (mulga) woodland over scattered mixed shrubs over scattered tussock grassland and herblands on red soil, sandy loam plains and stony substrates.	Mulga woodlands are only found in small, isolated patches within the study area usually associated with alluvial deposits. Some areas of the mulga woodland habitat were burnt at the time of survey. Refuges for fauna include woody debris and substrates conduce for burrowing by monitor species and trap door spiders. Widespread habitat degradation associated with grazing and trampling by European cattle was recorded within this habitat type, particularly in areas of mulga woodland adjacent to water sources. The grey falcon (VU) was recorded within this habitat type and may utilise Woodland (open) habitat while foraging.	
Woodland (closed)	883.9975	0.86	**Habitat assessment**:** 1 site **Systematic trapping site:** 2 sites **Ultrasonic ARU:** 2 devices **Acoustic ARU:** 1 device **Ornithological survey:** 1 site	Dense *Acacia aptaneura* (mulga) woodland over scattered mixed shrubs over scattered tussock grassland and herblands on red soil, sandy loam plains and stony substrates.	Mulga woodlands are only found in small, isolated patches within the study area usually associated with alluvial deposits. Some areas of the mulga woodland habitat were burnt at the time of survey. Refuges for fauna include woody debris and substrates conduce for burrowing by monitor species and trap door spiders. Widespread habitat degradation associated with grazing and trampling by European cattle was recorded within this habitat type, particularly in areas of mulga woodland adjacent to water sources. No significant fauna taxa were recorded within this habitat type.	
Granite Outcrops (flat dome)	12.45969	0.01	**Incidental observations only**	Exposed boulder piles and domes, the vegetation is sparse and limited to scattered *Triodia* sp. hummocks and other soft grasses. Sandy substrate with no leaf or wood litter.	Cracks and crevices, overhangs and the underside of rocks may provide shelter and foraging opportunities for terrestrial fauna. The open nature and small extent of this habitat type makes it unlikely to provide critical habitat for significant fauna; however, the northern quoll, Pilbara olive python, significant bats and both falcons may intermittently utilise this habitat while foraging or dispersing. No significant fauna taxa were recorded within this habitat type.	

Broad habitat type	Area (ha)	%	Sampling effort*	Vegetation description	Fauna suitability	Representative photos
Plain (stony/gibber)	81388.91	79.17	**Habitat assessment**:** 16 sites **Systematic trapping site:** 7 sites **Elliott transect**:1 site **Camera trap:** 10 devices **Ultrasonic ARU:** 26 devices **Acoustic ARU:** 6 devices **BBSUS:** 15 sites **Ornithological survey:** 6 sites	Low open *Eucalyptus leucophloia* woodland over *Acacia bivenosa* and *Acacia inaequilatera* scattered shrubs over *Triodia longiceps, Triodia* epactia, *Triodia brizoides, Triodia wiseana* mid-dense hummock grassland. Some areas supporting *Acacia xiphophylla* (snakewood) tall shrubland.	Stony or stony sand on undulating plains and low rises with spinifex hummock grasslands on loam-clay with a stony mantle. Mixed *Acacia* open shrubland may be present in isolated areas. Coarse stony red clay soils provide habitat for the western pebble-mound mouse (Priority 4). The northern quoll, Pilbara leaf-nosed bat and ghost bat are known to forage in these areas. This habitat type is well represented at a local and regional scale and is not restricted to the study area. The brush-tailed mulgara (P4), Gane's blind snake (P1), grey falcon (VU), Pilbara leaf-nosed bat (VU), Pilbara olive python (VU) and western pebble-mound mouse (P4) were recorded within this habitat type. Substrates within this habitat type are generally considered to be too stony for greater bilby occupancy. Areas of Plain (stony/gibber) habitat containing long-unburnt *Triodia longiceps* may provide suitable roosting habitat for the night parrot (if present).	
Plain (cracking clays)	5755.222	5.60	**Habitat assessment**:** 2 sites **Trapping site:** 5 sites **Ultrasonic ARU:** 8 devices **Acoustic ARU:** 7 devices **BBSUS:** 3 sites **Ornithological survey:** 2 sites	Mid-sparse *Acacia synchronicia* and *Vachellia farnesiana* shrubland over low *Aristida latifolia*, *Cynodon convergens*, *Rhynchosia minima* tussock grassland/ herbland.	Basalt upland gilgai plains associated with the Wona Land System supporting scattered shrubs over grasses and herbs. Provides quality foraging for granivores including cockatoos and budgerigars with large flocks recorded foraging in this habitat type. Provides habitat for the Priority 4 (DBCA) northern short-tailed mouse (*Leggadina lakedownensis*). Habitat degradation associated with grazing and trampling by European cattle. The Pilbara leaf-nosed bat (VU) and short-tailed mouse (P4) were recorded within this habitat type. Although this habitat type may provide foraging habitat for the night parrot, widespread cattle grazing and trampling throughout the survey area is likely to prevent annual access to potential foraging resources. Usage of herbland within this habitat type by the night parrot (if present) limited to areas with low/no cattle impacts, during periods of high seasonal productivity only.	
Hills/Ranges/Plateaux	6446.92	6.27	**Trapping site:** 2 sites **Camera trap:** 1 device **Ultrasonic ARU:** 3 devices **BBSUS:** 1 site	Low open *Eucalyptus* woodland over mixed *Acacia* and *Senna* shrubland over mixed *Triodia* low hummock grassland.	Hills/Ranges/Plateaux consists of large ranges and hills associated with the Capricorn Land System with ridgelines and cliffs containing breakaways, boulders, crevices and caves may provide shelter, denning, foraging and roosting habitat for species such as the northern quoll, Pilbara leaf-nosed bat and ghost bat. No significant fauna taxa were recorded within this habitat type.	

Broad habitat type	Area (ha)	%	Sampling effort*	Vegetation description	Fauna suitability	Representative photos
Gorges/Gullies	82.56092	0.08	**Camera traps:** 14 devices **Ultrasonic ARU:** 2 devices **Ghost bat lure:** 2 lures	Low open *Acacia cyperophylla* var. *omearana*, *Corymbia candida* woodland over tall sparse *Acacia tumida*, *Grevillea wickhamii*, *Santalum lanc eolatum* shrubland over mixed *Triodia* and *Eriachne* low sparse tussock/hummock grassland.	Gorges and Gullies are characterised by steep sided rocky habitats with breakaways, caves, crevices, and cracks with a number of semi-permanent and permanent water sources present at the time of survey. Moist areas, woody debris along with dense shrubbery and leaf litter provide shelter and habitat for ground dwelling species. Generally, these areas are of high conservation value providing denning and roosting habitat for species such as the northern quoll, Pilbara olive python, ghost bat and Pilbara leaf-nosed bat. Permanent and semi-permanent waterholes within this habitat type provide important habitat for numerous species (including the northern quoll, ghost bat, Pilbara olive python and Pilbara leaf-nosed bat). No significant fauna taxa were recorded within this habitat type.	
Rocky Escarpments (Ridges/Mesa/Cliffs/ Outcrops/Breakaways)	2142.946	2.08	**Habitat assessment**:** 2 sites **Trapping site:** 8 sites **Ultrasonic ARU:** 10 sites **Camera trap:** 43 devices **BBSUS:** 2 sites **Nocturnal search:** 1 night **Ornithological survey:** 1 site	Mixed shrubland of *Acacia* sp., *Senna* sp., *Hakea* sp., *Eremophila*, *Ptilotus obovatus*, *Paspalidium clementii* and *Solanum lasiophyllum* over hummock grassland of *Triodia* sp.	Rocky features from small-scale rock face to large protruding rocks/boulders and mesas, usually associated with the tops or bases of ridgelines, stony hills and rises. Ridgelines, cliff, breakaways, boulders, crevices and caves within this habitat type may provide shelter, denning and roosting habitat for species such as the northern quoll, ghost bat and Pilbara leaf-nosed bat. This habitat type is well represented at a local and regional scale and is not restricted to the study area. The northern quoll (EN), Pilbara leaf-nosed bat (VU) and western pebble-mound mouse (P4) were recorded within this habitat type.	

Broad habitat type	Area (ha)	%	Sampling effort*	Vegetation description	Fauna suitability	Representative photos
Drainage Line/River/Creek (major)	2027.208	1.97	**Habitat assessment**:** 3 sites **Trapping site:** 7 sites **Ultrasonic ARU:** 27 devices **Acoustic ARU:** 1 device **Camera trap:** 33 devices **BBSUS**: 8 sites **Ghost bat lure:** 4 lures **Nocturnal search:** 1 night **Ornithological survey:** 4 sites	Open woodland of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over and *Acacia coriacea* subsp. *pendens* over mixed *Cenchrus* and *Triodia* low tussock and hummock grassland.	Generally encompassing major drainage lines and associated tributaries, this habitat type feature deeply incised drainage channels and a higher density of vegetation than surrounding areas. Substrates of gravelly, sand or rocks on clay/loam soils provide quality burrowing substrates. Scattered trees and shrub species provide habitat for birds and shelter for species using this habitat for dispersal (northern quoll, grey falcon, Pilbara leaf-nosed bat, ghost bat and Pilbara olive python). This habitat type is well represented at a local and regional scale and is not restricted to the study area. The ghost bat (VU), grey falcon (VU), northern quoll (EN), Pilbara leaf-nosed bat (VU) and Pilbara olive python (VU) were recorded in this habitat type.	
Drainage Line/River/Creek (minor)	2420.285	2.35	**Habitat assessment**:** 7 sites **Trapping site:** 2 sites **Cages:** 1 site **Ultrasonic ARU:** 10 devices **BBSUS**: 4 sites	Scattered *Eucalyptus leucophloia* subsp. *leucophloia* over *Acacia pruinocarpa* over *Triodia epactia*, *Eriachne lanata* low hummock/tussock grassland.	This habitat type features shallow incised drainage channels and a higher density of vegetation than surrounding areas. Substrates of gravelly, sand or rocks on clay/loam soils supports scattered trees and shrubs. This habitat type is well represented at a local and regional scale and is not restricted to the study area. The grey falcon (VU), short-tailed mouse (P4) and Pilbara leaf-nosed bat (VU) were recorded in this habitat type.	
Cleared	1068.554	1.04	**Habitat assessment**:** 2 sites **Bat detector**: 2 devices **BBSUS:** 5 sites **Ghost bat lure:** 1 lure **Nocturnal survey**: Four nights **Ornithological survey:** 2 sites	N/A	Anthropogenic clearing with little to no vegetation. The grey falcon and Pilbara leaf-nosed bat were both recorded in this habitat type; however, these records are associated with dispersal or utilisation of man-made waterbodies rather than permanent occupancy.	N/A
Total	102,802.56	100				

***Note: Sites which appear to be located in cleared areas were sampled in adjacent habitat or were associated with man-made structures and waterbodies (e.g. dams).**
****Number only includes habitat assessments not undertaken at systematic trap sites.**

119.7°E
119.8°E
119.9°E
120°E
120.1°E
21.9°S
22°S
22.1°S
22.2°S
22.3°S
22.4°S

Survey area

Habitat type

- Cleared
- Drainage Line/River/Creek (major)
- Drainage Line/River/Creek (minor)
- Gorges/Gullies
- Granite Outcrops (flat dome)
- Hills/Ranges/Plateaux
- Plain (Cracking clays)
- Plain (stony/gibber)
- Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)
- Woodland (closed)
- Woodland (open)

Water sources

- Bonney Downs Station Dam
- Bonnie Pools
- Non-permanent pool/waterhole
- Permanent pool/waterhole
- Date Palm

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 23 January 2025
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 14: Fauna habitat types identified within the survey area.

0 2 4 6 10 Kilometers

Earthstar Geographics

4.2 FAUNA ASSEMBLAGE

Of the 305 vertebrate fauna species identified by database searches as potentially occurring within 40 km of the study area, 237 (63.5%) were recorded during the current surveys including 31 mammals (20 non-volant species and 11 bats), 82 reptiles, 118 birds, four amphibians and two fish. A regional fauna summary table, showing species recorded during each survey is provided in Appendix C. The fauna assemblage recorded is considered typical for the habitat types observed within the study area.

4.2.1 Mammals

A total of 31 mammal species from 13 families were recorded within the study area including 17 species of native ground dwelling mammals, 11 species of bat and three introduced species (Appendix C). Ground dwelling mammal species recorded include six carnivorous marsupials (Dasyuridae), six native rodents (Muridae), three macropods (Macropodidae), the dingo (Canidae) and three introduced mammals (European cattle, feral cat and house mouse). The number of non-volant mammal species recorded (20, three introduced) represents 66.7% of species identified as occurring the region based on database searches. The mammal assemblage recorded during the current surveys is greater than or equal to all bar one detailed survey assessed as part of the literature review (Appendix C).

Echolocation calls belonging to two species of sheath-tailed bat (Emballonuridae), three species of freetail bat (Molossidae), the Pilbara leaf-nosed bat, the ghost bat, the black flying fox and three species of evening bats (Vespertilionidae) were recorded during the current survey. A single ghost bat 'fly-by' was recorded on motion cameras at acoustic lure site BDGB03 within Drainage Line/River/Creek (major) at Bonney Downs North and the Pilbara leaf-nosed bat was recorded at 19 sites across the study area. A small colony of the black flying-fox was recorded roosting at site BB006 in a large date palm growing in a major drainage line.

The northern quoll (*Dasyurus hallucatus* [Endangered]), Pilbara leaf-nosed bat (*Rhinonicteris aurantia* [Vulnerable]), ghost bat (*Macroderma gigas* [Vulnerable]), short-tailed mouse (*Leggadina lakedownensis* [Priority 4], brush-tailed mulgara (*Dasycercus blythi* [Priority 4]) and western pebble-mound mouse (*Pseudomys chapmani* [Priority 4]) were recorded during the current survey. Four significant species, comprising the northern quoll, Pilbara leaf nosed bat, short-tailed mouse and western pebble-mound mouse were recorded at both Bonney North and Bonney South. The ghost bat was only recorded in Bonney North and the brush-tailed mulgara was only recorded at Bonney South. Further discussion regarding significant mammals recorded within the study area is provided in Section 4.3.

4.2.2 Avifauna

A total of 118 bird species from 49 families were recorded during the current surveys (Appendix C). The family Meliphagidae (honeyeaters) (12 species) was the most diverse family recorded during the surveys, followed by Accipitridae (raptors) (nine species), Anatidae (ducks) (seven species) and Artamidae (woodswallows, butcherbirds and magpies) (six species) (Appendix C). The number of avifauna taxa recorded within the study area (118 species) represents 66.3% of species potentially occurring according to database searches and the assemblage recorded is significantly more diverse than that recorded by all other detailed assessed as part of the literature review (Appendix C). No introduced avifauna taxa were recorded during the surveys.

The grey falcon (*Falco hypoleucos* [Vulnerable]) was recorded on 10 occasions during the Bonney Downs detailed, targeted and BBSUS surveys. One additional grey falcon observation was recorded at Bonney Downs South. Further discussion on the grey falcon is provided in Section 4.3.2.1. An additional 10 Migratory birds and three Threatened avifauna species (common greenshank [EN/MI], Australian painted snipe [EN] and night parrot [EN/CR]) considered

moderately likely to occur within the study area. These species are discussed further in Section 4.3.5.

4.2.3 Reptiles

A combined total of 82 species of reptile, represented by 11 families, were recorded during the current survey (Appendix C). Reptile species recorded included 21 geckos (12 Diplodactylidae, one Carphodactylidae and eight Gekkonidae), 23 skinks (Scincidae), 11 venomous snakes (Elapidae), three pythons (Pythonidae), nine monitor lizards (Varanidae), six legless lizards (Pygopodidae), five dragons (Agamidae), three blind snakes (Typhlopidae) and one turtle (Chelidae) (Appendix C). The reptile diversity recorded within the study area (82 species) represents 92.1% of reptile species potentially occurring within 40 km of the study area according to database searches and the assemblage recorded is significantly more diverse than that recorded by all other detailed assessed as part of the literature review (Appendix C). No introduced reptile taxa were recorded during the surveys.

The Pilbara olive python (*Liasis olivaceus barroni*) was recorded on two occasions during detailed and targeted surveys at Bonney Downs North, with one individual recorded during nocturnal spotlighting adjacent to Bonney Pools and one individual captured at a systematic trapping site (BDDP16). The Gane's blind snake was also recorded during the phase three detailed fauna survey undertaken at Bonney Downs North. Significant reptiles recorded in the study area are discussed in further detail in Section 4.3.2.

4.2.4 Amphibians

Four amphibian taxa were recorded during the surveys, represented by three families including Limnodynastidae (one species), Myobatrachidae (one species) and Pelodryadidae (two species) (Appendix C). The amphibian diversity recorded within the study area represents 50% of species potentially occurring within 40 km of the study area according to database searches. The number of amphibians recorded during the current surveys was equal to or greater than that recorded during all detailed fauna surveys assessed as part of the literature review (Appendix C). No introduced or significant amphibian taxa were recorded within the study area and no significant taxa are expected to occur based on database searches.

Significant rainfall was recorded in the months prior to the phase three detailed fauna survey resulting in favourable conditions for amphibians.

4.2.5 Fish

Two fish were recorded from aquatic habitat at Bonney Creek during the Bonney Downs North detailed survey. Both species are considered common throughout the Pilbara. Although database searches failed to identify any fish taxa within 40 km of the study area, this likely reflects the low levels of historical sampling effort undertaken within the local area rather than an actual absence of these species. The number of fish taxa recorded during the current surveys exceeds that recorded by all other detailed surveys assessed as part of the literature review (Appendix C). No significant or introduced fish taxa were recorded within the study area.

4.2.6 Introduced Species

Three introduced species were recorded during the surveys including European cattle, the cat and the house mouse. Canines were recorded during both detailed fauna surveys; however, genetic research suggests that feral dogs and feral dog/dingo hybrids are very rare across mainland Australia (Cairns, Crowther, Nesbitt, & Letnic, 2021). Therefore, these canines have been classified as dingoes for the purposes of this report and are not considered to represent an introduced species.

The study area intersects an operational pastoral lease and European cattle activity (trampling, grazing, primary sighting, scats and tracks) was widely recorded throughout the study area. The house mouse was recorded at three trapping sites at Bonney Downs North and a single individual was recorded at site BDS 2 at Bonney Downs South. Feral cats were recorded at 10 camera trapping sites within the Bonney Downs North survey area, with additional opportunistic records obtained at Bonney Downs South.

4.3 SIGNIFICANT FAUNA

A post-survey likelihood of occurrence assessment was undertaken for significant fauna species with the potential to occur within the study area, taking into consideration the field survey results, habitat types identified, and desktop survey (Appendix G). Further discussion surrounding significant species recorded within the study area and species considered highly or moderately likely to occur within the study area is provided in Sections 4.3.2 - 4.3.5.

Nine significant species were recorded during the current survey, included one bird, six mammals and two reptiles:

- Northern quoll (*Dasyurus hallucatus*) – Endangered EPBC Act and BC Act;
- Grey falcon (*Falco hypoleucos*) – Vulnerable EPBC Act and BC Act;
- Pilbara olive python (*Liasis olivaceus barroni*)- Vulnerable EPBC Act and BC Act;
- Pilbara leaf-nosed bat (*Rhinonicteris aurantia* [Pilbara form]) - Vulnerable EPBC Act and BC Act;
- Ghost bat (*Macroderma gigas*) – Vulnerable EPBC Act and BC Act
- Gane's blind snake (*Anilios ganei*) – Priority 1;
- Brush-tailed mulgara (*Dasycercus blythi*) – Priority 4;
- Western pebble-mound mouse (*Pseudomys chapmani*) – Priority 4; and
- Short-tailed mouse (*Leggadina lakedownensis*) – Priority 4.

Although the greater bilby (*Macrotis lagotis* [VU]) has been historically recorded on two occasions (1982 & 1984) within the study area, suitable burrowing substrates are generally absent from habitat types and no evidence of this species was recorded during the current survey.

The long-tailed dunnart (*Sminthopsis longicaudata* [Priority 4]) and peregrine falcon (*Falco peregrinus* [Other Specially Protected Fauna]) were allocated a high likelihood of occurrence rating due to proximity of recent records and presence of suitable habitat within the study area. Ten Migratory birds (common sandpiper, fork-tailed swift, sharp-tailed sandpiper, red-necked stint, oriental plover, gull-billed tern, Caspian tern, glossy ibis, wood sandpiper and marsh sandpiper) and two Threatened avifauna taxa (common greenshank and Australian painted snipe) were allocated a moderate likelihood of occurrence based on distance of records from the study area and ability of these species to overfly or intermittently utilise habitat within the study area. One additional Threatened avifauna species (night parrot [CR/EN]) was assessed as moderately likely to occur, based on the modelled distribution of the species and presence of suitable roosting and foraging habitat within the study area.

The likelihood of occurrence assessment identified 10 species (seven birds, one mammal and two reptiles) as having a low likelihood of occurrence within the study area due to absence of suitable habitat, age of records, distance of records from the study area or a combination of these factors. An additional two species (crest-tailed mulgara and barking owl) were classified as 'Does Not Occur' as these records were assessed to represent inaccurate taxonomic identifications and/or the species does not occur within the region. Species assigned a likelihood of occurrence of 'Low' or 'Does Not Occur' will not be discussed further.

4.3.1 Matters of National Significance (MNES)

Significant impacts to MNES are considered by DEWHA (2013) to be impacts which are important, notable or of consequence having regard to its context or intensity. DEWHA (2013) also outlines important populations necessary for a species' long-term survival and recovery, which may include:

- key source populations either for breeding or dispersal;
- populations necessary for maintaining genetic diversity; and/or
- populations near the limit of the species range.

Six MNES species listed as Threatened (EPBC Act) have been recorded in the survey area during current or previous surveys:

- Northern quoll (*Dasyurus hallucatus*) - Endangered EPBC and BC Act.
- Grey falcon (*Falco hypoleucos*) – Vulnerable EPBC and BC Act.
- Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) - Vulnerable EPBC Act and BC Act.
- Ghost bat (*Macroderma gigas*) - Vulnerable EPBC Act and BC Act.
- Greater bilby (*Macrotis lagotis*) - Vulnerable EPBC Act and BC Act.
- Pilbara olive python (*Liasis olivaceus barroni*) - Vulnerable EPBC Act and BC Act.

Significant impacts to MNES are considered by DEWHA (2013) to be impacts which are important, notable or of consequence having regard to its context or intensity. Habitat critical to the survival of a species and important populations is considered important. According to DEWHA (2013), critical habitat to the survival of a species refers to areas that are necessary:

- for activities such as foraging, breeding, roosting or dispersal;
- for the long-term maintenance of the species;
- to maintain genetic diversity and long-term evolutionary development; or
- for the reintroduction of populations or recovery of the species.

Further discussion regarding habitats within the study area considered critical for each MNES species recorded within the study area is provided in Sections 4.3.2 and 4.3.3.

4.3.2 Significant Fauna Recorded – Current Surveys

4.3.2.1 Grey falcon (*Falco hypoleucos*) – Vulnerable EPBC Act and BC Act

Ecology and Distribution

The grey falcon (*Falco hypoleucos)* is a stocky, elusive species endemic to mainland Australia and is the rarest of the Australian members of the *Falco* genus (Marchant & Higgins, 1993); (Schoenjahn, 2011b). The total population size is accepted to be <1,000 mature individuals (Schoenjahn, 2011a) and as a result, this species was listed as Vulnerable under the EPBC Act in September 2019. The grey falcon is also listed as Vulnerable under the BC Act.

The grey falcon is a medium-sized raptor, with average body mass for males around 390 grams and for females around 560 grams (Schoenjahn, 2011b). A sleek, grey plumaged falcon with a swift, direct flight pattern, patrolling low over groundcover below treetop level with shallow wing beats and brief glides (Morcombe, 2022). Soars with wings held close to level with dark tipped primaries slightly spread to give a blunt wingtip (Morcombe, 2022).

Grey falcons of all ages feed almost exclusively on birds including doves, pigeons, parrots, cockatoos and finches (Schoenjahn, Pavey, & Walter, 2020). Grey falcons hunt predominantly in open country, often over treeless grassland, which is also a key feeding habitat of prey species (Schoenjahn, 2013) and are well known for hunting over natural and artificial water sources (Schoenjahn, 2018).

The grey falcon is distributed sparsely over parts of Australia's arid and semi-arid zone with climate characteristics appearing to play a crucial role in the species' distribution (Schoenjahn *et al*., 2020). This species occurs in low densities across inland Australia and is considered to comprise a single, monotypic population (Marchant & Higgins, 1993). The species frequents timbered lowland plains, particularly Acacia shrublands that are crossed by tree-lined water courses (Garnett, Szabo, & Dutson, 2011); (Ehmann & Watson, 2008); (Schoenjahn, 2013). The species has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter (Schoenjahn, 2018); (Olsen & Olsen, 1986).

Grey falcons do not build their own nests and use old stick-nests of other birds, mainly corvids and other raptors in trees or on artificial structures including telecommunication towers and powerline poles (Schoenjahn *et al*., 2020); (Johnstone & Storr, 1998). Nesting usually occurs high in the tallest trees in the area usually along watercourses or river pools (Morcombe, 2022) particularly in *Eucalyptus camaldulensis* and *Eucalyptus coolabah* (Threatened Species Scientific Committee, 2020). Breeding takes place between June and November with a clutch size of 2-4, a nestling number of 1-4 and a nestling period of >38 days (Schoenjahn, 2013).

Occurrence within the Study Area

DBCA and Fortescue database searches identified 38 records of the grey falcon within 100 km of the study area, with the closest record (historical) located within 70 m of the study area (Map 7).

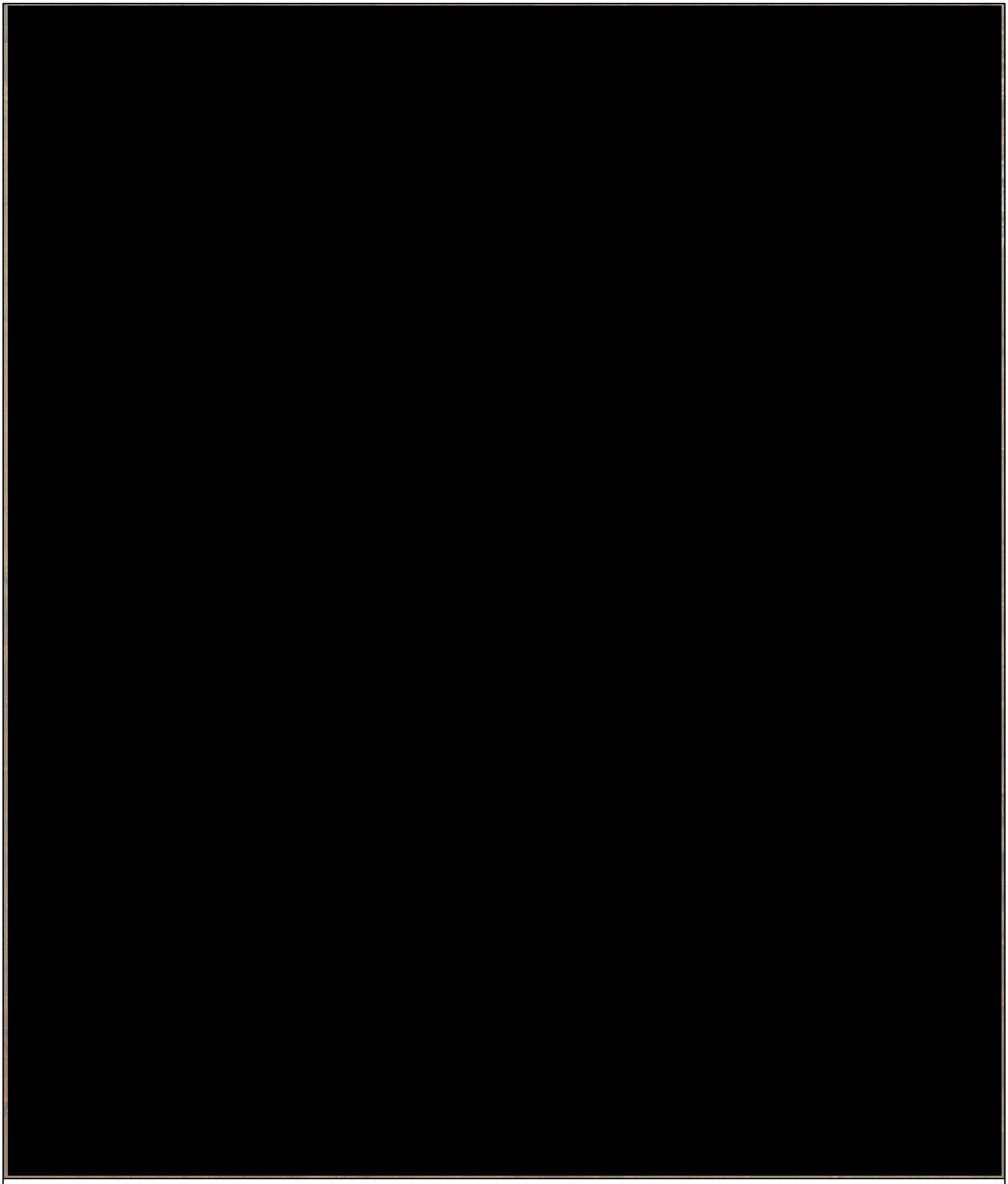
The grey falcon was recorded on 10 occasions during the Bonney Downs North and BBSUS surveys (ecologia, 2024a, 2024b), with an additional record obtained during the Bonney Downs South surveys (Spectrum Ecology, 2024). A maximum of two individuals have been recorded at any given time, suggesting that at least one pair of birds are regularly utilising habitat within the study area. Behaviours recorded include soaring and active flight, feeding, perching and standing in an ephemeral waterbody (ecologia, 2024a).

Grey falcon records and critical habitat mapping are provided in Map 15.

Critical Habitat within the Study Area

Repeated sightings of grey falcons during the detailed, targeted and BBSUS surveys suggest regular utilisation of habitat in and around the study area. The species may overfly and forage within all habitat types and Drainage Line/River/Creek (major) (2,029.04 ha) habitat within the study area represents critical breeding and foraging habitat for the grey falcon.

At least 12 suitably sized stick nests (Map 13) were recorded within minor and major drainage lines within the Bonney Downs North portion of the study area (ecologia, 2024a). Breeding activity, presence of juvenile or sub-adult birds and nest utilisation has not been recorded to date despite extensive targeted searches. Although no evidence of nest utilisation by grey falcons was recorded during the current surveys, nests identified within the study area represent potential future breeding habitat for the species. Inspection of man-made structures (e.g. telecommunication towers) within the study area failed to identify any nests which may be utilised by grey falcons.



Study area

Ecologia (2024) BBSUS Year 1
- Grey falcon (EPBC: VU)

Spectrum (2024) Bonney South
- Grey falcon (EPBC: VU)

Ecologia (2024) Bonney North
- Grey falcon (EPBC: VU)

Grey falcon breeding habitat
- Drainage Line/River/Creek (major)
- Stick nest - potential nesting site

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 2 December 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 15: Grey falcon records, stick nests and critical habitat within the study area.

Earthstar Geographics

0 2 4 6 10 Kilometers

4.3.2.2 Northern quoll (*Dasyurus hallucatus*) - Endangered EPBC and BC Act

Ecology and Distribution

The northern quoll's range once extended contiguously across the north of Australia but is now restricted to six separate land units including the Pilbara (DoE, 2023a). The Pilbara is now regarded as the stronghold population for the species given that the cane toad is not expected to make its way across the desert into parts of the Pilbara (Woinarski, Burbidge, & Harrison, 2014). The preferred denning habitat for the northern quoll is rocky escarpments, but the species also utilises riverine habitat for dispersal (Woinarski *et al.,* 2014). Rocky habitats with rock crevices and caves support higher densities of northern quoll (S. van Dyck & R. Strahan, 2008; Woinarski *et al.*, 2014). Predominantly inhabiting dissected rocky escarpments, a male quoll can have a home range of more than 100 ha while a female occupies territories of up to 35 ha (Steve Van Dyck & Ronald Strahan, 2008).

While this species is predominantly nocturnal, it may be observed during the day particularly during the breeding season and on overcast days (Oakwood, 2008). Northern quolls are opportunistic omnivores, feeding primarily on small vertebrates (mammals, amphibians and reptiles), invertebrates and soft fruits (Oakwood, 2008). Breeding occurs once per year, with juveniles deposited in dens once they reach eight to nine weeks of age (Oakwood, 2008). Northern quolls are the smallest of the Australian quolls and are the largest mammal species in the world for males to undergo die-off events following the breeding season (Oakwood, 2008). Lifespan of females in the wild is typically less than three years, with most females only surviving a single breeding season (Oakwood, 2008).

Important Populations and Critical Habitat

Northern quoll populations considered important for the long-term survival of this species are outlined by the Commonwealth of Australia (2016) in the EPBC referral guidelines for the northern quoll. Populations important for the long-term survival of this species include:

- high density populations, which occur in refuge-rich habitat critical to the survival of the species, including where cane toads are present
- occurring in habitat that is free of cane toads and unlikely to support cane toads upon arrival i.e. granite habitats in WA, populations surrounded by desert and without permanent water
- subject to ongoing conservation or research actions i.e. populations being monitored by government agencies or universities or subject to reintroductions or translocation.

The EPBC referral guidelines define a high-density population as being characterised by numerous camera triggers by multiple individuals at multiple sites and or traps (Commonwealth of Australia, 2016). A low density population is defined as on which is characterised by infrequent captures of one or two individuals which are confined to one or two sites or where no individuals have been trapped but latrine evidence is present (Commonwealth of Australia, 2016).

The EPBC referral guidelines for the northern quoll also outline habitat critical to the survival of the species (Commonwealth of Australia, 2016). Critical habitat for this species is outlined below:

- offshore islands where the northern quoll is known to exist
- rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines

- structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs.

Dispersal and foraging habitat which is associated with or connects populations important for long-term survival of the species are also considered critical habitat for the northern quoll (Commonwealth of Australia, 2016).

Occurrence within the Study Area

DBCA and Fortescue database searches indicate that a total of 934 northern quoll records have previously been documented within 100 km of the study area, with 85 Fortescue records occurring within the study area (Map 7).

The northern quoll was recorded at 13 sites across six camera transects and a single opportunistic camera trapping site within Bonney Downs North (ecologia, 2024a). A total of 219 independent motion camera visits were recorded during targeted northern quoll surveys at Bonney Downs North, with spot pattern analysis identifying at least eight individuals (ecologia, 2024a). An additional nine northern quoll individuals (seven males, two females) were trapped across four systematic sites (BDDP04, BDDP07, BDDP10 and BDDP19) at Bonney Downs North (ecologia, 2024a). A single visit by a northern quoll was recorded at Bonney Downs South, which is considered likely to have been a dispersing male rather than a permanent occupant (Spectrum Ecology, 2024).

Northern quoll records and critical habitat mapping are shown in Map 16.

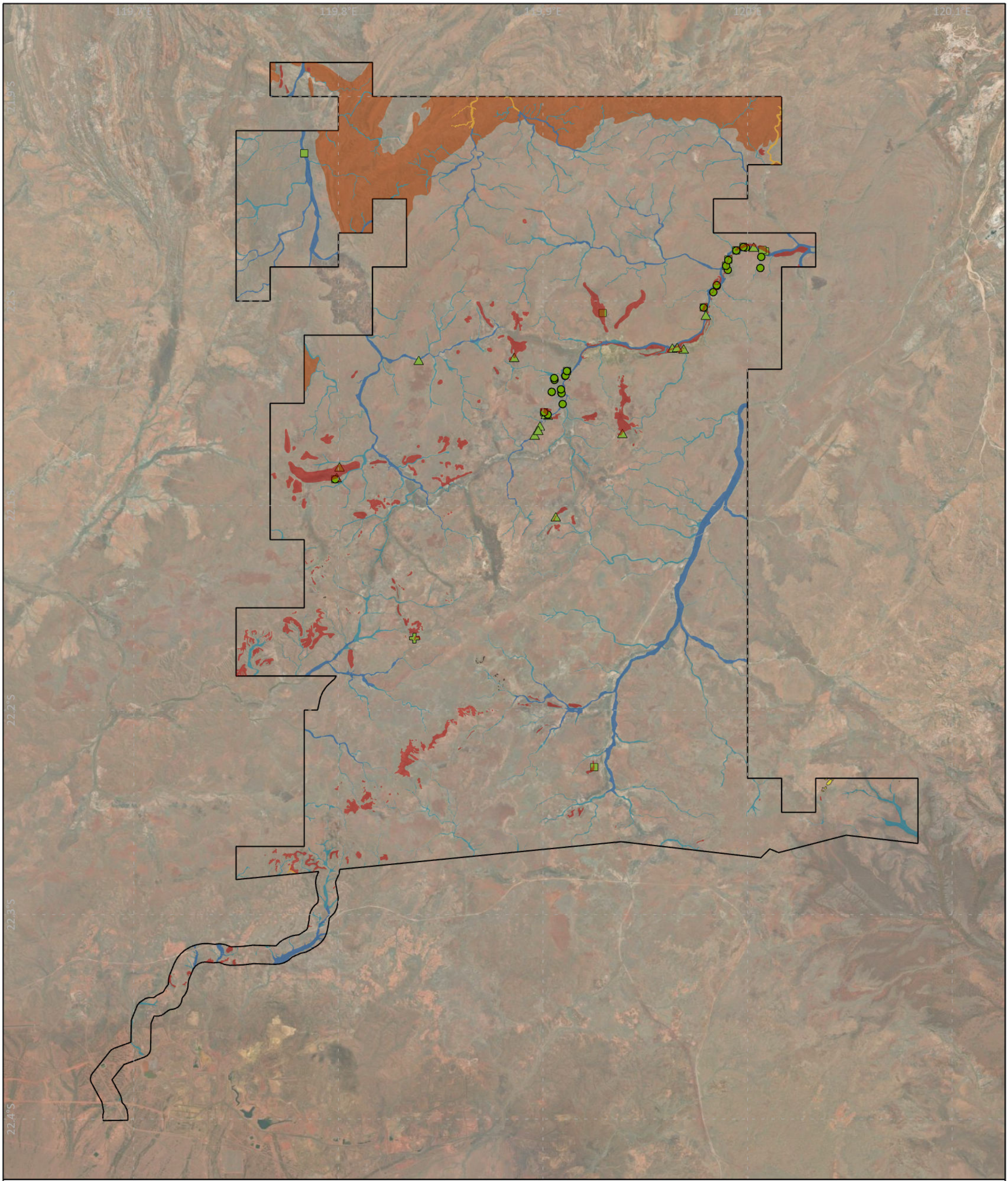
Critical Habitat and Important Populations within the Study Area

The EPBC referral guidelines define a high-density population as one characterised by numerous camera triggers or captures of two or more individuals across multiple traps or cameras on the site (Commonwealth of Australia, 2016). High density northern quoll populations are considered important for the long-term survival of the species when they occur in refuge-rich habitats, even when cane toads are present (Commonwealth of Australia, 2016).

Based on the number of individuals identified and frequency of detections, the northern half of the study area appears to support a high density, reproductive population of northern quolls. Conversely, the low number of records obtained in the southern half of the study area (Bonney Downs South), suggests that this portion of the study area only supports a low-density quoll population and is unlikely to represent critical habitat for the species.

Rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, and major drainage lines which provide shelter for breeding, refuge from fire or predation are considered critical habitat for the northern quoll (Commonwealth of Australia, 2016). Additionally, populations which occur in habitats that are currently free of cane toads and are unlikely to support any future cane toad invasion are considered critical for the survival of the species (Commonwealth of Australia, 2016). Based on this, Rocky Escarpment (2,142.50 ha), Gorges/Gullies (82.56 ha), Drainage Line/River/Creek (major and minor) (4,453.44 ha) and Hills/Ranges/Plateaux (6,446.92 ha) habitat within the northern half of the study area is considered critical for the survival of the northern quoll.

Based on the results of the current surveys, habitat in the southern half of the study area does not appear to be critical for the survival of the northern quoll; however, Rocky Escarpments, Granite Outcrops and Drainage Line/River/Creek (major and minor) habitat types in the southern half of the study area may be utilised by the species during dispersal and foraging activities.



Study area

Ecologia (2024) Bonney North
- Northern quoll (EPBC: EN)

Spectrum (2024) Bonney South
- Northern quoll (EPBC: EN)

DBCA database
- Northern quoll (EPBC: EN)

FMG Database
- Northern Quoll (EPBC: EN)

Dispersal habitat
- Drainage Line/River/Creek (major)
- Drainage Line/River/Creek (minor)

Critical habitat
- Gorges/Gullies
- Granite Outcrops (flat dome)
- Hills/Ranges/Plateaux
- Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 2 December 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 16: Northern quoll records and critical habitat within the study area.

0 2 4 6 10 Kilometers

Earthstar Geographics

4.3.2.3 Pilbara leaf-nosed bat (*Rhinonicteris aurantia* [Pilbara form]) – Vulnerable EPBC Act and BC Act

Ecology and Distribution

This small insectivorous bat occurs throughout the Pilbara and adjacent upper Gascoyne regions of Western Australia (Threatened Species Scientific Committee, 2016b). The species was listed under the EPBC Act as Vulnerable in April 2001 as it had undergone a substantial reduction in numbers, its geographic distribution is precarious for its survival (being limited to the Pilbara), the estimated total number of mature individuals is limited, and the number is likely to continue to decline.

The Pilbara leaf-nosed bat has very restrictive habitat requirements, including caves and disused mines with hot to very hot and humid roost sites with temperatures in the 28° to 32°C range and 96% to 100% relative humidity (K. N. Armstrong, 2001; S. Churchill, 2008). During the Pilbara dry, winter months, preceding the heavy summer rains, Pilbara leaf-nosed bat colonies are thought to contract to the deepest mines and caves that maintain microclimates suitable for roosting (K. N. Armstrong, 2001; Bullen & McKenzie, 2011; S. van Dyck & R. Strahan, 2008). During the hotter, wetter and more humid summer months, the species has a greater ability to disperse through the landscape. The Pilbara leaf-nosed bat has been observed foraging in a variety of habitats including *Triodia* hummock grasslands covering low rolling hills and shallow gullies, with scattered *Eucalyptus camaldulensis* along the creeks (DoE, 2023b). This species is most commonly encountered over small pools of water in rocky gullies and gorges (DoE, 2023b).

Critical Roosting and Foraging Habitat

Underground refuges used by the Pilbara leaf-nosed bat can be categorised into one of the following standard categories:

- **permanent diurnal roosts (Priority 1)**—occupied year-round and likely the focus for some part of the 9-month breeding cycle; considered as critical habitat that is essential for the daily survival of the PLNB.
- **non-permanent breeding roosts (Priority 2)**—evidence of usage during some part of the 9-month breeding cycle (July–March), but not occupied year-round; considered as critical habitat that is essential for both the daily and long-term survival of the PLNB.
- **transitory diurnal roosts (Priority 3)**—occupied for part of the year only, outside the breeding season (i.e. April–June), and which could facilitate long distance dispersal in the region; considered as critical habitat that is essential for both the daily and long-term survival of the PLNB.
- **nocturnal refuge (Priority 4)**—occupied or entered at night for resting, feeding or other purposes, with perching not a requirement. Excludes overhangs. Not considered critical habitat but are important for persistence in a local area.

Pilbara leaf-nosed bats have been observed foraging in a variety of habitats including spinifex hummock grasslands covering low rolling hills and shallow gullies, black soil grasslands, open savannah woodland, tall open forest and monsoon rainforest (S. K. Churchill, Jolly, Hand, & Milne, 2008). The Pilbara leaf-nosed bat is commonly encountered over small pools of water in rocky gullies and gorges (DEWHA, 2021). Foraging areas may range up to 20 km away from a diurnal roost (Bat Call, 2016). Given the lack of understanding around which habitats are required to sustain a roosting colony, it is difficult to define critical foraging habitat of the PLNB (Threatened Species Scientific Committee, 2016b). According to the Conservation Advice for the Pilbara leaf-nosed bat, foraging habitats are categorised as follows:

- **Gorges with pools (Priority 1)**—watercourses through upland areas bounded by sheer rock walls for parts of their length, often containing pools that remain for weeks or months, sites of relatively large biomass production, sometimes containing caves;
- **Gullies (Priority 2)**—primary drainage with limited riparian development in upland rocky habitats, sometimes containing small pools that may last for weeks, with less biomass production than Priority 1 gorge habitat;
- **Rocky outcrop (Priority 3)**—areas of exposed rock at the top of rocky outcrop and mesa hills that contain caves and overhangs, and boulder piles in the granite terrains;
- **Major watercourses (Priority 4)**—riparian vegetation on flat land plus the main gravelly or sandy channel of the riverbed, sometimes containing pools that persist for weeks or months, and generally supporting higher productivity of biomass than the surrounding habitats;
- **Open grassland and woodland (Priority 5**)—dominated by *Triodia,* on lowland plains, colluvial slopes and hilltops.

Occurrence within the Study Area

DBCA and Fortescue database search results indicate that the Pilbara leaf-nosed bat has been recorded on 1,838 occasions within 100 km of the study area, with the closest record located approximately 20 km from the study area (Map 7).

Echolocation calls belonging to the Pilbara leaf-nosed bat were recorded at seven sites (54 passes) during the phase one detailed surveys undertaken at Bonney Downs North, with a single detection recorded in phase two and no detections in phase three. Calls belonging to the Pilbara leaf nosed bat were also recorded at three sites (43 passes) during the October 2024 BBSUS and three sites (four passes) during the February 2024 BBSUS. No calls were recorded at BBSUS sites in March 2024. The Pilbara leaf-nosed bat was recorded at five sites within Bonney Downs South, with 70 passes recorded across four sites during the phase 1 survey and four passes recorded at two sites in phase two.

Call patterns recorded to date do not indicate the presence of a nearby roost, with no low time calls recorded at or near civil twilight. Calls patterns recorded to date indicate relatively low activity levels across the study area, with the majority of records collected at sites within Drainage Line/River/Creek (major) habitat and adjacent to water sources (most dams) during the wet season.

Pilbara leaf-nosed bat records and habitat mapping are shown in Map 17.

Roosting and Foraging Habitat within the Study Area

No suitable roost caves have been identified within the study area and no call times indicative of a nearby roost site have been recorded despite extensive survey effort over multiple seasons. Given the general lack of evidence to support the presence of a nearby roost, habitat within the study area is not currently considered to represent critical roosting habitat for the Pilbara leaf-nosed bat. Although the study area supports suitable foraging and dispersal habitat for the Pilbara leaf-nosed bat, echolocation calls recorded to date indicate that this species only infrequently utilises habitat within the study area for foraging and dispersal.

During the wet season, Gorges/Gullies, Drainage Line/River/Creek (major and minor) and other permanent and semi-permanent water bodies within the study area may provide foraging habitat for the species, with site utilisation appearing to decrease significantly in the post-wet season. The species may utilise all habitat types while foraging. As no suitable roosting caves or low-time calls have been recorded to date, habitat within the study area is not considered to be critical for the survival of the species.

119.7°E
119.8°E
119.9°E
120°E
120.1°E
21.9°S
22°S
22.1°S
22.2°S
22.3°S
22.4°S

Study area

Ecologia (2024) Bonney North
- Ghost bat (EPBC: VU)
- Pilbara leaf-nosed bat (EPBC: VU)

Spectrum (2024) Bonney South
- Pilbara leaf-nosed bat (EPBC: VU)

Ecologia (2024) BBSUS Year 1
- Ghost bat (EPBC: VU)
- Pilbara leaf-nosed bat (EPBC: VU)

Ghost bat and PLnB potential roosting habitat
- Gorges/Gullies
- Hills/Ranges/Plateaux
- Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)

Foraging habitat
- Drainage Line/River/Creek (major)
- Drainage Line/River/Creek (minor)
- Plain (Cracking clays)
- Plain (stony/gibber)
- Woodland (closed)
- Woodland (open)

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 18 February 2025
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 17: Pilbara leaf-nosed bat and ghost bat records and roosting/foraging habitat within the study area.

Earthstar Geographics

0 2 4 6 10 Kilometers

4.3.2.4 Ghost bat (*Macroderma gigas*) – Vulnerable EPBC Act and BC Act

Ecology and Distribution

The ghost bat is the largest microchiropteran bat in Australia, is strictly carnivorous and captures its prey mainly on the ground before returning to an established feeding site to devour its catch (Steve Van Dyck & Ronald Strahan, 2008). The diet of this species includes amphibians, reptiles, birds, small terrestrial mammals, insects and other bats (Steve Van Dyck & Ronald Strahan, 2008). Unlike other microchiropterans, the ghost bat does not continuously call when in flight and instead uses its eyes and ears to scan for prey (Steve Van Dyck & Ronald Strahan, 2008). Females reach reproductive maturity between two and three years of age (Hoyle, Pople, & Toop, 2001).

The ghost bat was historically distributed across much of Australia but now has a fragmented although widespread distribution restricted to northern Australia (Threatened Species Scientific Committee, 2016c). Following European settlement, the distribution of this species contracted northward with arid zone populations undergoing the greatest contractions (Threatened Species Scientific Committee, 2016c). Ghost bat populations are highly structured and are considered to be genetically distinct at both local and regional scales (Threatened Species Scientific Committee, 2016c).

Critical Roosting and Foraging Habitat

Preferred roosting habitat in the Pilbara includes caves beneath bluffs of low, rounded hills composed of Marra Mamba geology, and granite rock piles. Ghost bats have also been known to roost in large colonies within sandstone caves, under boulder piles and in abandoned mines (S. Churchill, 1998). Permanent roost sites are typically deep caves, rock crevices or old mine adits with a relatively stable temperature (23-28°C) and high humidity (50-100%) (Threatened Species Scientific Committee, 2016c). During daylight hours, ghost bats roost in large caves, mines or deep rock fissures (Steve Van Dyck & Ronald Strahan, 2008). In some parts of its range, the ghost bat shares roosts with the Pilbara leaf-nosed bat, Finlayson's cave bat, common heath-tailed bat, and possibly Hill's sheath-tailed bat.

Ghost bats are known to seasonally move between a number of caves or as dictated by weather conditions (Hutson, Mickleburgh, & Racey, 2001) and disperse widely when not breeding, but concentrate in a relatively few roost sites when breeding (Threatened Species Scientific Committee, 2016c). Maternity caves are relatively uncommon, with only 11 recorded in the Pilbara region (three natural caves and eight mines) (K. Armstrong & Anstee, 2000). Diurnal roost caves usually contain one or more large chambers with additional geological features, including fissures and chambers which are completely dark and have a minimum roof height of 2-3 m (Bat Call, 2016). Maternal roost sites exhibit the features outlined for diurnal roosts with the addition of an interior chamber that rises towards the rear of the cave creating a warm and humid environment for breeding females and pups (Bat Call, 2016). Nocturnal roosts or feeding caves (middens), which are only used at night, are usually present in rock overhangs and small caves which are well lit during the day and can be easily recognised based on the presence of discarded prey pieces and faeces on the floor (Richards, Hand, & Armstrong, 2008). K. Armstrong and Anstee (2000) suggested that ghost bats occur in small groups within the Hamersley Ranges and may move about in a local area, possibly in response to disturbance, microclimate or social factors.

Occurrence within the Study Area

DBCA and Fortescue database searches identified 170 ghost bat records within 100 km of the study area, with the closest record located within 10 km. Echolocation and social calls belonging to the ghost bat were not recorded by bat detectors deployed at Bonney Downs North or Bonney

Downs South during the detailed and targeted surveys; however, analysis undertaken by Specialised Zoological indicates the species was detected on motion cameras at acoustic ghost bat lure site BDGB03 in March 2024 (Specialised Zoological, 2024). The image in question and associated commentary by Dr Kyle Armstrong is provided in Appendix D. Confirmatory echolocation recordings were not available for this site; however, identification of the species was based on the presence of an "anteriorly-directed structure resembling long ears, the broad wings and lack of a distinct tail" (Specialised Zoological, 2024). No ghost bat calls were recorded at Bonney Downs South (Spectrum Ecology, 2024); however, acoustic lures which may increase detectability of this cryptic species were not utilised within this portion of the study area.

Ghost bat records and habitat mapping are shown in Map 17.

Roosting and Foraging Habitat within the Study Area

The ghost bat was recorded within Drainage Line/River/Creek (major) habitat within the study area (timestamp 18:52:22). Given the location of the site, this record is likely to be associated with foraging or dispersal activities. No suitable ghost bat roost caves or middens were identified during the current surveys.

Hills/Ranges/Plateaux, Gorges/Gullies and Rocky Escarpment habitat types may provide potential nocturnal shelter and diurnal roosting opportunities for the ghost bat, with all other habitat types providing potential foraging and dispersal habitat. As no suitable roosting caves or low-time calls have been recorded to date, habitat within the study area is not considered to be critical for the survival of the species.

4.3.2.5 Brush-tailed mulgara (*Dasycercus blythi*) – Priority 4

Ecology and Distribution

The brush-tailed mulgara has been reclassified and taxonomically separated from the crest-tailed mulgara (*Dasycercus cristicauda*). This species is more widespread than the crest-tailed mulgara and is not listed in the EPBC Act but is listed as Priority 4 (Rare, Near Threatened and other species in need of monitoring) under *the Biodiversity Conservation Act* (2016).

The brush-tailed mulgara occurs in spinifex grasslands throughout much of the arid zone and dig burrows in flats between low sand dunes (Woolley, 2008). This species is generally solitary outside of the breeding season and constructs single-entranced, multi-tunnelled burrows within their home range (Woolley, 2008). According to Koertner *et al.* (2007), home ranges and burrows encompass both mature spinifex and open regrowth areas and this species does not appear to exhibit a preference for one habitat type over the other. Utilisation of open habitats may be associated with an increased risk of predation, especially following fire.

The brush-tailed mulgara is typically a nocturnal hunter, feeding on arthropods and small vertebrates (Woolley, 2008). This species is not exclusively nocturnal and may be seen basking at burrow entrances on sunny days (Woolley, 2008). During periods of abundant resource availability, fat is stored in the tail to provide an energy reserve when food is scarce (Woolley, 2008). Breeding is thought to occur from late winter to spring (Woolley, 2008).

Occurrence within the Study Area

DCBA and Fortescue database searches indicate that the brush-tailed mulgara has been recorded on 325 occasions within 100 km of the study area. A single brush-tailed mulgara was recorded by a targeted motion camera deployed on a potential burrow in Bonney Downs South (Spectrum Ecology, 2024).

Brush-tailed mulgara records are shown in Map 18.

Habitat within the Study Area

Habitat for the brush-tailed mulgara occurs within the Plain (stony/gibber) habitat type which encompasses spinifex grasslands and substrates suitable for burrowing.

4.3.2.6 Western pebble-mound mouse (*Pseudomys chapmani*) – Priority 4

Ecology and Distribution

The western pebble-mound mouse constructs distinctive mounds of pebbles around their burrows (S. D. Anstee, Roberts, & O'Shea, 1997). The species has a fragmented distribution in the Pilbara, but is known to have a preference for hilly and/or rocky landscapes (S. Anstee & Armstrong, 2001; Ford & Johnson, 2007). When first described, it was considered that the range and abundance of this species had decreased dramatically. Since that time, it has been recorded on numerous occasions and is considered common and widespread in the bioregion.

Occurrence within the Study Area

DBCA and Fortescue database searches identified a total of 991 records of the western pebble-mound mouse within 100 km of the study area, with two previous Fortescue records occuring within the study area. Secondary evidence of the western pebble-mouse mounds was recorded at 10 sites within the Rocky Escarpment and Plain (stony/gibber) habitat types during the Bonney Downs North surveys (ecologia, 2024a), with two additional mounds recorded in Plain (stony/gibber) habitat during the Bonney Downs South surveys (Spectrum Ecology, 2024).

Western pebble-mound mouse records are shown in Map 18.

Habitat within the Study Area

Pebbles of a suitable size for mound construction are found across most of the study area, with suitable habitat occuring within the Rocky Escarpments, Plain (stony/gibber) and Hills/Ranges/Plateaux habitat types. The western pebble-mound mouse is considered relatively widespread throughout the Pilbara and suitable habitat for this species extends well beyond the confines of the study area.

4.3.2.7 Short-tailed mouse (*Leggadina lakedownensis*) – Priority 4

Ecology and Distribution

Populations of this small, elusive rodent are distributed across northern Australia, but records of this species have been sporadic since 1969 (Moro & Kutt, 2008). The short-tailed mouse occupies a diverse range of habitats from the monsoon tropical coast to semi-arid climates, including spinifex and tussock grasslands, samphire and sedgelands, *Acacia* shrublands, tropical eucalypt and *Melaleuca* woodlands and stony ranges. However, the species is usually found in habitats which are seasonally inundated with red or white sandy-clay soils (Moro & Kutt, 2008).

The diet of the short-tailed mouse consists primarily of invertebrates and water requirements are satisfied by consuming supplementary plant material (Moro & Kutt, 2008). Studies indicate that the short-tailed mouse is extremely well physiologically and ecologically adapted to substantial variation in tropical climatic conditions (Moro & Kutt, 2008). Numbers fluctuate greatly in response to rainfall on Thevenard and Serrurier Islands, with populations occasionally reaching plague proportions following heavy rainfall events. Conversely, a population in Kakadu which has been the subject of a long-term monitoring program has exhibited large scale population oscillations which are not correlated with environmental factors. The species is both nocturnal and solitary, spending the day in simple, single-chambered burrows (Moro & Kutt, 2008).

Occurrence within the Study Area

DBCA and Fortescue database searches identified 57 records of the short-tailed mouse within 100 km of the study area, with a single record from 2004 located within 300m of the study area. The short-tailed mouse was recorded on four occasions within the Plain (cracking clay) and Drainage Line/River/Creek (minor) habitat types during the Bonney Downs North surveys (ecologia, 2024a). Four additional short-tailed mouse captures were recorded at two Plain (cracking clay) sites at Bonney Downs South (Spectrum Ecology, 2024).

Short-tailed mouse records are shown in Map 18.

Habitat within the Study Area

Plain (cracking clay) and Drainage Line/River/Creek (minor) habitat types within the study area may encompass suitable substrates for the short-tailed mouse. Suitable habitat for the short-tailed mouse is not restricted within the study area and the known distribution of the species extends beyond the confines of the study area.

4.3.2.8 Gane's blind snake (*Anilios ganei*) – Priority 1

Ecology and Distribution

Very little is known about this elusive blind snake due to its fossorial lifestyle. Blind snakes are exclusively insectivorous and, like other members of their genus, the Gane's blind snake is believed to burrow into social insect colonies to feed on termites and ants, as well as their eggs and pupae (S. Wilson & Swan, 2021). The Gane's blind snake has been found within the Pilbara region between Newman and Pannawonica (S. Wilson & Swan, 2010; S. Wilson & Swan, 2021). It has been suggested that the species prefers to live in subterranean habitats near moist gullies and gorges (S. Wilson & Swan, 2010), although there are records from sandy soil vegetated with spinifex and mulga woodland.

Occurrence within the Study Area

According to DBCA Threatened and Priority database searches, the Gane's blind snake has been recorded on nine occasions within 100 km of the study area. This species was recorded on a single occasion within the Plain (stony/gibber) habitat type at Bonney Downs North (ecologia, 2024a). The species was not recorded at Bonney Downs South (Spectrum Ecology, 2024).

Gane's blind snake records are shown in Map 18.

Habitat within the Study Area

Hills/Ranges/Plateaux, Plain (stony/gibber), Gorges/Gullies and Drainage Line/River/Creek (major) habitat types within the study area may encompass suitable habitat for the Gane's blind snake. Suitable habitat for the Gane's blind snake is not restricted within the study area and the known distribution of the species extends beyond the confines of the study area.

Study area

Ecologia (2024) Bonney North
- Gane's blind snake (DBCA: P1)
- Northern short-tailed mouse (DBCA:P4)
- Western pebble-mound mouse (DBCA: P4)

Spectrum (2024) Bonney South
- Brush-tailed mulgara (DBCA: P4)
- Northern short-tailed mouse (DBCA: P4)
- Western pebble-mound mouse (DBCA: P4)

FMG Database
- Western Pebble-mound Mouse (DBCA: P4)

Habitat type
- Cleared
- Drainage Line/River/Creek (major)
- Drainage Line/River/Creek (minor)
- Gorges/Gullies
- Granite Outcrops (flat dome)
- Hills/Ranges/Plateaux
- Plain (Cracking clays)
- Plain (stony/gibber)
- Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)
- Woodland (closed)
- Woodland (open)

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 17 January 2025
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 18: Priority fauna recorded within the study area.

0 2 4 6 10 Kilometers

Earthstar Geographics

4.3.2.9 Pilbara olive python (*Liasis olivaceus barroni*) - Vulnerable EPBC Act and BC Act

Ecology and Distribution

The Pilbara subspecies of the olive python only occurs in the ranges of the Pilbara region of Western Australia. It inhabits watercourses and areas of permanent water in rocky gorges and gullies (D. J. Pearson, 2006).This subspecies is an adept swimmer, often hunting in water, feeding on a variety of vertebrates such as rock wallabies, fruit bats, ducks and pigeons. Individuals spend the cooler winter months sheltering in caves and rock crevices. In the warmer months the pythons can move widely, usually in close proximity to water and rock outcrops (DEWHA, 2008). Radiotelemetry of individuals has found that they occupy a distinct home range, with males travelling long distances (up to 4 km) to locate and mate with females (D. Pearson, 2003).

Population size estimates are difficult due to the olive python's cryptic nature and lack of reliable trapping or census techniques (DEWHA, 2008). The main threats to this subspecies come from predation by feral cats and foxes, particularly of juveniles, competition with foxes for food, and destruction of habitat (D. J. Pearson, 2006).

Critical Habitat

Critical habitat for the Pilbara olive python includes areas which may contain escarpments, gorges, preferably with rock crevices and outcrops near water holes, which attract prey species (Threatened Species Scientific Committee, 2008). The species prefers deeps gorges and holes within ranges in the Pilbara and spends the cooler months sheltering in caves and rock crevices away from water sources (Threatened Species Scientific Committee, 2008).

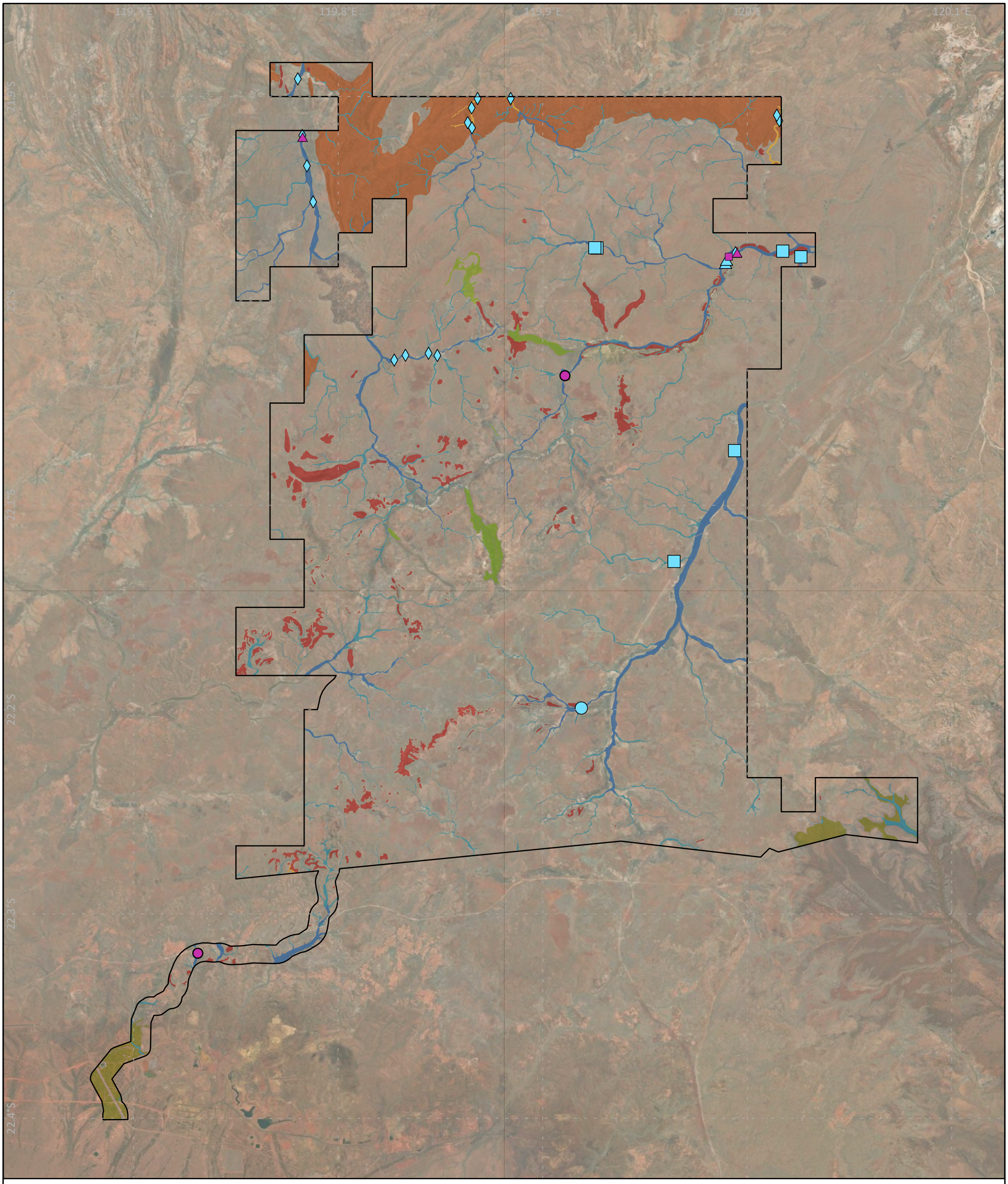
Occurrence within the Study Area

DBCA and Fortescue databases identified 64 records of the Pilbara olive python within 100 km of the study area, with the species recorded on three occasions during previous surveys. The Pilbara olive python was recorded on two occasions within the study area during detailed surveys at Bonney Downs North (ecologia, 2024a). One individual was recorded during nocturnal spotlighting activities near Bonney Pool and another individual was captured in a cage trap during the phase three detailed survey (ecologia, 2024a). No Pilbara olive pythons were recorded at Bonney Downs South (Spectrum Ecology, 2024).

Pilbara olive python records and critical habitat are shown in Map 19.

Critical Habitat within the Study Area

Hills/Ranges/Plateaux (6,446.92), Gorges/Gullies (82.56 ha), Drainage Line/River/Creek (major) (2,029.04 ha) and Rocky Escarpment (2,142.50 ha) habitat types within the study area provide critical habitat for the Pilbara olive python. Permanent and semi-permanent pools within the study area associated with Bonney Creek, Bonney Pools, the station dam, Nullagine River and the Coongan River provide suitable aquatic habitat for the species (Map 19).



Study area

Ecologia (2024) Bonney North
- Pilbara olive-python (EPBC: VU)

DBCA database
- Pilbara olive-python (EPBC: VU)

FMG Database
- Pilbara Olive Python (EPBC: VU)

Critical habitat
- Drainage Line/River/Creek (major)
- Drainage Line/River/Creek (minor)
- Gorges/Gullies
- Hills/Ranges/Plateaux
- Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)
- Woodland (closed)
- Woodland (open)

Water sources
- Bonney Downs Station Dam
- Bonnie Pools
- Non-permanent pool/waterhole
- Permanent pool/waterhole

ecologia ENVIRONMENT

Project No.: 2021
Author: SP
Created Date: 2 December 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 19: Pilbara olive python records and critical habitat within the study area.

0 2 4 6 10 Kilometers

Earthstar Geographics

4.3.3 Significant Fauna Recorded – Previous Surveys

4.3.3.1 Greater bilby (*Macrotis lagotis*) – Vulnerable EPBC Act and BC Act

Ecology and Distribution

Once common over 70% of mainland Australia's arid and semiarid regions, the greater bilby is now patchily distributed through the Tanami, Great Sandy and Gibson Deserts (Maxwell, Burbidge, & Morris, 1996). Isolated populations also occur in south-west Queensland and to the north-east of Alice Springs. The species experienced a sudden and widespread population reduction in the early 1900s, and the distribution is believed to still be contracting northwards (Threatened Species Scientific Committee, 2016a). Since the 1800s, the greater bilby has experienced dramatic population reductions to the extent that it now occupies less than 20% of its former range (Threatened Species Scientific Committee, 2016a). The greater bilby occupies a variety of habitats, including open tussock grasslands, Acacia (mulga) shrubland and woodlands, hummock grasslands on plains and alluvial areas and cracking clays (Johnson, 2008; Maxwell et al., 1996; Threatened Species Scientific Committee, 2016a).

The greater bilby is a medium-sized nocturnal marsupial with soft, silky fur (Pavey, 2006). Bilbies are solitary animals which are predominantly nocturnal and shelter in burrows during the day (Threatened Species Scientific Committee, 2016a). This species has strong forelimbs and claws which are used to construct extensive tunnel systems up to 3 m long and 1.8 m deep. Bilbies have been recorded using up to 12 burrows within their home range with short term home ranges varying in size between 0.1-3 km^2.

The diet of this species is highly specialised and it uses its long tongue to feed on seeds, insects, bulbs, fruit and fungi (Johnson, 2008). Reproduction is dependent on seasonal conditions and resource availability and litters consist of one to three offspring (Threatened Species Scientific Committee, 2016a). Females reach reproductive maturity at five months and males mature three months later (Threatened Species Scientific Committee, 2016a).

Reasons for historical decline included predation by feral predators on both young and adult bilbies, competition from rabbits and livestock, reduced food as a result of changed fire regimes, and drought (Johnson, 2008; Maxwell et al., 1996; O'Malley, 2006). Current threats impacting greater bilby population numbers are identical to historical threats, with the addition of habitat loss and fragmentation due to land clearing and development.

Critical Habitat

Remaining populations of the species are known to occupy three main habitat types: open tussock grassland on uplands and hills, mulga woodland/shrubland on ridges and rises and hummock grassland plains and alluvial areas (Threatened Species Scientific Committee, 2016a). The distribution of the species is limited by the availability of suitable substrates for burrowing, with the species considered more likely to occur in sandy areas where burrow excavation is easier (Commonwealth of Australia, 2019).

Critical habitat for the greater bilby is defined by the species recovery plan as any area which meets the criteria outlined below:

- Any area where the species is known or likely to occur as per the distribution map on the greater bilby SPRAT profile.
- Any location outside the modelled distribution where the bilby is found to occur.
- Any area between the areas noted above, that may be periodically occupied by bilbies.
- Any area which bilbies may naturally colonise or may feasibly be reintroduced.

Occurrence within the Study Area

DBCA and Fortescue database search results indicate that the greater bilby has previously been recorded on 285 occasions within 100 km of the study area, with two historical records (1982 & 1984) identified within the study area. The records identified within the study area have an unknown accuracy (0) and the locations provided are "Corunna 16kmN" (1984) and "Bonney Downs Station" (1982). Neither of the records were included in Dziminski, Carpenter, and Morris (2020) analysis of historical bilby records, which discarded records deemed to be uncertain due to low location accuracy. No evidence of this species was recorded during the current surveys, and limited suitable habitat was detected. Most of the study area encompasses rocky habitats and Plain (stony/gibber) habitat which have a rocky mantle and therefore, do not support suitable substrates for burrowing habitat for the greater bilby.

Historical greater bilby records and potential habitat are shown in Map 20.

Habitat within the Study Area

Potential greater bilby habitat in the study area primarily occurs within the Woodland (open/closed), with a small amount of suitable habitat present in the Drainage Line/River/Creek (major) habitat type along the Nullagine River. Given the questionable accuracy of the historical records, general lack of suitable habitat and absence of evidence to suggest that the species is occupying the study area, habitat within the study area is not currently considered to represent critical habitat for the species.

Historical records found to the west, are from sandy Triodia dominated habitats found on Hillside Station and the records to the east near Nullagine, are also in sandy substrates bordering large drainage lines and granite outcrops. No habitats within the study area provide connective dispersal habitat between these records and it is considered unlikely that greater bilbies would utilise Bonney Downs as dispersal habitat.

119.7°E 119.8°E 119.9°E 120°E 120.1°E

21.9°S 22°S 22.1°S 22.2°S 22.3°S 22.4°S

Study area

DBCA database

- Greater bilby (EPBC: VU)

Potential habitat

- Drainage Line/River/Creek (major)
- Woodland (closed)
- Woodland (open)

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Project No.: 2021
Author: SP
Created Date: 2 December 2024
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 20: Greater bilby records and potential habitat within the study area.

Earthstar Geographics

0 2 4 6 10 Kilometers

4.3.4 Significant Fauna with a High Likelihood of Occurrence

4.3.4.1 Long-tailed dunnart (*Sminthopsis longicaudata*) – Priority 4

Ecology and Distribution

The long-tailed dunnart is a small, carnivorous marsupial, distinguished from other *Sminthopsis* species by the length of its brush-tipped tail which is more than twice the head-body length (Burbidge, McKenzie, & Fuller, 2008). The species feeds on arthropods including beetles, ants, spiders, cockroaches, centipedes, grasshoppers and larvae. It has a long tail with a muscular base that allows it to be held in a variety of positions and probably acts as a balancer. This, along with striated foot-pads and behavioural observations made in captivity indicate that this species is well adapted to climbing (Burbidge et al., 2008). Breeding occurs in spring and summer, and juveniles disperse in March/April (Burbidge et al., 2008).

Long-tailed dunnarts are mostly found in rocky country in the western arid zone and occasionally in open country with a gravel/stony mantle (Burbidge et al., 2008). Although rarely encountered, in Western Australia they occur in the Pilbara, Murchison, north-eastern Goldfields, Ashburton and Gibson Desert regions (Burbidge et al., 2008).

Potential Occurrence within the Study Area

Although the long-tailed dunnart was not recorded during the current surveys, the species has previously been recorded on 10 occasions within 100 km of the study area, with two records (2005) located within 2 km of the study area. Suitable habitat may occur within the Rocky Escarpments, Gorges/Gullies, Granite Outcrops and Hills/Ranges/Plateaux habitat types. This species is highly cryptic, and was assigned a high likelihood of occurrence within the study area due to the presence of suitable rocky habitats and proximity of records.

4.3.4.2 Peregrine falcon (*Falco peregrinus*) – Other Specially Protected Fauna BC Act

Ecology and Distribution

This species is widespread in Australia but requires specific nesting sites. It does not build a nest but requires cliffs, rocky outcrops, or large tree hollows (Johnstone & Storr, 1998). Suitable breeding habitat has the potential to occur in the study area in the form of tree hollows and breakaways; however, due to its widespread movements, the species may also overfly all habitats of the study area intermittently. Peregrine falcons feed almost entirely on birds, especially ducks, parrots, and pigeons.

Potential Occurrence within the Study Area

According to DBCA and Fortescue database searches, the peregrine falcon has been recorded on 45 occasions within 100 km of the study area, with a single record located 3 km south of the study area. Records of the species appear to be concentrated around the Fortescue Marsh, with only a single record located north of the study area; however, this may reflect sampling bias rather than a true species distribution pattern. Although no evidence of this species was recorded during the current surveys, the peregrine falcon has the potential to utilise all habitat types while foraging. Rocky Escarpment habitat within the study area supports cliffs and overhangs for breeding activities and Drainage Line/River/Creek (major) habitat provide foraging habitat and encompass large trees which potentially provide nesting opportunities for this species.

4.3.5 Significant Fauna with a Moderate Likelihood of Occurrence

4.3.5.1 Migratory birds

Occurrence within the Study Area

DBCA and Fortescue database searches identified 10 Migratory bird species (common sandpiper, fork-tailed swift, sharp-tailed sandpiper, red-necked stint, oriental plover, gull-billed tern, Caspian tern, glossy ibis, wood sandpiper and marsh sandpiper) and two Threatened species (Australian painted snipe and common greenshank) which area considered moderately likely to occur within the study area based on the proximity of records to the study area and ability of these species to fly significant distances during migration. Although these species may intermittently occur within the study area (overflying or temporary utilisation of aquatic habitat), presence within the study area is likely to be associated with migratory movement to the Fortescue Marsh and does not represent permanent occupancy. Critical habitat for Migratory birds does not occur within the study area.

4.3.5.2 Night parrot (*Pezoporus occidentalis*) – Endangered EPBC Act and Critically Endangered BC Act

Ecology and Distribution

The night parrot is a cryptic, nocturnal parrot that is endemic to Australia primarily feeding on the ground inhabiting remote arid and semi-arid areas of Australia (DBCA, 2017b). Historical evidence indicates that night parrots were distributed over much of semi-arid and arid Australia (Garnett, Szabo, & Dutson, 2011). This elusive parrot was thought to be extinct for a long period of time prior to purported sightings in 2005 in the vicinity of Fortescue Marsh and the discovery of night parrots in western Queensland by John Young in 2013. Since 2013, detailed studies at Pullen Pullen Reserve in western Queensland have provided critical information relating to the ecology, biology, breeding behaviour, physiology, roosting and foraging habitat, nocturnal movements, and calling behaviour (Stephen A. Murphy, 2017). This species has subsequently been recorded and sighted in the East Murchison by (Jackett, Greatwich, Swann, & Boyle, 2017).

The structure of the Triodia recorded by Jackett et al. (2017) was similar to that described by Murphy, Silcock, Murphy, Reid, and Austin (2017) at Pullen Pullen, being dense, and ring-shaped. Murphy et al. (2017) recording a nest located in *Triodia longiceps* while (Jackett et al., 2017) recorded the nest in *Triodia* aff. *plurinervata*. night parrot nest site selection may be more reliant on the structure of the spinifex and not necessarily the size of the spinifex expanse, or the substrate type (Jackett et al., 2017). It is also suggested that the proximity of dense ground layer vegetation (e.g., *Triodia*) to suitable foraging grounds is likely to play a role in nest (and roost) site selection, suggesting the samphire and herbfields adjacent to the *Triodia* expanse could be a food source (Jackett et al., 2017; Murphy et al., 2017).

Potential Occurrence within the Study Area

Night parrot calls were not recorded during the current survey and it is considered unlikely that a long-term stable night parrot roosts exist in the area immediately surrounding the points sampled or that night parrots were foraging in proximity to these surveyed points at the time of sampling (Adaptive NRM, 2023). Methods used were compliant with the *Interim Survey Guidelines for the Night Parrot* (DBCA, 2017b) and further long-term surveys may be required to fulfil the requirements of new *Guidelines for Determining the Likely Presence and Habitat Usage of Night Parrot (Pezoporus occidentalis) in Western Australia* (DBCA, 2024) .

Potential Habitat within the Study Area

Potential roosting habitat

Plain (stony/gibber) habitat (81,441.48 ha) within the survey area may contain potential roosting habitat for the species; however, DBCA fire mapping indicates that only 15,706.37 ha (19.3%) of Plain (stony/gibber) habitat within the survey area has not been burnt within the past 25 years.

To further refine areas of potential night parrot roosting habitat, vegetation mapping (ecologia, 2025) was used to assess the likely presence/absence of *Triodia longiceps* within these areas as this species is known to provide suitable roosting habitat for the night parrot (DBCA, 2024). Vegetation associations in which *Triodia longiceps* was recorded within >50% of quadrats surveyed comprise 23,033 ha of the survey area, with DBCA fire mapping indicating that less than one quarter of these areas (5,645.39 ha, 24.5%) have not been burnt within the past 25 years.

Based on vegetation and fire history mapping undertaken within the survey area, the majority of suitable habitat occurs as small to medium patches of long-unburnt *Triodia longiceps*. Thirty-five percent of long-unburnt spinifex patches within the survey area comprise areas <1 ha, 50% of patches encompass <20 ha and only 3.11% of patches encompass >100 ha. Many areas of vegetation identified as potentially encompassing long-unburnt *Triodia longiceps* were associated with major drainage lines. These areas are considered unlikely to provide suitable roosting habitat for the night parrot due to the presence of large trees and shrubs. The remaining areas generally fall within the Plain (stony/gibber) habitat type.

No evidence of the night parrot has been recorded within the study area to date. Detailed ground-truthing may be required to determine what proportion of areas identified as potential roosting habitat areas actually contain long-unburnt spinifex and confirm the complete absence of long-unburnt *Triodia longiceps* in areas believed to have been burnt based on DBCA fire mapping.

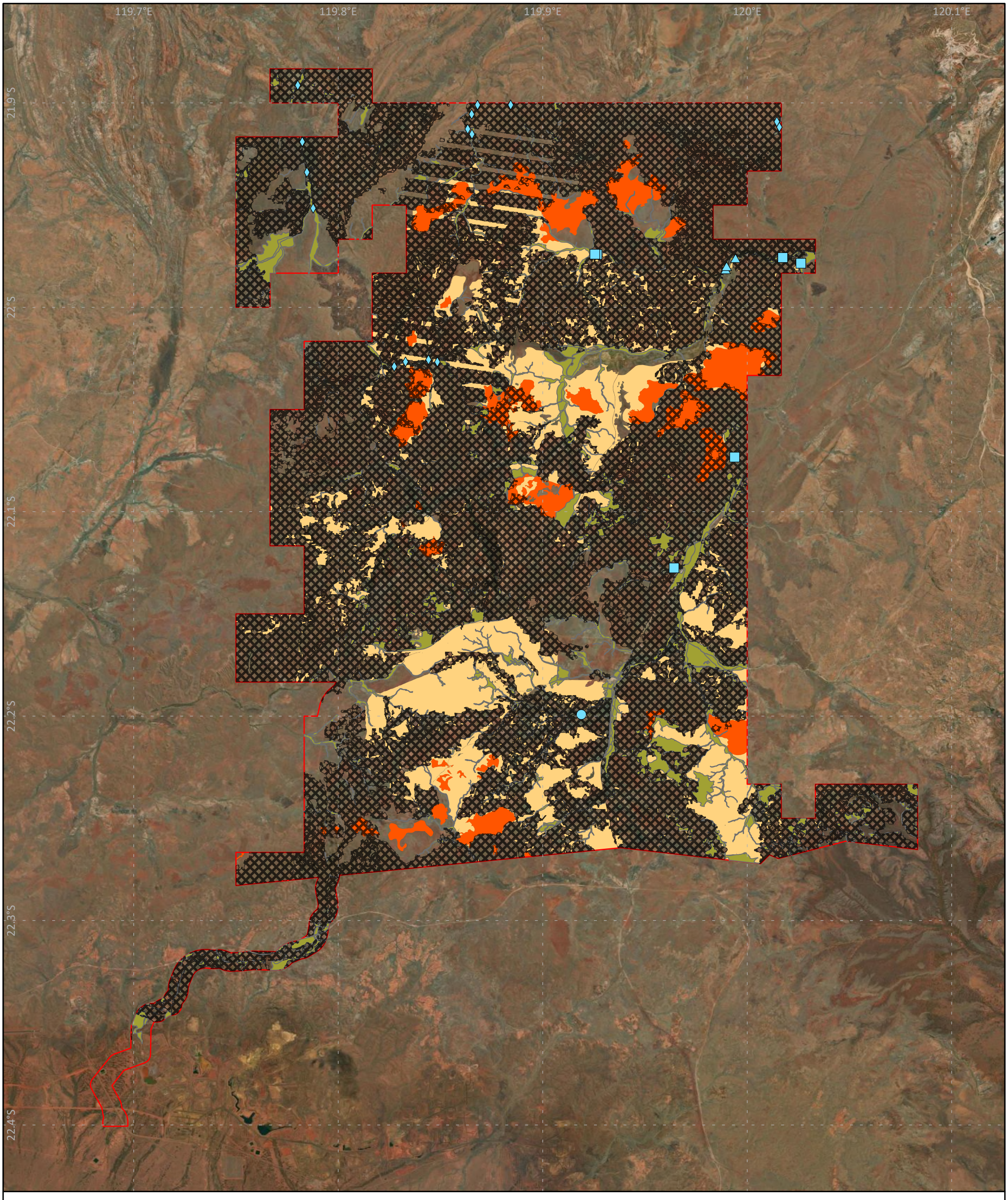
Potential roosting habitat for the night parrot is mapped in Map 21.

Potential foraging habitat

Suitable foraging habitat occurs within the Plain (cracking clays) habitat type (5,756.19 ha); however, due to heavy grazing and trampling by European cattle, potential foraging resources identified within the study area are unlikely to sustain a permanent population of the species during the dry season and foraging resource availability during the wet season is likely to be restricted to periods following sustained rainfall and areas where cattle are excluded. If grazing pressure or stocking rates were to decrease in the future, foraging habitat suitability may increase accordingly.

Fresh water sources are readily available within the survey area, including agricultural dams and troughs, permanent and semi-permanent pools (including Bonnie Pools) and major drainage lines (during periods of seasonal inundation).

Potential foraging habitat for the night parrot is mapped in Map 21.



Study area

Burnt (2007-2024)

Foraging habitat

Plain (Cracking clays) - wet season only

Roosting habitat

Plain (stony/gibber)

Potential long-unburnt T. longiceps

Water sources

Bonney Downs Station Dam

Bonnie Pools

Non-permanent pool/waterhole

Permanent pool/waterhole

ecologia ENVIRONMENT

Project No.: 2021
Author: CB
Created Date: 17 January 2025
Coordinate System: GCS GDA 1994
Scale: 1:190,000 @A3

Map 21: Potential night parrot roosting and foraging habitat within the study area.

0 2 4 6 10 Kilometers

Earthstar Geographics

5 CONCLUSIONS

The key conclusions from the terrestrial vertebrate fauna assessment of the Bonney Downs North study area are as follows:

- Ten fauna habitat types have been identified within the study area: Plain (stony/gibber), Rocky Escarpments, Gorges/Gullies, Granite Outcrop (flat dome), Drainage Line/River/Creek (major), Drainage Line/River/Creek (minor), Plain (cracking clays), Woodland (open), Woodland (closed) and Hills/Ranges/Plateaux.
- Rocky Escarpments and Hills/Ranges/Plateaux within the study area provide suitable denning habitat for the northern quoll and potential nocturnal shelter and diurnal roosting habitat for the ghost bat and Pilbara leaf-nosed bat, though no suitable roosting caves were recorded.
- Gorges/Gullies within the study area provides foraging and dispersal habitat for the Pilbara olive python, both significant bat species, the northern quoll and the Gane's blind snake.
- Plain (stony/gibber) habitat encompasses suitable substrates for the Gane's blind snake, the western pebble-mound mouse and the brush-tailed mulgara while the Plain (cracking clays) habitat type contains suitable habitat for the short-tailed mouse. This habitat type may also provide suitable roosting habitat for the night parrot.
- Drainage Line/River/Creek (major) habitat provides dispersal habitat for the northern quoll and Pilbara olive python, breeding and foraging habitat for significant falcons and foraging opportunities for the Pilbara leaf-nosed bat and ghost bat.
- A total of 237 terrestrial vertebrate fauna species including 31 mammals (17 native non-volant species, three introduced species and 11 bats), 82 reptiles, 118 birds, four amphibians and two fish have been recorded in the study area, representing 63.5% of the fauna assemblage potentially occurring based on database searches. The number of terrestrial vertebrate fauna taxa recorded during the current surveys (237 species) is significantly greater than that recorded by other detailed fauna surveys undertaken in the vicinity of the study area (min=32 species, max=194 species).
- Nine vertebrate species of significance were recorded during the current survey: the grey falcon, northern quoll, brush-tailed mulgara, western pebble-mound mouse, short-tailed mouse, Pilbara leaf-nosed bat, ghost bat, Pilbara olive python and Gane's blind snake. Although the greater bilby has historically been recorded within the study area, suitable habitat for this species is limited and no evidence of occupancy was recorded during the current surveys during targeted surveys for the species.
- The long-tailed dunnart and peregrine falcon are considered highly likely to occur within the study area based on proximity, abundance and recency of database records and a further 13 significant avifauna taxa (10 Migratory species and three Threatened species) are considered moderately likely to occur within the study area, though critical habitat for Migratory birds does not occur within the study area.
- No significant limitations were identified and survey methods were assessed as being in accordance with relevant Technical Guidance and significant fauna survey guidelines available at the time of survey. Both detailed and targeted fauna surveys included in the current consolidation included at least one survey phase within the optimal survey window for the region and were undertaken during optimal timing for birds, bats, mammals, amphibians and reptiles. BBSUS surveys included in the current consolidation were undertaken in accordance with timings outlined in the Draft Onshore Wind Farm Guidance Statement.

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7 APPENDICES

Appendix A Definitions.

SIGNIFICANT FAUNA

According to the *EPA Factor Guideline: Terrestrial* Fauna (EPA, 2016) animal taxa (or records) may be considered significant for a number of reasons including, but not restricted to, the following:

A taxon listed as 'Threatened' under the Biodiversity Conservation Act 2016 (WA) or the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth);

- A taxon on the Department of Biodiversity, Conservation and Attractions (DBCA) Priority Fauna List;
- Species with restricted distributions;
- Degree of historical impact from threatening processes;
- Providing an important function required to maintain the ecological integrity of a significant ecosystem.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Cwlth)

At a Commonwealth level, Threatened species are protected under the EPBC Act, which lists species in accordance with the criteria of the International Union for Conservation of Nature (International Union for Conservation of Nature, 2014), that is, 'Critically Endangered', 'Endangered', 'Vulnerable', 'Conservation Dependant', 'Extinct', or 'Extinct in the Wild' (see http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora and http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=fauna).

Biodiversity Conservation Act 2016 (Western Australia)

At a State level, Threatened species are protected under the BC Act. These are taxa which have been adequately surveyed and are deemed to be either rare, in danger of extinction, or otherwise in need of special protection in the wild and are gazetted as Threatened (Declared Rare) Flora. Threatened species are further categorised by the Department of Biodiversity, Conservation and Attractions (DBCA) according to their level of threat using the International Union for Conservation of Nature (IUCN) red list criteria ((International Union for Conservation of Nature, 2014) (see https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities for definitions).

Priority Fauna (DBCA)

The DBCA maintains a list of Priority species, which are considered poorly known, uncommon or under threat but for which there is insufficient justification to be listed as Threatened, based on known distribution and population sizes. Priority species are assigned to one of four categories, described below. DBCA listed Priority species do not have any statutory protection (see https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants for definitions.)

Appendix B Fauna database search results.

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 28-Nov-2024

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	13
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	24
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.		
Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat likely to occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
MAMMAL		
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
Macrotis lagotis		
Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Roosting known to occur within area
REPTILE		
Liasis olivaceus barroni		
Pilbara Olive Python [66699]	Vulnerable	Species or species habitat likely to occur within area
Liopholis kintorei		
Great Desert Skink, Tjakura, Warrarna, Mulyamiji, Tjalapa, Nampu [83160]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Scientific Name	Threatened Category	Presence Text
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State
Unknown	
Commonwealth Land - [51745]	WA
Commonwealth Land - [51746]	WA

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Bubulcus ibis as Ardea ibis		
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Rostratula australis as Rostratula benghalensis (sensu lato)		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area

Extra Information

Nationally Important Wetlands	[Resource Information]
Wetland Name	State
Fortescue Marshes	WA

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
East Hamersley Railway	2023/09542		Assessment
Nyidinghu Iron Ore Mine	2023/09543		Assessment
Roy Hill Iron Ore Mine expansion, Pilbara Region, WA	2018/8330		Post-Approval
Controlled action			
Additional Rail Infrastructure between Herb Elliott Port Facility and Cloudbreak Mine Site	2010/5513	Controlled Action	Post-Approval
Bonney Downs Rail Alignment	2011/5867	Controlled Action	Post-Approval
Christmas Creek Iron Ore Mine Expansion Project, East Pilbara, WA	2013/7055	Controlled Action	Post-Approval
Christmas Creek Water Management Scheme	2010/5706	Controlled Action	Post-Approval
Cloud Break Open Pit Iron Ore Mine	2005/2205	Controlled Action	Post-Approval
construction of iron ore mine & associated infrastructure	2013/6945	Controlled Action	Completed
Expansion of Cloudbreak iron ore mine	2010/5696	Controlled Action	Post-Approval
FerrAus Pilbara Project - mine & Rail Pilbara Region WA	2011/6036	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Golden Eagle Satellite Deposits Development	2011/5855	Controlled Action	Post-Approval
McPhee Iron Ore Project	2021/8897	Controlled Action	Assessment Approach
Nullagine Iron Ore Extension Project, Pilbara region, WA	2013/6887	Controlled Action	Post-Approval
Nullagine Iron Ore Project	2009/4930	Controlled Action	Post-Approval
Roy Hill to Port Hedland Rail Line and Associated Infrastructure	2010/5424	Controlled Action	Post-Approval
Not controlled action			
Development of iron ore resources in eastern Pilbara region, including port at P	2004/1562	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Pilbara Transmission Project, Pilbara, WA	2018/8349	Not Controlled Action	Completed
Roy Hill Iron Ore Project	2008/4624	Not Controlled Action	Completed
Stage B of Pilbara Iron Ore and Infrastructure Project	2004/1897	Not Controlled Action	Completed
Not controlled action (particular manner)			
Additional Rail Infrastructure	2012/6314	Not Controlled Action (Particular Manner)	Post-Approval
Northwest Resources Blue Spec Shear Gold-Antimony Project	2012/6672	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Mining at the Blue Spec and Gold Spec deposits	2012/6234	Referral Decision	Completed

Caveat

1 PURPOSE

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

The report contains the mapped locations of:

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

2 DISCLAIMER

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

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

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

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

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

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

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

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

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

Acknowledgements

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

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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

Please feel free to provide feedback via the Contact us page.

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Birdata Species List

Emu
Dromaius novaehollandiae
4 (1.17%)

Plumed Whistling-Duck
Dendrocygna eytoni
12 (3.52%)

Pink-eared Duck
Malacorhynchus membranaceus
11 (3.23%)

Black Swan
Cygnus atratus
15 (4.40%)

Australian Shelduck
Tadorna tadornoides
9 (2.64%)

Hardhead
Aythya australis
16 (4.69%)

Pacific Black Duck
Anas superciliosa
38 (11.14%)

Grey Teal
Anas gracilis
25 (7.33%)

Freckled Duck
Stictonetta naevosa
2 (0.59%)

Australian Wood Duck
Chenonetta jubata
9 (2.64%)

Brown Quail
Synoicus ypsilophorus
4 (1.17%)

Australasian Grebe
Tachybaptus novaehollandiae
9 (2.64%)

Hoary-headed Grebe
Poliocephalus poliocephalus
16 (4.69%)

Spinifex Pigeon
Geophaps plumifera
46 (13.49%)

Common Bronzewing
Phaps chalcoptera
13 (3.81%)

Crested Pigeon
Ocyphaps lophotes
81 (23.75%)

Diamond Dove
Geopelia cuneata
97 (28.45%)

Peaceful Dove
Geopelia placida
30 (8.80%)

Pheasant Coucal
Centropus phasianinus
1 (0.29%)

Horsfield's Bronze-Cuckoo
Chalcites basalis
16 (4.69%)

Pallid Cuckoo
Heteroscenes pallidus
17 (4.99%)

Australian Bustard
Ardeotis australis
17 (4.99%)

Tawny Frogmouth
Podargus strigoides
4 (1.17%)

Spotted Nightjar
Eurostopodus argus
8 (2.35%)

Australian Owlet-nightjar
Aegotheles cristatus
13 (3.81%)

Buff-banded Rail
Hypotaenidia philippensis
1 (0.29%)

Black-tailed Native-hen
Tribonyx ventralis
3 (0.88%)

Eurasian Coot
Fulica atra
7 (2.05%)

Bush Stone-curlew
Burhinus grallarius
2 (0.59%)

Pied Stilt
Himantopus leucocephalus
10 (2.93%)

Red-capped Plover
Charadrius ruficapillus
3 (0.88%)

Oriental Plover
Charadrius veredus
1 (0.29%)

Black-fronted Dotterel
Elseyornis melanops
45 (13.20%)

Red-kneed Dotterel
Erythrogonys cinctus
4 (1.17%)

Australian Painted-Snipe
Rostratula australis
1 (0.29%)

Sharp-tailed Sandpiper
Calidris acuminata
1 (0.29%)

Wood Sandpiper
Tringa glareola
3 (0.88%)

Little Button-quail
Turnix velox
24 (7.04%)

Silver Gull
Larus novaehollandiae
2 (0.59%)

Australian Gull-billed Tern
Gelochelidon macrotarsa
2 (0.59%)

Caspian Tern
Hydroprogne caspia
2 (0.59%)

Whiskered Tern
Chlidonias hybrida
7 (2.05%)

Black-necked Stork
Ephippiorhynchus asiaticus
8 (2.35%)

Australian Pelican
Pelecanus conspicillatus
23 (6.74%)

Nankeen Night-Heron
Nycticorax caledonicus
1 (0.29%)

Cattle Egret
Bubulcus ibis
1 (0.29%)

White-necked Heron
Ardea pacifica
23 (6.74%)

Great Egret
Ardea alba
24 (7.04%)

White-faced Heron
Egretta novaehollandiae
35 (10.26%)

Little Egret
Egretta garzetta
7 (2.05%)

Australian White Ibis
Threskiornis moluccus
3 (0.88%)

Straw-necked Ibis
Threskiornis spinicollis
22 (6.45%)

Yellow-billed Spoonbill
Platalea flavipes
12 (3.52%)

Royal Spoonbill
Platalea regia
8 (2.35%)

Glossy Ibis
Plegadis falcinellus
1 (0.29%)

Little Pied Cormorant
Microcarbo melanoleucos
28 (8.21%)

Great Cormorant
Phalacrocorax carbo
1 (0.29%)

Little Black Cormorant
Phalacrocorax sulcirostris
29 (8.50%)

Great Pied Cormorant
Phalacrocorax varius
1 (0.29%)

Australasian Darter
Anhinga novaehollandiae
30 (8.80%)

Black-shouldered Kite
Elanus axillaris
4 (1.17%)

Black-breasted Buzzard
Hamirostra melanosternon
3 (0.88%)

Wedge-tailed Eagle
Aquila audax
32 (9.38%)

Little Eagle
Hieraaetus morphnoides
10 (2.93%)

Swamp Harrier
Circus approximans
6 (1.76%)

Spotted Harrier
Circus assimilis
12 (3.52%)

Brown Goshawk
Accipiter fasciatus
13 (3.81%)

Collared Sparrowhawk
Accipiter cirrocephalus
8 (2.35%)

White-bellied Sea-Eagle
Haliaeetus leucogaster
1 (0.29%)

Whistling Kite
Haliastur sphenurus
106 (31.09%)

Black Kite
Milvus migrans
9 (2.64%)

Barn Owl
Tyto alba
1 (0.29%)

Southern Boobook
Ninox boobook
13 (3.81%)

Rainbow Bee-eater
Merops ornatus
71 (20.82%)

Sacred Kingfisher
Todiramphus sanctus
26 (7.62%)

Red-backed Kingfisher
Todiramphus pyrrhopygius
38 (11.14%)

Blue-winged Kookaburra
Dacelo leachii
46 (13.49%)

Nankeen Kestrel
Falco cenchroides
56 (16.42%)

Australian Hobby
Falco longipennis
18 (5.28%)

Brown Falcon
Falco berigora
45 (13.20%)

Peregrine Falcon
Falco peregrinus
2 (0.59%)

Cockatiel
Nymphicus hollandicus
83 (24.34%)

Galah
Eolophus roseicapilla
79 (23.17%)

Little Corella
Cacatua sanguinea
70 (20.53%)

Australian Ringneck
Barnardius zonarius
65 (19.06%)

Bourke's Parrot
Neopsephotus bourkii
6 (1.76%)

Budgerigar
Melopsittacus undulatus
64 (18.77%)

Western Bowerbird
Chlamydera guttata
2 (0.59%)

Black-tailed Treecreeper
Climacteris melanurus
2 (0.59%)

Variegated Fairy-wren
Malurus lamberti
44 (12.90%)

White-winged Fairy-wren
Malurus leucopterus
37 (10.85%)

Striated Grasswren
Amytornis striatus
4 (1.17%)

Black Honeyeater
Sugomel nigrum
6 (1.76%)

Brown Honeyeater
Lichmera indistincta
57 (16.72%)

Black-chinned Honeyeater
Melithreptus gularis
5 (1.47%)

Pied Honeyeater
Certhionyx variegatus
2 (0.59%)

Crimson Chat
Epthianura tricolor
21 (6.16%)

Orange Chat
Epthianura aurifrons
3 (0.88%)

White-gaped Honeyeater
Stomiopera unicolor
1 (0.29%)

Spiny-cheeked Honeyeater
Acanthagenys rufogularis
33 (9.68%)

Singing Honeyeater
Gavicalis virescens
68 (19.94%)

Grey-headed Honeyeater
Ptilotula keartlandi
15 (4.40%)

Grey-fronted Honeyeater
Ptilotula plumula
1 (0.29%)

White-plumed Honeyeater
Ptilotula penicillata
144 (42.23%)

White-fronted Honeyeater
Purnella albifrons
1 (0.29%)

Yellow-throated Miner
Manorina flavigula
128 (37.54%)

Red-browed Pardalote
Pardalotus rubricatus
45 (13.20%)

Striated Pardalote
Pardalotus striatus
12 (3.52%)

Western Gerygone
Gerygone fusca
5 (1.47%)

Weebill
Smicrornis brevirostris
59 (17.30%)

Redthroat
Pyrrholaemus brunneus
1 (0.29%)

Rufous Fieldwren
Calamanthus campestris
1 (0.29%)

Inland Thornbill
Acanthiza apicalis
1 (0.29%)

Slaty-backed Thornbill
Acanthiza robustirostris
3 (0.88%)

Chestnut-rumped Thornbill
Acanthiza uropygialis
16 (4.69%)

Grey-crowned Babbler
Pomatostomus temporalis
47 (13.78%)

White-browed Babbler
Pomatostomus superciliosus
4 (1.17%)

Ground Cuckoo-shrike
Coracina maxima
1 (0.29%)

Black-faced Cuckoo-shrike
Coracina novaehollandiae
98 (28.74%)

White-winged Triller
Lalage tricolor
25 (7.33%)

Chestnut-breasted Quail-thrush
Cinclosoma castaneothorax
1 (0.29%)

Rufous Whistler
Pachycephala rufiventris
52 (15.25%)

Grey Shrike-thrush
Colluricincla harmonica
16 (4.69%)

Crested Bellbird
Oreoica gutturalis
28 (8.21%)

Chiming Wedgebill
Psophodes occidentalis
1 (0.29%)

Australian Magpie
Gymnorhina tibicen
31 (9.09%)

Pied Butcherbird
Cracticus nigrogularis
73 (21.41%)

Grey Butcherbird
Cracticus torquatus
7 (2.05%)

Masked Woodswallow
Artamus personatus
5 (1.47%)

Black-faced Woodswallow
Artamus cinereus
69 (20.23%)

Little Woodswallow
Artamus minor
10 (2.93%)

Willie Wagtail
Rhipidura leucophrys
124 (36.36%)

Torresian Crow
Corvus orru
95 (27.86%)

Little Crow
Corvus bennetti
13 (3.81%)

Magpie-lark
Grallina cyanoleuca
139 (40.76%)

Red-capped Robin
Petroica goodenovii
35 (10.26%)

Hooded Robin
Melanodryas cucullata
13 (3.81%)

Mistletoebird
Dicaeum hirundinaceum
12 (3.52%)

Painted Finch
Emblema pictum
32 (9.38%)

Star Finch
Neochmia ruficauda
2 (0.59%)

Zebra Finch
Taeniopygia castanotis
152 (44.57%)

Australasian Pipit
Anthus novaeseelandiae
37 (10.85%)

Horsfield's Bushlark
Mirafra javanica
6 (1.76%)

Brown Songlark
Cincloramphus cruralis
31 (9.09%)

Rufous Songlark
Cincloramphus mathewsi
33 (9.68%)

Spinifexbird
Poodytes carteri
9 (2.64%)

Australian Reed-Warbler
Acrocephalus australis
8 (2.35%)

Fairy Martin
Petrochelidon ariel
20 (5.87%)

Tree Martin
Petrochelidon nigricans
17 (4.99%)

Welcome Swallow
Hirundo neoxena
3 (0.88%)

Corella spp
1 (0.29%)

Crow & Raven spp
6 (1.76%)

Atlas of Living Australia

Species Name	Vernacular Name	Class	Order	Family	Genus	Number of records
Litoria rubella	Little Red Tree Frog	Amphibia	Anura	Pelodryadidae	Litoria	23
Uperoleia saxatilis	Pilbara Toadlet	Amphibia	Anura	Myobatrachidae	Uperoleia	5
Platyplectrum spenceri	Spencer's Burrowing Frog	Amphibia	Anura	Limnodynastidae	Platyplectrum	3
Neobatrachus sutor	Shoemaker Frog	Amphibia	Anura	Limnodynastidae	Neobatrachus	2
Cyclorana maini	Main's Frog	Amphibia	Anura	Pelodryadidae	Cyclorana	2
Cyclorana occidentalis		Amphibia	Anura	Pelodryadidae	Cyclorana	1
Rhinella marina	Cane Toad	Amphibia	Anura	Bufonidae	Rhinella	1
Notaden nichollsi	Desert Spadefoot	Amphibia	Anura	Limnodynastidae	Notaden	1
Ctenotus saxatilis	Stony-soil Ctenotus	Reptilia	Squamata	Scincidae	Ctenotus	34
Anilios ammodytes	Sand-diving Blind Snake	Reptilia	Squamata	Typhlopidae	Anilios	31
Lerista timida	Timid Slider	Reptilia	Squamata	Scincidae	Lerista	30
Ctenophorus caudicinctus	Ring-tailed Dragon	Reptilia	Squamata	Agamidae	Ctenophorus	29
Tympanocryptis fortescuensis	Fortescue Pebble-mimic Dragon	Reptilia	Squamata	Agamidae	Tympanocryptis	25
Gehyra montium	Centralian Dtella	Reptilia	Squamata	Gekkonidae	Gehyra	22
Cyclodomorphus melanops	Spinifex Slender Blue-tongue	Reptilia	Squamata	Scincidae	Cyclodomorphus	21
Heteronotia binoei	Bynoe's Gecko	Reptilia	Squamata	Gekkonidae	Heteronotia	20
Ctenotus duricola	Pilbara Ctenotus	Reptilia	Squamata	Scincidae	Ctenotus	19
Lucasium woodwardi		Reptilia	Squamata	Diplodactylidae	Lucasium	18
Ctenotus helenae	Clay-soil Ctenotus	Reptilia	Squamata	Scincidae	Ctenotus	17
Delma pax	Peace Delma	Reptilia	Squamata	Pygopodidae	Delma	16
Lucasium wombeyi	Pilbara Ground Gecko	Reptilia	Squamata	Diplodactylidae	Lucasium	15
Menetia greyii	Grey's Menetia	Reptilia	Squamata	Scincidae	Menetia	15
Menetia surda	Western Dwarf Skink	Reptilia	Squamata	Scincidae	Menetia	14
Lerista amicorum		Reptilia	Squamata	Scincidae	Lerista	13
Gehyra variegata	Tree Dtella	Reptilia	Squamata	Gekkonidae	Gehyra	12
Carlia munda	Shaded-litter Rainbow-skink	Reptilia	Squamata	Scincidae	Carlia	12
Morethia ruficauda	Lined Firetail Skink	Reptilia	Squamata	Scincidae	Morethia	12
Gowidon longirostris	Long-nosed Dragon	Reptilia	Squamata	Agamidae	Gowidon	11
Lerista muelleri	Wood Mulch-slider	Reptilia	Squamata	Scincidae	Lerista	11
Strophurus wellingtonae	Western Shield Spiny-tailed Gecko	Reptilia	Squamata	Diplodactylidae	Strophurus	10
Gehyra punctata	Spotted Dtella	Reptilia	Squamata	Gekkonidae	Gehyra	9
Eremiascincus richardsonii	Broad-banded Sand-swimmer	Reptilia	Squamata	Scincidae	Eremiascincus	9
Strophurus elderi	Jewelled Gecko	Reptilia	Squamata	Diplodactylidae	Strophurus	9
Ctenotus nigrilineatus	Pin-striped Finesnout Ctenotus	Reptilia	Squamata	Scincidae	Ctenotus	8
Ctenophorus reticulatus	Western Netted Dragon	Reptilia	Squamata	Agamidae	Ctenophorus	8
Varanus acanthurus	Ridge-tailed Monitor	Reptilia	Squamata	Varanidae	Varanus	7

Ctenophorus isolepis	Central Military Dragon	Reptilia	Squamata	Agamidae	Ctenophorus	7
Anilios grypus	Long-beaked Blind Snake	Reptilia	Squamata	Typhlopidae	Anilios	7
Ctenotus pantherinus	Leopard Ctenotus	Reptilia	Squamata	Scincidae	Ctenotus	6
Delma nasuta	Sharp-snouted Delma	Reptilia	Squamata	Pygopodidae	Delma	6
Varanus giganteus	Perentie	Reptilia	Squamata	Varanidae	Varanus	6
Anilios waitii	Beaked Blind Snake	Reptilia	Squamata	Typhlopidae	Anilios	5
Pseudonaja mengdeni	Western Brown Snake	Reptilia	Squamata	Elapidae	Pseudonaja	5
Varanus bushi		Reptilia	Squamata	Varanidae	Varanus	4
Ctenophorus nuchalis	Central Netted Dragon	Reptilia	Squamata	Agamidae	Ctenophorus	4
Pseudonaja modesta	Ringed Brown Snake	Reptilia	Squamata	Elapidae	Pseudonaja	4
Cryptoblepharus plagiocephalus	PÃ©ron's Snake-eyed Skink	Reptilia	Squamata	Scincidae	Cryptoblepharus	4
Heteronotia spelea	Desert Cave Gecko	Reptilia	Squamata	Gekkonidae	Heteronotia	4
Furina ornata	Moon Snake	Reptilia	Squamata	Elapidae	Furina	4
Demansia reticulata	Yellow-faced Whipsnake	Reptilia	Squamata	Elapidae	Demansia	4
Varanus panoptes	Yellow-spotted Monitor	Reptilia	Squamata	Varanidae	Varanus	4
Diplodactylus savagei	Southern Pilbara Beak-faced Gecko	Reptilia	Squamata	Diplodactylidae	Diplodactylus	3
Gehyra micra	Small Pilbara Spotted Rock Gehyra	Reptilia	Squamata	Gekkonidae	Gehyra	3
Lerista jacksoni		Reptilia	Squamata	Scincidae	Lerista	3
Proablepharus reginae	Spinifex Snake-eyed Skink	Reptilia	Squamata	Scincidae	Proablepharus	3
Rhynchoedura ornata	Western Beaked Gecko	Reptilia	Squamata	Diplodactylidae	Rhynchoedura	3
Notoscincus ornatus	Ornate Soil-crevice Skink	Reptilia	Squamata	Scincidae	Notoscincus	3
Nephrurus cinctus		Reptilia	Squamata	Carphodactylidae	Nephrurus	3
Ctenotus uber	Spotted Ctenotus	Reptilia	Squamata	Scincidae	Ctenotus	3
Carlia triacantha	Desert Rainbow-skink	Reptilia	Squamata	Scincidae	Carlia	3
Lerista verhmens	Powerful Lerista	Reptilia	Squamata	Scincidae	Lerista	3
Antaresia childreni	Children's Python	Reptilia	Squamata	Pythonidae	Antaresia	3
Pseudechis australis	Mulga Snake	Reptilia	Squamata	Elapidae	Pseudechis	3
Varanus brevicauda	Short-tailed Pygmy Monitor	Reptilia	Squamata	Varanidae	Varanus	2
Ctenotus grandis	Grand Ctenotus	Reptilia	Squamata	Scincidae	Ctenotus	2
Lerista bipes	Two-toed Lerista	Reptilia	Squamata	Scincidae	Lerista	2
Delma tincta	Excitable Delma	Reptilia	Squamata	Pygopodidae	Delma	2
Varanus caudolineatus	Stripe-tailed Monitor	Reptilia	Squamata	Varanidae	Varanus	2
Anilios hamatus	Pale-headed Blind Snake	Reptilia	Squamata	Typhlopidae	Anilios	2
Varanus tristis	Black-headed Monitor	Reptilia	Squamata	Varanidae	Varanus	2
Delma elegans	Pilbara Delma	Reptilia	Squamata	Pygopodidae	Delma	2
Aspidites melanocephalus	Black-headed Python	Reptilia	Squamata	Pythonidae	Aspidites	2
Suta punctata	Little Spotted Snake	Reptilia	Squamata	Elapidae	Suta	2
Lerista flammicauda	Pilbara Flame-tailed Slider	Reptilia	Squamata	Scincidae	Lerista	2

Anilios pilbarensis	Pilbara Blind Snake	Reptilia	Squamata	Typhlopidae	Anilios	2
Acanthophis wellsi	Pilbara Death Adder	Reptilia	Squamata	Elapidae	Acanthophis	2
Varanus eremius	Pygmy Desert Monitor	Reptilia	Squamata	Varanidae	Varanus	1
Egernia formosa	Goldfields Crevice-skink	Reptilia	Squamata	Scincidae	Egernia	1
Lialis burtonis	Burton's Snake-lizard	Reptilia	Squamata	Pygopodidae	Lialis	1
Pygopus nigriceps	Western Hooded Scaly-foot	Reptilia	Squamata	Pygopodidae	Pygopus	1
Pogona minor	Dwarf Bearded Dragon	Reptilia	Squamata	Agamidae	Pogona	1
Diporiphora amphiboluroides	Mulga Dragon	Reptilia	Squamata	Agamidae	Diporiphora	1
Egernia cygnitos	Western Pilbara Spiny-tailed Skink	Reptilia	Squamata	Scincidae	Egernia	1
Varanus pilbarensis	Pilbara Rock Monitor	Reptilia	Squamata	Varanidae	Varanus	1
Gehyra media	Medium Pilbara Spotted Rock Gehyra	Reptilia	Squamata	Gekkonidae	Gehyra	1
Diplodactylus laevis	Desert Fat-tailed Gecko	Reptilia	Squamata	Diplodactylidae	Diplodactylus	1
Lerista labialis	Southern Sandslider	Reptilia	Squamata	Scincidae	Lerista	1
Suta fasciata	Rosen's Snake	Reptilia	Squamata	Elapidae	Suta	1
Egernia pilbarensis	Pilbara Crevice-skink	Reptilia	Squamata	Scincidae	Egernia	1
Diplodactylus pulcher	Fine-faced Gecko	Reptilia	Squamata	Diplodactylidae	Diplodactylus	1
Varanus gouldii	Gould's Goanna	Reptilia	Squamata	Varanidae	Varanus	1
Delma butleri	Unbanded Delma	Reptilia	Squamata	Pygopodidae	Delma	1
Egernia epsisolus	Eastern Pilbara Spiny-tailed Skink	Reptilia	Squamata	Scincidae	Egernia	1
Chelodina (Chelodina) steindachneri	Steindachner's Turtle	Reptilia	Testudines	Chelidae	Chelodina	1
Taeniopygia guttata	Zebra Finch	Aves	Passeriformes	Estrildidae	Taeniopygia	207
Ptilotula penicillata	White-plumed Honeyeater	Aves	Passeriformes	Meliphagidae	Ptilotula	191
Grallina cyanoleuca	Magpie-lark	Aves	Passeriformes	Monarchidae	Grallina	190
Manorina (Myzantha) flavigula	Yellow-throated Miner	Aves	Passeriformes	Meliphagidae	Manorina	166
Rhipidura (Sauloprocta) leucophrys	Willie Wagtail	Aves	Passeriformes	Rhipiduridae	Rhipidura	147
Coracina (Coracina) novaehollandiae	Black-faced Cuckoo-shrike	Aves	Passeriformes	Campephagidae	Coracina	135
Haliastur sphenurus	Whistling Kite	Aves	Accipitriformes	Accipitridae	Haliastur	131
Geopelia cuneata	Diamond Dove	Aves	Columbiformes	Columbidae	Geopelia	130
Eolophus roseicapilla	Galah	Aves	Psittaciformes	Cacatuidae	Eolophus	124
Corvus orru	Torresian Crow	Aves	Passeriformes	Corvidae	Corvus	121
Ocyphaps lophotes	Crested Pigeon	Aves	Columbiformes	Columbidae	Ocyphaps	110
Artamus (Angroyan) cinereus	Black-faced Woodswallow	Aves	Passeriformes	Artamidae	Artamus	108
Nymphicus hollandicus	Cockatiel	Aves	Psittaciformes	Cacatuidae	Nymphicus	107
Melopsittacus undulatus	Budgerigar	Aves	Psittaciformes	Psittacidae	Melopsittacus	103
Cracticus nigrogularis	Pied Butcherbird	Aves	Passeriformes	Artamidae	Cracticus	100
Cacatua (Licmetis) sanguinea	Little Corella	Aves	Psittaciformes	Cacatuidae	Cacatua	100
Merops (Merops) ornatus	Rainbow Bee-eater	Aves	Coraciiformes	Meropidae	Merops	92
Gavicalis virescens	Singing Honeyeater	Aves	Passeriformes	Meliphagidae	Gavicalis	91

Smicrornis brevirostris	Weebill	Aves	Passeriformes	Acanthizidae	Smicrornis	88
Geophaps (Lophophaps) plumifera	Spinifex Pigeon	Aves	Columbiformes	Columbidae	Geophaps	87
Barnardius zonarius	Australian Ringneck	Aves	Psittaciformes	Psittacidae	Barnardius	85
Falco (Tinnunculus) cenchroides	Nankeen Kestrel	Aves	Falconiformes	Falconidae	Falco	76
Pomatostomus (Pomatostomus) temporalis	Grey-crowned Babbler	Aves	Passeriformes	Pomatostomidae	Pomatostomus	75
Elseyornis melanops	Black-fronted Dotterel	Aves	Charadriiformes	Charadriidae	Elseyornis	72
Pachycephala (Alisterornis) rufiventris	Rufous Whistler	Aves	Passeriformes	Pachycephalidae	Pachycephala	70
Pardalotus (Pardalotinus) rubricatus	Red-browed Pardalote	Aves	Passeriformes	Pardalotidae	Pardalotus	70
Dacelo (Dacelo) leachii	Blue-winged Kookaburra	Aves	Coraciiformes	Alcedinidae	Dacelo	69
Lichmera (Lichmera) indistincta	Brown Honeyeater	Aves	Passeriformes	Meliphagidae	Lichmera	66
Emblema pictum	Painted Finch	Aves	Passeriformes	Estrildidae	Emblema	59
Falco (Ieracidea) berigora	Brown Falcon	Aves	Falconiformes	Falconidae	Falco	56
Malurus (Musciparus) leucopterus	White-winged Fairy-wren	Aves	Passeriformes	Maluridae	Malurus	56
Anthus (Anthus) novaeseelandiae	Australian Pipit	Aves	Passeriformes	Motacillidae	Anthus	55
Todiramphus (Cyanalcyon) pyrrhopygius	Red-backed Kingfisher	Aves	Coraciiformes	Alcedinidae	Todiramphus	53
Oreoica gutturalis	Crested Bellbird	Aves	Passeriformes	Oreoicidae	Oreoica	53
Cincloramphus (Maclennania) mathewsi	Rufous Songlark	Aves	Passeriformes	Locustellidae	Cincloramphus	51
Aquila (Uroaetus) audax	Wedge-tailed Eagle	Aves	Accipitriformes	Accipitridae	Aquila	50
Egretta novaehollandiae	White-faced Heron	Aves	Ciconiiformes	Ardeidae	Egretta	48
Anas (Anas) superciliosa	Pacific Black Duck	Aves	Anseriformes	Anatidae	Anas	46
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	Aves	Passeriformes	Meliphagidae	Acanthagenys	43
Malurus (Leggeornis) lamberti	Variegated Fairy-wren	Aves	Passeriformes	Maluridae	Malurus	42
Ardea pacifica	White-necked Heron	Aves	Ciconiiformes	Ardeidae	Ardea	41
Ptilotula keartlandi	Grey-headed Honeyeater	Aves	Passeriformes	Meliphagidae	Ptilotula	39
Petroica (Petroica) goodenovii	Red-capped Robin	Aves	Passeriformes	Petroicidae	Petroica	39
Gymnorhina tibicen	Australian Magpie	Aves	Passeriformes	Artamidae	Gymnorhina	39
Epthianura (Parepthianura) tricolor	Crimson Chat	Aves	Passeriformes	Meliphagidae	Epthianura	38
Todiramphus (Todiramphus) sanctus	Sacred Kingfisher	Aves	Coraciiformes	Alcedinidae	Todiramphus	37
Ardeotis australis	Australian Bustard	Aves	Gruiformes	Otididae	Ardeotis	36
Cincloramphus (Cincloramphus) cruralis	Brown Songlark	Aves	Passeriformes	Locustellidae	Cincloramphus	36
Phalacrocorax (Phalacrocorax) sulcirostris	Little Black Cormorant	Aves	Pelecaniformes	Phalacrocoracidae	Phalacrocorax	32
Petrochelidon (Petrochelidon) ariel	Fairy Martin	Aves	Passeriformes	Hirundinidae	Petrochelidon	32
Microcarbo melanoleucos	Little Pied Cormorant	Aves	Pelecaniformes	Phalacrocoracidae	Microcarbo	30
Colluricincla (Colluricincla) harmonica	Grey Shrike-thrush	Aves	Passeriformes	Pachycephalidae	Colluricincla	30
Anhinga novaehollandiae	Australasian Darter	Aves	Pelecaniformes	Anhingidae	Anhinga	29
Pelecanus conspicillatus	Australian Pelican	Aves	Pelecaniformes	Pelecanidae	Pelecanus	28
Turnix (Alphaturnia) velox	Little Button-quail	Aves	Turniciformes	Turnicidae	Turnix	28
Poodytes carteri	Spinifexbird	Aves	Passeriformes	Locustellidae	Poodytes	27

Ardea alba	Great Egret	Aves	Ciconiiformes	Ardeidae	Ardea	26
Anas gracilis	Grey Teal	Aves	Anseriformes	Anatidae	Anas	25
Malurus (Leggeornis) assimilis	Purple-backed Fairy-wren	Aves	Passeriformes	Maluridae	Malurus	24
Heteroscenes pallidus	Pallid Cuckoo	Aves	Cuculiformes	Cuculidae	Heteroscenes	24
Aegotheles (Aegotheles) cristatus	Australian Owlet-nightjar	Aves	Apodiformes	Aegothelidae	Aegotheles	24
Petrochelidon (Hylochelidon) nigricans	Tree Martin	Aves	Passeriformes	Hirundinidae	Petrochelidon	23
Phaps (Phaps) chalcoptera	Common Bronzewing	Aves	Columbiformes	Columbidae	Phaps	23
Threskiornis spinicollis	Straw-necked Ibis	Aves	Ciconiiformes	Threskiornithidae	Threskiornis	23
Accipiter (Leucospiza) fasciatus	Brown Goshawk	Aves	Accipitriformes	Accipitridae	Accipiter	22
Corvus bennetti	Little Crow	Aves	Passeriformes	Corvidae	Corvus	21
Circus assimilis	Spotted Harrier	Aves	Accipitriformes	Accipitridae	Circus	21
Acanthiza (Geobasileus) uropygialis	Chestnut-rumped Thornbill	Aves	Passeriformes	Acanthizidae	Acanthiza	20
Pardalotus (Pardalotinus) striatus	Striated Pardalote	Aves	Passeriformes	Pardalotidae	Pardalotus	19
Dromaius novaehollandiae	Emu	Aves	Struthioniformes	Casuariidae	Dromaius	18
Milvus migrans	Black Kite	Aves	Accipitriformes	Accipitridae	Milvus	18
Melanodryas (Melanodryas) cucullata	Hooded Robin	Aves	Passeriformes	Petroicidae	Melanodryas	18
Ninox (Ninox) novaeseelandiae	Southern Boobook	Aves	Strigiformes	Strigidae	Ninox	18
Chenonetta jubata	Australian Wood Duck	Aves	Anseriformes	Anatidae	Chenonetta	17
Geopelia placida	Peaceful Dove	Aves	Columbiformes	Columbidae	Geopelia	17
Falco (Falco) longipennis	Australian Hobby	Aves	Falconiformes	Falconidae	Falco	17
Artamus (Angroyan) minor	Little Woodswallow	Aves	Passeriformes	Artamidae	Artamus	17
Dicaeum (Dicaeum) hirundinaceum	Mistletoebird	Aves	Passeriformes	Dicaeidae	Dicaeum	17
Platalea (Platibis) flavipes	Yellow-billed Spoonbill	Aves	Ciconiiformes	Threskiornithidae	Platalea	15
Cracticus torquatus	Grey Butcherbird	Aves	Passeriformes	Artamidae	Cracticus	14
Chalcites basalis	Horsfield's Bronze-cuckoo	Aves	Cuculiformes	Cuculidae	Chalcites	14
Ephippiorhynchus (Ephippiorhynchus) asiaticus	Black-necked Stork	Aves	Ciconiiformes	Ciconiidae	Ephippiorhynchus	13
Eurostopodus (Eurostopodus) argus	Spotted Nightjar	Aves	Caprimulgiformes	Caprimulgidae	Eurostopodus	13
Lalage (Lalage) tricolor	White-winged Triller	Aves	Passeriformes	Campephagidae	Lalage	13
Aythya (Nyroca) australis	Hardhead	Aves	Anseriformes	Anatidae	Aythya	13
Tadorna (Casarca) tadornoides	Australian Shelduck	Aves	Anseriformes	Anatidae	Tadorna	12
Poliocephalus poliocephalus	Hoary-headed Grebe	Aves	Podicipediformes	Podicipedidae	Poliocephalus	12
Himantopus himantopus	Black-winged Stilt	Aves	Charadriiformes	Recurvirostridae	Himantopus	12
Melithreptus (Eidopsarus) gularis	Black-chinned Honeyeater	Aves	Passeriformes	Meliphagidae	Melithreptus	11
Acrocephalus (Acrocephalus) australis	Australian Reed Warbler	Aves	Passeriformes	Acrocephalidae	Acrocephalus	11
Chlamydera guttata	Western Bowerbird	Aves	Passeriformes	Ptilonorhynchidae	Chlamydera	11
Amytornis (Magnamytis) whitei		Aves	Passeriformes	Maluridae	Amytornis	11
Artamus (Campbellornis) personatus	Masked Woodswallow	Aves	Passeriformes	Artamidae	Artamus	11
Sugomel niger	Black Honeyeater	Aves	Passeriformes	Meliphagidae	Sugomel	11

Hieraaetus (Hieraaetus) morphnoides	Little Eagle	Aves	Accipitriformes	Accipitridae	Hieraaetus	11
Dendrocygna eytoni	Plumed Whistling-duck	Aves	Anseriformes	Anatidae	Dendrocygna	11
Tachybaptus novaehollandiae	Australasian Grebe	Aves	Podicipediformes	Podicipedidae	Tachybaptus	11
Cygnus atratus	Black Swan	Aves	Anseriformes	Anatidae	Cygnus	11
Ninox (Ninox) boobook	Southern Boobook	Aves	Strigiformes	Strigidae	Ninox	10
Climacteris (Climacteris) melanurus	Black-tailed Treecreeper	Aves	Passeriformes	Climacteridae	Climacteris	10
Mirafra (Mirafra) javanica	Horsfield's Bushlark	Aves	Passeriformes	Alaudidae	Mirafra	10
Erythrogonys cinctus	Red-kneed Dotterel	Aves	Charadriiformes	Charadriidae	Erythrogonys	9
Platalea (Platalea) regia	Royal Spoonbill	Aves	Ciconiiformes	Threskiornithidae	Platalea	9
Stiltia isabella	Australian Pratincole	Aves	Charadriiformes	Glareolidae	Stiltia	8
Chlidonias (Pelodes) hybrida	Whiskered Tern	Aves	Charadriiformes	Laridae	Chlidonias	8
Podargus strigoides	Tawny Frogmouth	Aves	Caprimulgiformes	Podargidae	Podargus	8
Burhinus (Burhinus) grallarius	Bush Stone-curlew	Aves	Charadriiformes	Burhinidae	Burhinus	8
Neopsephotus bourkii	Bourke's Parrot	Aves	Psittaciformes	Psittacidae	Neopsephotus	7
Egretta garzetta	Little Egret	Aves	Ciconiiformes	Ardeidae	Egretta	7
Circus approximans	Swamp Harrier	Aves	Accipitriformes	Accipitridae	Circus	7
Acanthiza (Milligania) robustirostris	Slaty-backed Thornbill	Aves	Passeriformes	Acanthizidae	Acanthiza	7
Malacorhynchus membranaceus	Pink-eared Duck	Aves	Anseriformes	Anatidae	Malacorhynchus	7
Accipiter (Paraspizias) cirrocephalus	Collared Sparrowhawk	Aves	Accipitriformes	Accipitridae	Accipiter	6
Pomatostomus (Morganornis) superciliosus	White-browed Babbler	Aves	Passeriformes	Pomatostomidae	Pomatostomus	6
Gerygone fusca	Western Gerygone	Aves	Passeriformes	Acanthizidae	Gerygone	6
Ninox (Hieracoglaux) connivens	Barking Owl	Aves	Strigiformes	Strigidae	Ninox	6
Tribonyx ventralis	Black-tailed Native-hen	Aves	Gruiformes	Rallidae	Tribonyx	5
Cinclosoma (Samuela) castaneothorax	Chestnut-breasted Quail-thrush	Aves	Passeriformes	Cinclosomatidae	Cinclosoma	5
Hamirostra melanosternon	Black-breasted Buzzard	Aves	Accipitriformes	Accipitridae	Hamirostra	5
Coturnix ypsilophora		Aves	Galliformes	Phasianidae	Coturnix	4
Purnella albifrons	White-fronted Honeyeater	Aves	Passeriformes	Meliphagidae	Purnella	4
Falco (Hierofalco) hypoleucos	Grey Falcon	Aves	Falconiformes	Falconidae	Falco	4
Synoicus ypsilophora	Brown Quail	Aves	Galliformes	Phasianidae	Synoicus	4
Tyto javanica	Eastern Barn Owl	Aves	Strigiformes	Tytonidae	Tyto	4
Certhionyx (Certhionyx) variegatus	Pied Honeyeater	Aves	Passeriformes	Meliphagidae	Certhionyx	4
Elanus axillaris	Black-shouldered Kite	Aves	Accipitriformes	Accipitridae	Elanus	4
Threskiornis moluccus	Australian White Ibis	Aves	Ciconiiformes	Threskiornithidae	Threskiornis	4
Epthianura (Aurepthianura) aurifrons	Orange Chat	Aves	Passeriformes	Meliphagidae	Epthianura	3
Tringa (Rhyacophilus) glareola	Wood Sandpiper	Aves	Charadriiformes	Scolopacidae	Tringa	3
Cheramoeca leucosterna	White-backed Swallow	Aves	Passeriformes	Hirundinidae	Cheramoeca	3
Amytornis (Magnamytis) striatus	Striated Grasswren	Aves	Passeriformes	Maluridae	Amytornis	3
Daphoenositta (Neositta) chrysoptera	Varied Sittella	Aves	Passeriformes	Neosittidae	Daphoenositta	3

Fulica atra	Eurasian Coot	Aves	Gruiformes	Rallidae	Fulica	3
Neochmia (Neochmia) ruficauda	Star Finch	Aves	Passeriformes	Estrildidae	Neochmia	3
Falco (Hierofalco) peregrinus	Peregrine Falcon	Aves	Falconiformes	Falconidae	Falco	2
Cinclosoma (Samuela) marginatum	Western Quail-thrush	Aves	Passeriformes	Cinclosomatidae	Cinclosoma	2
Stictonetta naevosa	Freckled Duck	Aves	Anseriformes	Anatidae	Stictonetta	2
Acanthiza (Acanthiza) apicalis	Red-rumped Tit	Aves	Passeriformes	Acanthizidae	Acanthiza	2
Phalacrocorax (Phalacrocorax) varius	Pied Cormorant	Aves	Pelecaniformes	Phalacrocoracidae	Phalacrocorax	2
Gelochelidon nilotica	Gull-billed Tern	Aves	Charadriiformes	Laridae	Gelochelidon	2
Psophodes (Sphenostoma) occidentalis	Chiming Wedgebill	Aves	Passeriformes	Psophodidae	Psophodes	2
Charadrius (Charadrius) ruficapillus	Red-capped Plover	Aves	Charadriiformes	Charadriidae	Charadrius	2
Plegadis falcinellus	Glossy Ibis	Aves	Ciconiiformes	Threskiornithidae	Plegadis	2
Glareola (Glareola) maldivarum	Oriental Pratincole	Aves	Charadriiformes	Glareolidae	Glareola	1
Hypotaenidia philippensis	Buff-banded Rail	Aves	Gruiformes	Rallidae	Hypotaenidia	1
Phalacrocorax (Phalacrocorax) carbo	Great Cormorant	Aves	Pelecaniformes	Phalacrocoracidae	Phalacrocorax	1
Ptilotula plumula	Grey-fronted Honeyeater	Aves	Passeriformes	Meliphagidae	Ptilotula	1
Conopophila (Lacustroica) whitei	Grey Honeyeater	Aves	Passeriformes	Meliphagidae	Conopophila	1
Columba (Janthoenas) leucomela	White-headed Pigeon	Aves	Columbiformes	Columbidae	Columba	1
Hirundo (Hirundo) neoxena	Welcome Swallow	Aves	Passeriformes	Hirundinidae	Hirundo	1
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Aves	Psittaciformes	Cacatuidae	Lophochroa	1
Chalcites osculans	Black-eared Cuckoo	Aves	Cuculiformes	Cuculidae	Chalcites	1
Psephotellus varius	Mulga Parrot	Aves	Psittaciformes	Psittacidae	Psephotellus	1
Stipiturus ruficeps	Rufous-crowned Emu-wren	Aves	Passeriformes	Maluridae	Stipiturus	1
Pyrrholaemus brunneus	Redthroat	Aves	Passeriformes	Acanthizidae	Pyrrholaemus	1
Charadrius (Eupoda) veredus	Oriental Plover	Aves	Charadriiformes	Charadriidae	Charadrius	1
Bubulcus ibis	Cattle Egret	Aves	Ciconiiformes	Ardeidae	Bubulcus	1
Falco (Hierofalco) subniger	Black Falcon	Aves	Falconiformes	Falconidae	Falco	1
Hydroprogne caspia	Caspian Tern	Aves	Charadriiformes	Laridae	Hydroprogne	1
Haliaeetus (Pontoaetus) leucogaster	White-bellied Sea-eagle	Aves	Accipitriformes	Accipitridae	Haliaeetus	1
Coracina (Pteropodocys) maxima	Ground Cuckoo-shrike	Aves	Passeriformes	Campephagidae	Coracina	1
Nycticorax caledonicus	Nankeen Night-heron	Aves	Ciconiiformes	Ardeidae	Nycticorax	1
Chroicocephalus novaehollandiae	Silver Gull	Aves	Charadriiformes	Laridae	Chroicocephalus	1
Calidris (Erolia) ferruginea	Curlew Sandpiper	Aves	Charadriiformes	Scolopacidae	Calidris	1
Calidris (Erolia) acuminata	Sharp-tailed Sandpiper	Aves	Charadriiformes	Scolopacidae	Calidris	1
Vespadelus finlaysoni	Finlayson's Cave Bat	Mammalia	Chiroptera	Vespertilionidae	Vespadelus	149
Taphozous georgianus	Common Sheathtail-bat	Mammalia	Chiroptera	Emballonuridae	Taphozous	31
Ningaui timealeyi	Pilbara Ningaui	Mammalia	Dasyuromorphia	Dasyuridae	Ningaui	26
Pseudomys hermannsburgensis	Sandy Inland Mouse	Mammalia	Rodentia	Muridae	Pseudomys	25
Macroderma gigas	Ghost Bat	Mammalia	Chiroptera	Megadermatidae	Macroderma	23

Sminthopsis macroura	Stripe-faced Dunnart	Mammalia	Dasyuromorphia	Dasyuridae	Sminthopsis	20
Pseudomys desertor	Desert Mouse	Mammalia	Rodentia	Muridae	Pseudomys	18
Mus musculus	House Mouse	Mammalia	Rodentia	Muridae	Mus	10
Pseudomys chapmani	Pebble-mound Mouse	Mammalia	Rodentia	Muridae	Pseudomys	6
Dasykaluta rosamondae	Little Red Antechinus	Mammalia	Dasyuromorphia	Dasyuridae	Dasykaluta	5
Leggadina lakedownensis	Lakeland Downs Mouse	Mammalia	Rodentia	Muridae	Leggadina	4
Oryctolagus cuniculus	Rabbit	Mammalia	Lagomorpha	Leporidae	Oryctolagus	3
Pseudomys delicatulus	Delicate Mouse	Mammalia	Rodentia	Muridae	Pseudomys	3
Dasyurus hallucatus	Digul	Mammalia	Dasyuromorphia	Dasyuridae	Dasyurus	2
Osphranter rufus	Red Kangaroo	Mammalia	Diprotodontia	Macropodidae	Osphranter	2
Camelus dromedarius	One-humped Camel	Mammalia	Artiodactyla	Camelidae	Camelus	2
Zyzomys argurus	Common Rock-rat	Mammalia	Rodentia	Muridae	Zyzomys	2
Pseudantechinus woolleyae	Woolley's Pseudantechinus	Mammalia	Dasyuromorphia	Dasyuridae	Pseudantechinus	2
Petrogale rothschildi	Rothschild's Rock-wallaby	Mammalia	Diprotodontia	Macropodidae	Petrogale	2
Canis familiaris	Common Dog	Mammalia	Carnivora	Canidae	Canis	2
Tachyglossus aculeatus	Short-beaked Echidna	Mammalia	Monotremata	Tachyglossidae	Tachyglossus	1
Rhinonicteris aurantia	Orange Leaf-nosed Bat	Mammalia	Chiroptera	Rhinonycteridae	Rhinonicteris	1
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart	Mammalia	Dasyuromorphia	Dasyuridae	Sminthopsis	1
Chalinolobus nigrogriseus	Hoary Wattled Bat	Mammalia	Chiroptera	Vespertilionidae	Chalinolobus	1
Trichosurus vulpecula	Common Brushtail Possum	Mammalia	Diprotodontia	Phalangeridae	Trichosurus	1

Appendix C Regional fauna records from detailed surveys within 100 km of study area.

Letter	Survey
Previous surveys	
A	Adele Flora, Fauna and SRE Survey (360 Environmental, 2021)
B	Cloudbreak Level 2 Terrestrial Vertebrate Fauna Assessment (ecologia Environment, 2011)
C	Fauna Assessment - Nyidinghu Iron Ore Project (Bamford Consulting, 2012)
D	Targeted Fauna Assessment of the Rail Duplication (Bamford Consulting, 2010)
E	Nyidinghu Iron Ore Project Detailed Terrestrial Fauna Survey (360 Environmental, 2023)
F	Corunna Downs Project: Terrestrial Vertebrate Fauna Survey (Stantec, 2016)
G	Nyidinghu Mine Terrestrial Vertebrate Fauna Assessment (Ecologia Environment, 2023)
H	East Hamersley Rail Terrestrial Vertebrate Fauna Assessment (Ecologia Environment, 2023)
I	Mindy South: Detailed and Targeted Terrestrial Vertebrate Fauna Baseline Survey
J	McPhee Creek: Consolidated Terrestrial Fauna Report (Biologic, 2021)
K	Roy Hill Iron Ore Project, Level 2 Terrestrial Vertebrate Fauna Survey (ecologia, 2009)
L	Christmas Creek Terrestrial Vertebrate Fauna and Fauna Habitat Assessment (ENV Australia, 2012)
Current consolidation	
M	Bonney Downs North: Terrestrial Vertebrate Fauna Assessment (ecologia, 2024a)
N	Bonney Downs South: Terrestrial Vertebrate Fauna Assessment (Spectrum Ecology, 2024)
O	Bonney Downs Wind Farm: Bird and Bat Site Utilisation Report -Year 1 (ecologia, 2024b)

Family	Scientific Name	Common Name	Conservation Status		Database					Literature												Current consolidation		
			WA	EPBC	ALA	Birdata	PMST	DBCA	Fortescue	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Amphibians																								
Limnodynastidae	*Neobatrachus sutor*	Shoemaker frog			x																			
	Notaden nichollsi	Desert spadefoot			x																			
	Platyplectrum spenceri	Centralian burrowing frog			x										x							x		
Myobatrachidae	*Pseudophryne douglasi*	Gorge toadlet																			x			
	Uperoleia saxatilis	Pilbara toadlet			x										x			x				x		
Pelodryadidae	*Cyclorana maini*	Sheep frog			x							x		x	x						x	x	x	
	Cyclorana occidentalis	Western water holding frog			x																			
	Litoria rubella	Little red tree frog			x						x	x			x		x	x	x	x	x	x	x	
Bufonidae	*Rhinella marina**	Cane toad			x																			
Total					**8**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**1**	**4**	**0**	**1**	**2**	**1**	**1**	**3**	**4**	**2**	**0**
Birds																								
Acanthizidae	*Acanthiza apicalis*	Inland thornbill			x	x												x						
	Acanthiza chrysorrhoa	Yellow-rumped thornbill								x								x						
	Acanthiza robustirostris	Slaty-backed thornbill			x	x					x									x			x	x
	Acanthiza uropygialis	Chestnut-rumped thornbill			x	x					x	x		x			x	x		x			x	x
	Gerygone fusca	Western gerygone			x	x						x		x		x	x			x	x			x
	Pyrrholaemus brunneus	Redthroat			x	x					x							x						x
	Smicrornis brevirostris	Weebill			x	x					x	x		x	x	x	x	x	x	x	x	x	x	x
	Calamanthus campestris	Rufous fieldwren				x																		
Accipitridae	*Tachyspiza cirrocephala*	Collared sparrowhawk			x	x						x			x			x		x		x	x	x
	Tachyspiza fasciata	Brown goshawk			x	x						x		x	x		x	x		x		x	x	x
	Aquila audax	Wedge-tailed eagle			x	x				x		x	x	x	x	x	x	x			x	x	x	x
	Circus approximans	Swamp harrier			x	x																		
	Circus assimilis	Spotted harrier			x	x						x			x	x	x			x		x	x	x
	Elanus axillaris	Black-shouldered kite			x	x							x		x					x			x	x
	Erythrotriorchis radiatus	Red goshawk	VU	EN			x																	
	Haliaeetus leucogaster	White-bellied sea-eagle			x	x	x																	
	Haliastur sphenurus	Whistling kite			x	x					x	x	x	x	x	x	x	x		x	x	x	x	x
	Hamirostra melanosternon	Black-breasted buzzard			x	x						x				x	x	x						
	Hieraaetus morphnoides	Little eagle			x	x											x	x		x			x	
	Milvus migrans	Black kite			x	x				x		x		x	x			x			x			x
	Lophoictinia isura	Square-tailed kite															x							x
Acrocephalidae	*Acrocephalus australis*	Australian reed warbler			x	x				x				x		x								
Aegothelidae	*Aegotheles cristatus*	Australian owlet-nightjar			x	x				x		x			x	x	x	x	x	x		x	x	x
Alaudidae	*Mirafra javanica*	Horsfield's bush lark			x	x					x	x								x	x	x	x	x
Alcedinidae	*Dacelo leachii*	Blue-winged kookaburra			x	x					x			x	x			x	x	x	x	x	x	x
	Todiramphus pyrrhopygius	Red-backed kingfisher			x	x				x	x	x		x	x	x		x		x	x	x	x	
	Todiramphus sanctus	Sacred kingfisher			x	x					x					x		x			x	x	x	x
Anatidae	*Anas gracilis*	Grey teal			x	x					x	x										x	x	x
	Anas superciliosa	Pacific black duck			x	x					x			x				x			x	x	x	x
	Aythya australis	Hardhead			x	x								x						x				x
	Chenonetta jubata	Australian wood duck			x	x								x										x

Family	Scientific Name	Common Name	Conservation Status		Database					Literature												Current consolidation		
			WA	EPBC	ALA	Birdata	PMST	DBCA	Fortescue	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Cygnus atratus	Black swan			x	x						x										x		
	Dendrocygna eytoni	Plumed whistling duck			x	x					x			x							x		x	x
	Malacorhynchus membranaceus	Pink-eared duck			x	x								x									x	x
	Stictonetta naevosa	Freckled duck			x	x																		
	Tadorna tadornoides	Australian shelduck			x	x						x												
Anhingidae	*Anhinga novaehollandiae*	Australasian darter			x	x																x	x	x
Apodidae	*Apus pacificus*	Fork-tailed swift	MI	MI			x	x	x			x												
Ardeidae	*Ardea alba*	Great egret			x	x						x								x		x	x	x
	Ardea pacifica	White-necked heron			x	x								x						x		x	x	x
	Bubulcus ibis	Cattle egret			x	x	x																	
	Egretta garzetta	Little egret			x	x																		
	Egretta novaehollandiae	White-faced heron			x	x						x		x								x	x	x
	Nycticorax caledonicus	Nankeen night-heron			x	x													x			x		x
Artamidae	*Artamus cinereus*	Black-faced woodswallow			x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Artamus minor	Little woodswallow			x	x				x				x	x			x		x				x
	Artamus personatus	Masked woodswallow			x	x						x					x	x	x	x		x	x	x
	Artamus leucorynchus	White-breasted woodswallow																x						
	Cracticus nigrogularis	Pied butcherbird			x	x					x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Cracticus torquatus	Grey butcherbird			x	x					x	x		x		x	x	x		x	x	x	x	x
	Gymnorhina tibicen	Australian magpie			x	x						x			x	x			x	x		x	x	x
Burhinidae	*Burhinus grallarius*	Bush stone-curlew			x	x					x				x				x	x		x	x	x
Cacatuidae	*Cacatua sanguinea*	Little corella			x	x					x	x	x	x	x	x		x		x	x	x	x	x
	Eolophus roseicapilla	Galah			x	x				x		x	x	x	x	x	x	x	x	x	x	x	x	x
	Nymphicus hollandicus	Cockatiel			x	x						x		x	x	x	x	x	x	x	x	x	x	x
	Lophochroa leadbeateri	Major Mitchell's cockatoo			x																			
Campephagidae	*Coracina maxima*	Ground cuckoo-shrike			x														x		x		x	x
	Coracina novaehollandiae	Black-faced cuckoo-shrike			x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Lalage tricolor	White-winged triller			x	x						x			x	x		x		x	x	x	x	x
Caprimulgidae	*Eurostopodus argus*	Spotted nightjar			x	x					x	x		x	x	x		x	x	x		x	x	x
Casuariidae	*Dromaius novaehollandiae*	Emu			x	x					x	x	x	x		x	x			x		x		
Charadriidae	*Charadrius ruficapillus*	Red-capped plover				x																		
	Charadrius veredus	Oriental plover	MI	MI	x	x	x	x	x															
	Elseyornis melanops	Black-fronted dotterel			x	x					x	x		x	x			x			x	x	x	x
	Erythrogonys cinctus	Red-kneed dotterel			x	x														x				x
	Vanellus miles	Masked plover			x																x			
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked stork			x	x																		x
Cinclosomatidae	*Cinclosoma marginatum*	Western quail-thrush			x															x				
	Cinclosoma castaneothorax	Chestnut-breasted quail-thrush			x	x																		
Climacteridae	*Climacteris melanurus*	Black-tailed treecreeper			x	x									x			x						
Columbidae	*Columba livia**	Rock pigeon																x						
	Geopelia cuneata	Diamond dove			x	x				x	x	x	x	x	x	x	x	x		x	x	x	x	x
	Geopelia placida	Peaceful dove			x	x				x	x			x	x			x		x		x	x	x
	Geophaps plumifera	Spinifex pigeon			x	x				x	x	x	x	x	x	x	x	x		x	x	x	x	x

Family	Scientific Name	Common Name	Conservation Status		Database					Literature												Current consolidation		
			WA	EPBC	ALA	Birdata	PMST	DBCA	Fortescue	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Ocyphaps lophotes	Crested pigeon			x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Phaps chalcoptera	Common bronzewing			x	x					x			x	x	x	x	x		x	x	x	x	x
Corvidae	*Corvus bennetti*	Little crow			x	x					x	x			x					x	x			
	Corvus orru	Torresian crow			x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cuculidae	*Centropus phasianinus*	Pheasant coucal				x								x								x	x	x
	Chalcites basalis	Horsfield's bronze cuckoo			x	x						x		x	x	x	x	x		x		x	x	x
	Chalcites osculans	Black-eared cuckoo			x		x											x		x	x			
	Heteroscenes pallidus	Pallid cuckoo			x	x					x	x			x	x		x		x	x	x	x	x
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird			x	x						x			x	x				x			x	x
Estrildidae	*Emblema pictum*	Painted finch			x	x					x	x		x	x	x	x	x	x	x	x	x	x	x
	Neochmia ruficauda	Star finch			x	x								x						x	x			
	Taeniopygia guttata castanotis	Zebra finch			x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Falconidae	*Falco berigora*	Brown falcon			x	x					x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Falco cenchroides	Nankeen kestrel			x	x				x	x	x	x	x	x	x	x	x		x	x	x	x	x
	Falco hypoleucos	Grey falcon	VU	VU	x		x	x	x							x	x			x		x	x	x
	Falco longipennis	Australian hobby			x	x						x						x		x			x	x
	Falco peregrinus	Peregrine falcon	OS	-	x	x		x	x			x			x					x				
	Falco subniger	Black falcon			x																			
Glareolidae	*Stiltia isabella*	Australian pratincole			x																		x	
	Glareola maldivarum	Oriental pratincole	MI	MI	x																			
Hirundinidae	*Cheramoeca leucosterna*	White-backed swallow			x											x								
	Hirundo neoxena	Welcome swallow			x	x																		
	Hirundo rustica	Barn swallow	MI	MI			x																	
	Petrochelidon ariel	Fairy martin			x	x						x			x	x	x					x	x	x
	Petrochelidon nigricans	Tree martin			x	x				x		x			x	x				x	x	x	x	x
Laridae	*Chlidonias hybrida*	Whiskered tern			x	x						x												
	Gelochelidon nilotica	Gull-billed tern	MI	MI	x	x		x	x			x												
	Hydroprogne caspia	Caspian tern	MI	MI	x	x		x	x										x					
	Chroicocephalus novaehollandiae	Silver gull			x	x																		
Locustellidae	*Cincloramphus cruralis*	Brown songlark			x	x								x									x	x
	Cincloramphus mathewsi	Rufous songlark			x	x									x		x			x	x	x	x	x
	Poodytes carteri	Spinifexbird			x	x				x		x	x	x	x	x	x	x	x	x		x	x	x
Maluridae	*Amytornis whitei*	Pilbara grasswren (striated grasswren)			x	x								x	x	x		x		x		x	x	x
	Malurus assimilis	Purple-backed fairywren			x	x				x	x	x		x	x	x	x	x		x	x	x	x	x
	Malurus leucopterus	White-winged fairywren			x	x				x	x	x	x			x	x	x		x	x	x	x	x
	Stipiturus ruficeps	Rufous-crowned emu-wren			x																			
Meliphagidae	*Acanthagenys rufogularis*	Spiny-cheeked honeyeater			x	x					x	x		x		x		x		x	x	x	x	x
	Certhionyx variegatus	Pied honeyeater			x	x										x		x		x	x		x	
	Epthianura aurifrons	Orange chat			x	x																		
	Epthianura tricolor	Crimson chat			x	x						x			x					x	x	x	x	x
	Gavicalis virescens	Singing honeyeater			x	x				x		x	x	x	x	x	x	x	x	x	x	x	x	x
	Conopophila whitei	Grey honeyeater			x									x				x					x	
	Lichmera indistincta	Brown honeyeater			x	x				x	x	x		x	x	x	x	x		x	x	x	x	x

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			WA	EPBC	ALA	Birdata	PMST	DBCA	Fortescue	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Manorina flavigula	Yellow-throated miner			x	x					x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Melithreptus gularis	Black-chinned honeyeater			x	x					x				x		x	x	x					
	Ptilotula keartlandi	Grey-headed honeyeater			x	x				x		x		x	x	x	x	x	x	x		x	x	x
	Ptilotula penicillata	White-plumed honeyeater			x	x				x		x		x	x	x	x	x		x	x	x	x	x
	Ptilotula plumula	Grey-fronted honeyeater			x	x									x									x
	Purnella albifrons	White-fronted honeyeater			x	x																	x	x
	Sugomel nigrum	Black honeyeater			x	x						x						x		x				x
	Stomiopera unicolor	White-gaped honeyeater				x																		
Meropidae	*Merops ornatus*	Rainbow bee-eater			x	x	x			x	x	x	x	x	x	x		x	x	x	x	x	x	x
Monarchidae	*Grallina cyanoleuca*	Magpie-lark			x	x					x	x	x	x	x	x	x	x	x	x	x	x	x	x
Motacillidae	*Anthus australis*	Australian pipit			x	x					x	x	x		x			x		x	x	x	x	x
	Motacilla cinerea	Grey wagtail	MI	MI			x	x																
	Motacilla flava	Yellow wagtail	MI	MI			x																	
Neosittidae	*Daphoenositta chrysoptera*	Varied sittella			x						x													
Oreoicidae	*Oreoica gutturalis*	Crested bellbird			x	x					x	x		x	x	x	x	x	x	x	x	x	x	x
Otididae	*Ardeotis australis*	Australian bustard			x	x				x	x	x	x	x	x	x	x	x		x	x	x	x	x
Pachycephalidae	*Colluricincla harmonica*	Grey shrikethrush			x	x				x	x	x		x	x	x	x	x	x	x	x	x	x	x
	Pachycephala rufiventris	Rufous whistler			x	x				x	x	x		x	x	x	x	x		x	x	x	x	x
Pandionidae	*Pandion haliaetus*	Osprey	MI	MI				x																
Pardalotidae	*Pardalotus rubricatus*	Red-browed pardalote			x	x					x	x		x	x	x			x	x	x	x	x	x
	Pardalotus striatus	Striated pardalote			x	x										x	x	x				x	x	x
Pelecanidae	*Pelecanus conspicillatus*	Australian pelican			x	x						x				x						x	x	x
Petroicidae	*Melanodryas cucullata*	Hooded robin			x	x					x	x		x	x	x		x		x		x	x	x
	Petroica goodenovii	Red-capped robin			x	x					x	x				x	x			x			x	x
Phalacrocoracidae	*Microcarbo melanoleucos*	Little pied cormorant			x	x																x	x	x
	Phalacrocorax sulcirostris	Little black cormorant			x	x													x		x	x	x	x
	Phalacrocorax carbo	Great cormorant			x	x																		
	Phalacrocorax varius	Pied cormorant			x	x													x					
Phasianidae	*Synoicus ypsilophorus*	Brown quail			x	x								x				x			x	x	x	x
Podargidae	*Podargus strigoides*	Tawny frogmouth			x	x											x	x		x		x	x	x
Podicipediformes	*Poliocephalus poliocephalus*	Hoary-headed grebe			x	x																	x	x
	Tachybaptus novaehollandiae	Australasian grebe			x	x								x										x
Pomatostomidae	*Pomatostomus superciliosus*	White-browed babbler			x	x					x			x				x		x		x		
	Pomatostomus temporalis	Grey-crowned babbler			x	x					x	x		x	x	x	x	x	x	x	x	x	x	x
Procellariidae	*Macronectes giganteus*	Southern giant petrel	MI	EN				x																
Psittaculidae	*Barnardius zonarius*	Australian ringneck			x	x				x		x		x	x	x	x	x	x	x	x	x	x	x
	Melopsittacus undulatus	Budgerigar			x	x						x		x	x	x	x	x	x	x	x	x	x	x
	Neopsephotus bourkii	Bourke's parrot			x	x								x										
	Pezoporus occidentalis	Night parrot	CR	EN			x	x																
	Polytelis alexandrae	Princess parrot	P4	VU			x	x																
	Psephotellus varius	Mulga parrot			x														x					
Psophodidae	*Psophodes occidentalis*	Chiming wedgebill			x	x																		
Ptilonorhynchidae	*Chlamydera guttata*	Western bowerbird			x	x						x			x	x	x	x				x	x	x

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Rallidae	*Fulica atra*	Eurasian coot			x	x					x										x			
	Gallirallus philippensis	Buff-banded rail			x	x																		
	Porphyrio porphyrio	Australasian swamphen									x			x										
	Tribonyx ventralis	Black-tailed native hen			x	x																		
Recurvirostridae	*Himantopus leucocephalus*	Black-winged stilt			x							x		x				x					x	x
	Recurvirostra novaehollandiae	Red-necked avocet										x												
	Cladorhychus leucocephalus	Banded stilt				x																		
Rhipiduridae	*Rhipidura albiscapa*	Grey fantail													x					x		x		
	Rhipidura leucophrys	Willie wagtail			x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rostratulidae	*Rostratula australis*	Australian painted snipe	EN	EN		x	x	x																
Scolopacidae	*Actitis hypoleucos*	Common sandpiper	MI	MI			x	x	x															
	Calidris acuminata	Sharp-tailed sandpiper	MI	MI	x	x	x	x	x															
	Calidris ferruginea	Curlew sandpiper	CR	CR	x		x																	
	Calidris ruficollis	Red-necked stint	MI	MI				x	x															
	Calidris melanotos	Pectoral sandpiper	MI	MI			x																	
	Tringa glareola	Wood sandpiper	MI	MI	x	x		x	x											x				
	Tringa nebularia	Common greenshank	MI	MI				x	x															
	Tringa stagnatilis	Marsh sandpiper	MI	MI				x	x															
Strigidae	*Ninox boobook boobook*	Southern boobook			x	x						x		x	x	x		x	x	x		x	x	x
	Ninox connivens	Barking owl			x			x (P3)																x
Threskiornithidae	*Platalea flavipes*	Yellow-billed spoonbill			x	x								x										
	Platalea regia	Royal spoonbill			x	x								x						x				x
	Plegadis falcinellus	Glossy ibis	MI	MI	x	x		x	x															
	Threskiornis moluccus	Australian white ibis				x																		
	Threskiornis spinicollis	Straw-necked ibis			x	x						x		x								x	x	x
Turnicidae	*Turnix velox*	Little buttonquail			x	x						x		x	x	x	x	x		x	x	x	x	x
Tytonidae	*Tyto javanica*	Eastern barn owl			x	x						x			x			x		x		x	x	
Total					**161**	**149**	**18**	**20**	**13**	**31**	**55**	**83**	**25**	**75**	**71**	**66**	**55**	**89**	**32**	**91**	**60**	**87**	**99**	**108**
Mammals																								
Bovidae	*Bos primigenius taurus**	European cattle								x		x		x	x	x	x	x	x	x	x	x	x	
Camelidae	*Camelus dromedarius**	Camel			x									x	x	x		x						
Canidae	*Canis familiaris*	Dingo			x							x		x	x	x	x	x	x	x		x	x	
Dasyuridae	*Dasycercus blythi*	Brush-tailed mulgara	P4	-				x					x										x	
	Dasycercus cristicauda	Crest-tailed mulgara	P4	-				x																
	Dasykaluta rosamondae	Kaluta			x						x	x		x	x	x	x	x				x		
	Dasyurus hallucatus	Northern quoll	EN	EN	x		x	x	x						x		x	x				x	x	
	Ningaui timealeyi	Pilbara ningaui			x					x	x	x		x	x		x	x				x	x	
	Planigale ingrami	Long-tailed planigale												x	x									
	Planigale kendricki (formerly Planigale 1)															x		x						
	Planigale tealei																					x		
	Planigale sp.																			x	x			
	Pseudantechinus woolleyae	Woolley's pseudantechinus			x							x			x	x		x						
	Sminthopsis hirtipes	Hairy-footed dunnart										x												
	Sminthopsis longicaudata	Long-tailed dunnart	P4	-				x																

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	Sminthopsis macroura	Stripe-faced dunnart			x									x		x	x	x		x		x	x	
	Sminthopsis ooldea	Ooldea dunnart																x						
	Sminthopsis youngsoni	Lesser hairy-footed dunnart			x									x		x		x						
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied sheath-tailed bat								x	x	x		x	x	x	x	x			x	x	x	x
	Taphozous georgianus	Common sheath-tailed bat			x					x		x		x	x	x	x	x	x		x	x	x	x
	Taphozous hilli	Hill's sheath-tailed bat												x										
Equidae	*Equus africanus asinus**	Donkey															x			x				
	*Equus ferus caballus**	Horse																		x				
Felidae	*Felis catus**	Cat								x		x		x	x	x	x	x	x	x		x	x	
Leporidae	*Oryctolagus cuniculus**	Rabbit			x									x		x	x	x						
Macropodidae	*Osphranter robustus erubescens*	Euro								x		x	x	x	x			x	x	x		x	x	
	Osphranter rufus	Red kangaroo			x							x	x	x	x	x	x	x		x		x	x	
	Petrogale rothschildi	Rothschild's rock-wallaby			x									x	x	x		x				x	x	
	Lagorchestes conspicillatus	Spectacled hare-wallaby	P4	-				x							x									
Megadermatidae	*Macroderma gigas*	Ghost bat	VU	VU	x		x	x	x					x	x				x			x		x
Molossidae	*Austronomus australis*	White-striped free-tailed bat												x		x	x	x				x		x
	Chaerephon jobensis	Greater northern free-tailed bat								x		x		x	x	x	x	x		x	x	x	x	x
	Ozimops lumsdenae	Northern free-tailed bat												x		x		x				x	x	x
	Mormopterus beccarii	Beccari's freetail-bat													x									
Muridae	*Leggadina lakedownensis*	Short-tailed mouse	P4	-	x			x	x													x	x	
	*Mus musculus**	House mouse			x									x	x	x	x	x		x	x	x	x	
	Notomys alexis alexis	Spinifex hopping-mouse												x		x	x	x						
	Pseudomys chapmani	Western pebble-mound mouse	P4	-	x			x	x	x	x	x	x	x	x	x		x		x		x	x	
	Pseudomys pilbarensis	Pilbara delicate mouse			x										x	x	x					x		
	Pseudomys desertor	Desert mouse			x							x		x	x	x	x	x		x		x		
	Pseudomys hermannsburgensis	Sandy inland mouse			x							x		x	x	x	x	x		x		x	x	
	Zyzomys argurus	Common rock-rat			x							x		x	x	x	x	x				x	x	
Pteropodidae	*Pteropus alecto*	Black flying-fox																				x	x	
Phalangeridae	*Trichosurus vulpecula*	Common brushtail possum			x										x									
Rhinonycteridae	*Rhinonicteris aurantia* (Pilbara form)	Pilbara leaf-nosed bat	VU	VU	x		x	x						x	x			x	x			x	x	x
Tachyglossidae	*Tachyglossus aculeatus acanthion*	Short-beaked echidna			x					x					x	x		x				x		
Thylacomyidae	*Macrotis lagotis*	Greater bilby	VU	VU			x	x	x				x											
Vespertilionidae	*Chalinolobus gouldii*	Gould's wattled bat								x	x	x		x	x	x	x	x		x	x	x	x	x
	Chalinolobus nigrogriseus	Hoary wattled bat			x																			
	Nyctophilus geoffroyi geoffroyi	Lesser long-eared bat										x		x	x					x	x			
	Nyctophilus daedalus	Pallid long-eared bat																		x	x			
	Nyctophilus sp.															x	x							
	Scotorepens greyii	Little broad-nosed bat								x	x	x		x	x	x	x	x		x	x	x	x	x
	Vespadelus finlaysoni	Finlayson's cave bat			x					x	x	x		x	x	x	x	x	x	x	x	x	x	x
Total					25	0	4	10	5	12	7	2	5	31	31	29	24	33	8	19	11	30 (3)	24 (3)	10
Reptiles																								
Agamidae	*Ctenophorus caudicinctus*	Western ring-tailed dragon			x					x	x	x		x	x	x	x	x		x	x	x	x	
	Ctenophorus isolepis	Central military dragon			x							x		x	x	x	x	x				x	x	

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	Ctenophorus nuchalis	Central netted dragon			x							x		x	x									
	Ctenophorus reticulatus	Western netted dragon			x																			
	Diporiphora amphiboluroides	Mulga dragon			x											x	x			x	x			
	Diporiphora valens	Southern Pilbara tree-dragon																x						
	Gowidon longirostris	Long-nosed dragon			x							x		x	x		x	x		x	x	x	x	
	Pogona minor mitchelli	Bearded dragon			x							x		x		x	x	x		x	x	x	x	
	Tympanocryptis cephalus	Coastal pebble-mimic dragon									x										x			
	Tympanocryptis fortescuensis	Fortescue pebble-mimic dragon			x																		x	
Carphodactylidae	*Nephrurus cinctus*	Southern banded knob-tailed gecko			x						x					x	x	x		x		x		
Chelidae	*Chelodina steindachneri*	Flat-shelled turtle			x						x			x	x							x	x	
Diplodactylidae	*Crenadactylus pilbarensis*	Pilbara clawless gecko																				x		
	Diplodactylus bilybara	Western fat-tailed gecko																x						
	Diplodactylus conspicillatus	Variable fat-tailed gecko									x	x			x			x			x			
	Diplodactylus galaxias	Northern Pilbara beak-faced gecko								x													x	
	Diplodactylus laevis	Desert fat-tailed gecko			x									x		x	x					x	x	
	Diplodactylus mitchelli																						x	
	Diplodactylus pulcher				x						x			x							x		x	
	Diplodactylus savagei	Southern Pilbara beak-faced gecko			x						x				x			x			x	x		
	Lucasium squarrosum									x														
	Lucasium stenodactylus	Sand-plain gecko													x					x			x	
	Lucasium wombeyi				x						x	x		x	x			x		x	x	x		
	Lucasium woodwardi				x						x	x		x			x	x			x	x	x	
	Oedura fimbria	Western marbled velvet gecko													x			x				x		
	Rhynchoedura ornata	Western beaked gecko			x						x	x		x	x	x					x		x	
	Strophurus elderi				x					x	x	x			x							x	x	
	Strophurus jeanae											x		x										
	Strophurus strophurus	Western spiny-tailed gecko																x						
	Strophurus wellingtonae				x						x	x				x	x	x		x	x			
Elapidae	*Acanthophis wellsi*	Pilbara death adder			x										x							x		
	Acanthophis pyrrhus	Desert death adder													x									
	Brachyurophis approximans									x	x	x			x			x		x	x	x	x	
	Demansia reticulata	Reticulated whipsnake			x							x		x	x	x	x	x		x	x	x		
	Demansia rufescens	Rufous whipsnake												x	x	x	x	x			x	x	x	
	Furina ornata	Moon snake			x					x	x			x	x					x	x	x	x	
	Parasuta monachus	Inland hooded snake										x		x	x									
	Pseudechis australis	Mulga snake			x						x	x		x	x	x		x		x		x	x	
	Pseudonaja mengdeni	Western brown snake			x						x	x		x		x		x				x		
	Pseudonaja modesta	Ringed brown snake			x										x		x	x						
	Pseudonaja nuchalis	Northern brown snake																x		x	x		x	
	Simoselaps bertholdi	Jan's banded snake																x						
	Suta fasciata	Rosen's snake			x										x			x				x	x	
	Suta gaikhorstorum	Pilbara hooded snake																x						
	Suta punctata	Spotted snake			x										x	x		x			x		x	

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	Vermicella snelli														x							x		
Gekkonidae	*Gehyra crypta*	Western cryptic gehyra														x	x	x				x	x	
	Gehyra fenestrula	Hamersley Range spotted gehyra														x								
	Gehyra media	Medium Pilbara spotted rock gehyra			x																	x		
	Gehyra micra	Small Pilbara spotted rock gehyra			x													x				x	x	
	Gehyra montium	Centralian dtella			x											x	x	x				x		
	Gehyra pilbara																	x						
	Gehyra punctata	Spotted dtella			x					x	x			x	x			x		x	x	x	x	
	Gehyra purpurascens	Purplish dtella										x												
	Gehyra variegata	Variegated gehyra			x						x	x		x	x	x	x	x		x	x	x	x	
	Heteronotia binoei	Bynoe's gecko			x					x	x	x		x	x	x	x	x		x	x	x	x	
	Heteronotia spelea	Pilbara cave gecko			x						x				x			x			x	x	x	
Pygopodidae	*Delma butleri*				x							x		x	x			x			x	x		
	Delma desmosa																x	x				x		
	Delma elegans				x										x						x			
	Delma nasuta				x					x				x	x			x		x	x	x	x	
	Delma pax				x						x	x		x	x	x	x	x		x	x	x	x	
	Delma tincta				x										x			x		x				
	Lialis burtonis				x						x	x		x	x	x	x	x		x		x	x	
	Pygopus nigriceps				x						x	x			x	x				x		x		
Pythonidae	*Antaresia childreni*	Children's python			x							x												
	Antaresia perthensis	Pygmy python									x	x			x	x		x			x	x	x	
	Aspidites melanocephalus	Black-headed python			x							x										x	x	
	Liasis olivaceus barroni	Pilbara olive python	VU	VU			x	x	x			x			x				x		x	x		
Scincidae	*Carlia munda*				x					x	x	x		x	x	x	x	x		x	x	x	x	
	Carlia triacantha				x						x			x	x	x	x							
	Cryptoblepharus buchananii																						x	
	Cryptoblepharus plagiocephalus				x																			
	Cryptoblepharus ustulatus														x			x					x	
	Ctenotus ariadnae											x		x										
	Ctenotus duricola	Eastern Pilbara lined ctenotus			x					x		x			x	x	x	x		x	x	x	x	
	Ctenotus grandis				x							x		x	x							x		
	Ctenotus hanloni											x		x		x	x	x						
	Ctenotus helenae				x					x	x			x		x		x				x	x	
	Ctenotus inornatus														x									
	Ctenotus nigrilineatus		P1	-	x			x																
	Ctenotus leonhardii											x		x	x			x				x		
	Ctenotus pallasotus	Western Pilbara lined ctenotus															x	x						
	Ctenotus pantherinus				x					x	x	x		x	x	x	x	x		x	x	x	x	
	Ctenotus piankai	Coarse sands ctenotus															x							
	Ctenotus quattuordecimlineatus													x		x								
	Ctenotus robustus																	x					x	
	Ctenotus rubicundus														x			x		x		x	x	

Family	Scientific Name	Common Name	Conservation Status		Database					Literature												Current consolidation		
			WA	EPBC	ALA	Birdata	PMST	DBCA	Fortescue	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Ctenotus rutilans											x		x	x			x		x				
	Ctenotus saxatilis	Rock ctenotus			x					x	x	x		x		x	x			x	x	x	x	
	Ctenotus serventyi													x										
	Ctenotus uber uber				x									x		x	x				x			
	Cyclodomorphus melanops				x							x			x	x				x	x	x	x	
	Egernia cygnitos	Western Pilbara spiny-tailed skink			x													x						
	Egernia epsisolus				x										x							x	x	
	Egernia formosa				x						x				x		x	x				x		
	Egernia pilbarensis				x																			
	Eremiascincus richardsonii	Broad-banded sand swimmer			x						x	x						x		x	x	x		
	Lerista amicorum				x							x		x								x		
	Lerista bipes				x							x		x	x	x		x						
	Lerista flammicauda	Pilbara flame-tailed slider			x															x				
	Lerista jacksoni				x							x			x									
	Lerista labialis				x							x						x						
	Lerista muelleri				x						x	x			x	x	x	x		x	x	x		
	Lerista neander																	x						
	Lerista timida				x							x				x	x	x			x			
	Lerista verhmens				x																		x	
	Lerista vermicularis													x										
	Lerista zietzi (Lerista chalybura)																	x						
	Liopholis kintorei	Great desert skink	VU	VU			x																	
	Menetia greyii				x					x	x	x		x	x	x	x	x		x		x	x	
	Menetia surda				x																			
	Morethia ruficauda				x									x	x	x		x		x	x	x	x	
	Notoscincus ornatus				x									x	x	x	x					x		
	Proablepharus reginae				x									x								x	x	
	Tiliqua multifasciata	Central blue-tongue								x	x			x	x	x	x	x			x		x	
Typhlopidae	*Anilios ammodytes*				x					x				x	x	x	x	x		x	x	x	x	
	Anilios ganei	Gane's blind snake	P1	-				x						x								x		
	Anilios grypus				x									x	x			x		x	x	x	x	
	Anilios hamatus	Pale-headed blind snake			x										x					x				
	Anilios waitii	Beaked blind snake			x																			
	Anilios pilbarensis				x									x								x	x	
Varanidae	*Varanus acanthurus*	Spiny-tailed goanna			x					x	x	x			x	x		x		x	x	x	x	
	Varanus brevicauda	Short-tailed pygmy goanna			x						x			x	x	x						x	x	
	Varanus bushi	Pilbara mulga goanna			x						x			x										
	Varanus caudolineatus				x						x									x				
	Varanus eremius	Pygmy desert goanna			x							x		x	x			x				x	x	
	Varanus giganteus	Perentie			x					x	x			x	x			x				x	x	
	Varanus gouldii	Bungarra			x						x	x	x	x				x			x	x		
	Varanus hamersleyensis															x		x						
	Varanus panoptes				x							x	x	x	x	x				x	x	x	x	

Family	Scientific Name	Common Name	Conservation Status		Database					Literature												Current consolidation		
			WA	EPBC	ALA	Birdata	PMST	DBCA	Fortescue	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Varanus pilbarensis	Northern Pilbara rock goanna			x							x			x							X	X	
	Varanus tristis	Racehorse goanna			x						x	x		x	x		x	x		x	x	X	X	
Total					**86**	**0**	**2**	**3**	**1**	**19**	**41**	**52**	**2**	**57**	**67**	**43**	**36**	**70**	**1**	**40**	**45**	**69**	**58**	**0**
Fish																								
Terapontidae	*Leiopotherapon unicolor*	Spangled perch												x		x						X		
Atherinidae	*Craterocephalus cuneiceps*	Murchison River hardyhead																				X		
Total					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**

Appendix D Bat echolocation call analysis.

Specialised Zoological

Identification of bat species from Bonney Downs, Western Australia

Prepared for **Ecologia Environment Pty Ltd**

Version **22 August 2024**

SZ project reference **SZ720**

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

Specialised Zoological (2024). Identification of bat species from Bonney Downs, Western Australia. Unpublished report by Specialised Zoological for Ecologia Environment Pty Ltd, 22 August 2024, project reference SZ720.

Version history

Date	Version	Note
2024-06-20	2024-06-20	Interim results from partial analysis of the datasets
2024-08-19	2024-08-19	Final report with outcomes from full analysis
2024-08-22	2024-08-22	Final report with addition of 2023 data

Contents

1.0 Summary

1.1 Scope and data

Bat identifications from acoustic recordings are provided from the Bonney Downs project area, in the Pilbara region of Western Australia. The datasets reported on here comprise a total of 144 sites, 320 recording nights and 475,151 WAV files:

- May 2023 'BBD' and 'BDDP' series—18 sites, 53 recording nights (119,133 sound files)
- July 2023 'BDTBD' series—4 sites, 18 recording nights (9,912 sound files)
- October 2023 'BB' and 'BDDP' series—42 sites, 80 recording nights (121,987 sound files)
- February 2024 'BB' series—39 sites, 78 recording nights (104,101 WAV sound files)
- March 2024 'BB' series—31 sites, 63 recording nights (65,952 WAV sound files)
- March 2024 'BDDP'—10 sites, 28 recording nights (54,066 WAV sound files)

Particular attention was given to the detection of two bat species of conservation significance: Ghost Bat *Macroderma gigas* (Megadermatidae) and Pilbara Diamond-faced Bat *Rhinonicteris aurantia* (Rhinonycteridae).

Two methods were used on the field survey:

1. Ultrasonic recordings with bat detectors to provide species identifications from echolocation calls;
2. Acoustic lure (portable speaker broadcasting Ghost Bat social calls; **Figure 1**) with detections and identification of the Ghost Bat from both infrared video and ultrasonic recordings; this is a targeted survey method to detect the species away from roost sites.

1.2 Species richness

Ten species of bat were detected (**Table 1**; **Figure 2**); which includes both the Ghost Bat and Pilbara Diamond-faced Bat. Each bat species was assigned to one of three categories representing the likelihood that they would be encountered above an altitude of 50 metres. This is an authoritative estimate based on my own accumulated casual field observations.

To give a further indication of the relative risk of collision of each species, the frequency of detection was calculated across sites for each species on each survey, and across all sites (**Table 2**). A risk matrix was devised based on the likelihood of detection at height categories and the frequency of detection values, which might be useful as a 'starting point' (conjecture) for considering the relative risk of collision with a turbine for each species (**Appendix 1**).

Details of detections at each site (collated across recording nights per site) are summarised in **Tables 3 – 8**.

One interesting observation was made for a high-flying species: the White-striped Free-tailed Bat *Austronomus australis* (Molossidae) is only seasonally present in the region from April to September according to an analysis presented by Bullen and McKenzie (2005). Observations

from the surveys were consistent with this analysis, with *A. australis* being detected only on the May and July 2023 surveys.

1.3 Ghost Bat

The Ghost Bat was detected at one acoustic lure site: BDGB03. One 'fly-by' was observed in in video recordings on both infrared camera traps at 18:52:22 and 18:52:54 (**Table 9**). The identification was based on the observation of an anteriorly-directed structure resembling long ears, the broad wings, and lack of a distinct tail (**Figure 3**; see comparison with images of birds and insects in **Figure 4**). It was not detected in echolocation recordings at the acoustic lure sites. However, the bat detector recording failed at site BDGB03. No other detections of the Ghost Bat were made on the surveys.

1.4 Pilbara Diamond-faced Bat

The Pilbara Diamond-faced Bat was detected from one echolocation sequence from acoustic lure site BDGB01 (unit 641036) on the night of 2024-03-22 at 23:21:09 (**Figure 5**). I have observed this species approaching a Ghost Bat social call broadcast on previous occasions. The Pilbara Diamond-faced Bat was also detected well after sunset and well before sunrise at 14 other sites in 2023 and 2024 (**Table 10**):

- 7 sites in May 2023
- 4 sites October 2023
- 3 sites in February 2024

1.5 Bat species not detectable with the methods used

Given that this survey was conducted to understand the possible effects of the construction and operation of wind turbines on bats, it is worth noting six species that were not detected in the analysis. Three of these are known to forage or commute above the tree canopy height and might range within the blade swept area of a wind turbine in this study area. These species cannot be detected using the methods described in the present report. Three other species not detected are either not found in this part of the Pilbara, or else have low detectability with bat detectors.

- **Black Flying-fox *Pteropus alecto* and Little Red Flying-fox *Pteropus scapulatus*** (Pteropodidae)—do not echolocate and are therefore not detected by acoustic recorders (bat detectors).
- **Hill's Sheath-tailed Bat *Taphozous hilli*** (Emballonuridae)—could be present in addition to *T. georgianus*, given its distribution in the region (Milne et al. 2023), but its calls cannot be distinguished reliably from those of *T. georgianus*.
- **Pallid Long-eared Bat *Nyctophilus daedalus* and Lesser Long-eared Bat *Nyctophilus geoffroyi*** (Vespertilionidae)—might be present but their echolocation calls are usually low in amplitude, and can be difficult to distinguish from clutter calls of the Little Broad-nosed Bat *Scotorepens greyii*.
- **Northern Coastal Free-tailed Bat *Ozimops cobourgianus*** (Molossidae)—found only along the Pilbara coast, usually in mangal habitat.

2.0 Methods

2.1 Ultrasonic recordings

The ultrasonic recordings provided were recorded in WAV format with Titley Scientific Anabat Chorus bat detectors (sampling rate 500 kHz, set to turn on automatically at sunset and off at sunrise), and Wildlife Acoustics SM4BAT-FS bat detectors (sampling rate 384 kHz).

A multi-step acoustic analysis procedure developed to process large full spectrum echolocation recording datasets from insectivorous bats (Armstrong et al. 2021a,b) was applied to the recordings made on the survey. Firstly, the WAV files were scanned for bat echolocation calls using several parameter sets in the software SCAN'R version 1.8.3 (Binary Acoustic Technology), which also provides measurements (SCAN'R parameters) from each putative bat pulse. The outputs were then used to determine if putative bat pulses measured in SCAN'R could be identified to species. This was done using a custom [R] language application that performed three tasks:

1. undertook a Discriminant Function Analysis on training data from representative calls from the Pilbara;
2. from the measurements of each putative bat pulse from SCAN'R, calculated values for the first two Discriminant Functions that could separate the echolocation call types derived from the analysis of training data, and plotted these resulting coordinates over data ellipses representing one standard deviation of the variation for the defined call types; and
3. facilitated an inspection in a spectrogram of multiple examples of each call type for each recording night by opening the original WAV files containing pulses of interest in ADOBE AUDITION version 23.1.

Species were identified based on information in the author's unpublished material and Churchill (2008). Nomenclature follows Jackson and Groves (2015). Identifications were supported by distribution information in a curated source of distribution records maintained by the Australasian Bat Society, Inc. (https://www.ausbats.org.au/batmap.html) (Milne et al. 2023). Custom [R] language scripts were used to summarise the analysis outcomes.

2.2 Acoustic lure sites with infrared video recordings

An acoustic lure system was set at seven sites for one night each. This method is based on recent demonstrations of its utility by Hanrahan et al. (2023) and Ruykys et al. (2023), and is broadly consistent with guidelines on the approach released in the Northern Territory (Ruykys et al. 2024). The system comprised a portable speaker (generic brand from Amazon), an Anabat Chorus bat detector, two infrared-capable camera traps (Jaycar model QC8051), and two 'long range infrared spotlights' (Jaycar model QC3654).

The portable speakers were loaded with a micro-SD card containing a sequence of sound files comprising 'squabble' calls; *sensu* Hanrahan et al. 2023; see **Appendix 2**) of the Ghost Bat. Sound files consisted of a 2-minute period with various examples of squabble calls, followed by a 2-minute period of silence. The speakers played sound files on a memory card

sequentially upon startup, for the entire night. The speaker volume was maximised. The distance at which Ghost Bats can hear the signals at night is unknown but assumed to be at least 100 m.

The camera trap was set to record back-to-back 3-minute black and white video files at high resolution (4K 3840 x 2160) continuously upon start up. Recordings were started after covering the camera lens so that the unit switched from colour to night (black and white) mode. The settings were adjusted so that built-in infrared LEDs were non-functional, and infrared light was instead provided by the long-range infrared spotlight, which was powered by 10 AA batteries that lasted c. 5 hours. Each camera trap contained a blank 256 GB Sandisk SD card, which had the capacity to save the recording from a full night.

The Chorus bat detector was placed on the central star picket underneath the portable speaker to maximise the chance of detection via echolocation calls if a Ghost Bat approached the speaker. Detection of echolocation calls provides a way to independently validate any detection made from the video recordings (**Appendix 2**).

Figure 1. Representation of the acoustic lure system deployment. There are two camera traps for redundancy and corroboration of images of bats, and a bat detector for validation of an identification made from videos based on echolocation calls only.

All videos were processed with an expeditious and robust analysis method. A custom Python (https://www.python.org/) script (Dr R. C. Morgans, Supersensory Technologies Pty Ltd unpublished) applied a background subtraction algorithm from the *opencv* framework (https://opencv.org/) to the recordings and constructed a concatenated short video containing only portions of the recording with moving objects above a certain size. These concatenated videos are watched at <50% speed in the MPV MEDIA PLAYER (https://mpv.io/), which allows fine control of frame advancement. Objects of interest were located and re-examined in the original 4K recording using the embedded timestamp information.

Smaller species of bat can be seen often in the infrared videos. Without careful consideration, these species can sometimes be confused for the Ghost Bat when they fly near the speaker—a behaviour that might intuitively be expected only from the Ghost Bat. Ghost Bats can be distinguished in infrared and thermal video recordings from other bat species and insects based on the observation of any combination of the following morphological and behavioural features that provide an empirical basis for the identification:

- flight pattern (four distinct behaviours classified as: ‘circling’ of the post containing the speaker; ‘hover’ in front of the speaker; ‘long glide’ towards the speaker; and ‘drop in’ whereby they would sometimes approach at c. 2 m above the speaker and then drop vertically towards it);
- body size relative to other objects in the frame;
- large ear size;
- lack of a tail;
- bright eyeshine of the reflected infrared light from their large eyes (infrared recordings only, though not always visible); and
- corroboration with concurrently-recorded diagnostic echolocation calls (**Appendix 2**).

All bats observed in videos are examined by single manual frame advancement to check for diagnostic features. The relatively high resolution and video frame rate provides a reasonable level of image quality.

3.0 Limitations

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

1. The identifications made herein were based on the ultrasonic sound recordings made and provided by a 'third party' (the client named on the front of this report).
2. In the case of the present report, the recording equipment was set up and supplied by Specialised Zoological. The equipment was operated by the third party during the survey.
3. Other than the general location of the study area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.
4. Specialised Zoological has had no input into the overall design and timing of this bat survey, recording site placement, nor the degree of recording site replication.
5. This version of the document supersedes any previous version, including the interim report (Specialised Zoological 2024). Previous drafts are not authorised by us for submission to the regulator or the public domain.
6. Please see **Appendix 2** for more information about the application of the acoustic lure.

4.0 References

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Table 1. Species identified in the present survey from all sites combined. The predicted presence above 50 metres in altitude is an authoritative estimate based on my own accumulated casual field observations ('predicted to be encountered commonly above 50 m').

Predicted presence above 50 m altitude		
	MEGADERMATIDAE	
Medium	Ghost Bat	*Macroderma gigas*
	RHINONYCTERIDAE	
Low	Pilbara Diamond-faced Bat (Pilbara Leaf-nosed Bat)	*Rhinonicteris aurantia*
	EMBALLONURIDAE	
Medium	Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*
High	Common Sheath-tailed Bat	*Taphozous georgianus*
	VESPERTILIONIDAE	
Low	Gould's Wattled Bat	*Chalinolobus gouldii*
Low	Little Broad-nosed Bat	*Scotorepens greyii*
Low	Finlayson's Cave Bat	*Vespadelus finlaysoni*
	MOLOSSIDAE	
High	White-striped Free-tailed Bat	*Austronomus australis*
Medium	Greater Northern Free-tailed Bat	*Chaerephon jobensis*
Medium	Northern Free-tailed Bat	*Ozimops lumsdenae*

Table 2. Frequency of detection across sites for each species on each survey (higher intensity of colour for higher values).

Species	May 2024	July 2024	October 2024	February 2024 (BB series)	March 2024 (BB series)	March 2024 (BDDP series)	Over all surveys
A. australis	0.00	0.00	0.00	0.44	0.50	0.00	0.07
C. gouldii	0.87	0.77	0.80	0.94	1.00	0.74	0.85
C. jobensis	0.54	0.39	0.50	0.83	1.00	0.45	0.55
O. lumsdenae	0.18	0.26	0.00	0.11	0.50	0.14	0.18
R. aurantia	0.08	0.00	0.00	0.39	0.00	0.10	0.10
S. flaviventris	0.87	0.84	0.90	0.50	0.25	0.48	0.71
S. greyii	0.87	0.74	0.80	0.89	1.00	0.79	0.85
T. georgianus	0.77	0.61	0.80	0.83	1.00	0.50	0.70
V. finlaysoni	0.49	0.42	0.60	0.50	1.00	0.55	0.53

Table 3. Species detected at each site in May 2023 ('BBD' and 'BDDP' sites).

						A. australis	*C. gouldii*	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**									
BBD01	S4U06484-MDSM4-02	-22.579550, 117.011240	2023-05-27	2023-05-30	4	X	X	X	.	X	.	X	X	X
BBD02	S4U11723-MDSM4-03	-22.579550, 117.011240	2023-05-28	2023-05-29	2	X	X	X	.	X	.	X	X	X
BBD03	S4U11658-MDSM4-05	-22.579330, 117.011580	2023-05-30	2023-05-31	2	.	X	X	.	.	.	X	.	.
BBD04	S4U11723-MDSM4-03	-22.579550, 117.011240	2023-05-30	2023-05-31	2	.	X	X	.	.	X	.	.	.
BBD05	S4U06478-MDSM4-01	-22.579550, 117.011240	2023-05-30	2023-05-31	2	.	X	X	.	.	X	X	X	.
BBD06	S4U11657-MDSM4-07	-22.140550, 118.563240	2023-05-30	2023-05-31	2	X	X	X	.	X	X	X	X	X
BBD07	S4U11659-MDSM4-04	-22.579330, 117.011240	2023-05-30	2023-05-31	2	.	X	X	.	.	X	X	X	X
BBDDP02	S4U11723-MDSM4-03	-22.579550, 117.011240	2023-05-25	2023-05-27	3	.	X	X	.	.	X	X	X	X
BDBAT01	S4U11651-MDSM4-06	-22.579330, 117.011580	2023-05-28	2023-05-30	3	X	X	X	X	X	.	.	X	X
BDDP01	S4U11651-MDSM4-06	-22.579330, 117.011580	2023-05-24	2023-05-26	3	X	X	.	.	.	X	X	X	.
BDDP03	S4U06478-MDSM4-01	-22.579550, 117.011240	2023-05-23	2023-05-26	4	X	X	X	.	X	.	X	X	.
BDDP04	S4U11657-MDSM4-07	-22.140550, 118.563240	2023-05-24	2023-05-26	3	X	X	X	.	.	X	X	X	X
BDDP05	S4U11658-MDSM4-05	-22.579330, 117.011580	2023-05-23	2023-05-25	3	.	X	X	X	.	X	X	X	X
BDDP06	S4U11658-MDSM4-05	-22.579330, 117.011580	2023-05-26	2023-05-29	4	.	X	X	.	X	.	X	X	X
BDDP07	S4U11659-MDSM4-04	-22.579330, 117.011240	2023-05-26	2023-05-29	4	.	X	X	.	X	.	X	X	.
BDDP08	S4U06484-MDSM4-02	-22.579550, 117.011240	2023-05-23	2023-05-26	4	.	X	.	.	.	.	X	X	.
BDDP09	S4U06478-MDSM4-01	-22.579550, 117.011240	2023-05-27	2023-05-29	3	.	X	.	.	.	.	X	.	.
BDDP10	S4U11657-MDSM4-07	-22.140550, 118.563240	2023-05-27	2023-05-29	3	X	.	X	.	.	X	X	X	.

Table 4. Species detected at each site in July 2023 ('BDTBD' sites).

						A. australis	*C. gouldii*	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**									
BDTBD01	636494	-22.018644, 119.971222	2023-07-25	2023-07-28	4	.	X	X	X	.	.	X	X	X
BDTBD02	644439	-22.021631, 119.964485	2023-07-25	2023-07-28	4	.	X	X	X	.	.	X	X	X
BDTBD03	644439	-21.973442, 119.999969	2023-07-26	2023-07-31	6	X	X	X	.	.	.	X	X	X
BDTBD04	636494	-21.978964, 119.990219	2023-07-29	2023-08-01	4	X	X	X	.	.	X	X	X	X

Table 5. Species detected at each site in October 2023 ('BB' and 'BDDP' sites; continued next page).

						A. australis	*C. gouldii*	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**									
BDDP13	S4U06484-MDSM4-02	.	2023-10-12	2023-10-14	3	.	.	.	.	X	.	X	X	X
BB017	S4U06484-MDSM4-02	.	2023-10-15	2023-10-16	2	.	X	X	.	.	X	X	.	X
BB012	S4U06484-MDSM4-02	.	2023-10-17	2023-10-18	2	.	X	.	.	.	X	X	.	X
BB040	S4U11723-MDSM4-03	.	2023-10-09	2023-10-10	2	.	X	.	.	.	.	X	.	.
BDDP11	S4U11723-MDSM4-03	.	2023-10-11	2023-10-13	3	.	X	X	.	.	X	X	X	X
BB039	S4U11723-MDSM4-03	.	2023-10-14	2023-10-15	2	.	X	X	.	.	X	X	X	.
BB011	S4U11723-MDSM4-03	.	2023-10-16	2023-10-18	3	.	X	X	.	X	X	X	X	X
BB028	S4U11659-MDSM4-04	.	2023-10-11	2023-10-12	2	.	.	.	.	.	.	X	X	.
BB026	S4U11659-MDSM4-04	.	2023-10-13	2023-10-14	2	.	X	X	.	.	.	.	X	X
BB018	S4U11659-MDSM4-04	.	2023-10-15	2023-10-16	2	.	X	.	.	.	.	X	.	X
BB015	S4U11659-MDSM4-04	.	2023-10-17	2023-10-18	2	.	X	X	X	.	X	X	X	X
BB033	S4U11658-MDSM4-05	.	2023-10-11	2023-10-12	2	.	X	X	X	.	.	X	.	.
BB030	S4U11658-MDSM4-05	.	2023-10-13	2023-10-14	2	.	X	X	.	.	.	X	X	.
BB002	S4U11658-MDSM4-05	.	2023-10-15	2023-10-16	2	.	.	.	.	.	.	.	.	.
BB029	MDSM4-06	no data	2023-10-11	2023-10-12	2	.	.	.	.	.	.	.	.	.
BB023	MDSM4-06	no data	2023-10-13	2023-10-14	2	.	.	.	.	.	.	.	.	.
BB001	MDSM4-06	no data	2023-10-15	2023-10-16	2	.	.	.	.	.	.	.	.	.
BB007	MDSM4-06	no data	2023-10-17	2023-10-18	2	.	.	.	.	.	.	.	.	.
BB032	S4U11659-MDSM4-07	-22.045100, 119.944370	2023-10-09	2023-10-10	2	.	X	X	.	.	.	X	X	.
BB025	S4U11659-MDSM4-07	-22.045100, 119.944370	2023-10-11	2023-10-12	2	.	X	X	.	.	X	X	X	X
BB036	S4U11659-MDSM4-07	-22.045100, 119.944370	2023-10-13	2023-10-14	2	.	X	X	X	X	X	X	X	X
BB005	S4U11659-MDSM4-07	-22.045100, 119.944370	2023-10-15	2023-10-16	2	.	X	X	.	.	.	X	X	X
BB010	S4U11659-MDSM4-07	-22.045100, 119.944370	2023-10-17	2023-10-18	2	.	X	.	.	.	X	X	.	X
BB020	TC36-644436	-22.107889, 119.867348	2023-10-11	2023-10-13	2	.	X	.	.	.	X	X	.	X

						A. australis	*C. gouldii*	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**									
BB016	TC36-644436	-22.198734, 119.918373	2023-10-13	2023-10-15	2	.	X	X	X	.	X	X	.	X
BB004	TC36-644436	-21.951029, 119.794090	2023-10-15	2023-10-17	2	.	X	.	.	.	X	X	.	X
BB021	TC36-644436	-22.196741, 120.013084	2023-10-17	2023-10-19	2	.	X	.	.	.	X	X	.	.
BB037	TC39-644439	-22.045776, 119.883430	2023-10-11	2023-10-13	2	.	.	.	.	.	.	X	X	.
BB022	TC39-644439	-22.114225, 119.975815	2023-10-13	2023-10-15	2	.	X	X	.	.	X	X	X	X
BB003	TC39-644439	-21.919384, 119.782402	2023-10-15	2023-10-17	2	.	X	X	.	X	X	X	X	X
BB008	TC39-644439	no data	.	.	.	.	.	.	.	.	.	.	.	.
BB035	TC40-644440	-22.076000, 119.895966	2023-10-11	2023-10-13	2	.	X	.	.	.	X	X	X	.
BB024	TC40-644440	-21.999393, 119.954002	2023-10-13	2023-10-15	2	.	X	X	X	.	.	.	X	X
BB038	TC40-644440	-22.225801, 119.852524	2023-10-15	2023-10-17	2	.	X	X	.	.	X	X	X	X
BB013	TC40-644440	-22.256664, 119.987633	2023-10-17	2023-10-19	2	.	X	.	.	.	X	X	.	X
BB031	TC88-636488	-22.015324, 119.875801	2023-10-11	2023-10-13	2	.	X	X	X	.	X	X	X	X
BB027	TC88-636488	-21.933846, 119.972397	2023-10-13	2023-10-15	2	.	X	.	.	.	.	.	X	.
BB014	TC88-636488	-22.209757, 119.814163	2023-10-15	2023-10-17	2	.	.	.	.	.	.	X	.	.
BB019	TC88-636488	-22.174740, 119.855011	2023-10-17	2023-10-19	2	.	X	X	.	.	.	X	.	.
BDDP12	TC94-636494	-22.070423, 119.854462	2023-10-11	2023-10-14	3	.	.	.	.	.	X	X	.	X
BB034	TC94-636494	-22.092993, 119.863396	2023-10-14	2023-10-16	2	.	X	.	.	.	.	X	X	X
BB009	TC94-636494	.	2023-10-17	2023-10-17	1	.	X	.	.	.	.	X	.	.

Table 6. Species detected at each site in February 2024 ('BB' sites; continued next page).

						C. gouldii	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**								
BB001	S4U11723	-32.911090,116.475810	2024-02-09	2024-02-10	2	X	X	.	.	X	X	X	X
BB002	S4U11657	-32.816600,116.379770	2024-02-09	2024-02-10	2	X	X	.	.	X	X	.	.
BB003	S4U11659	-32.781330,116.495450	2024-02-09	2024-02-10	2	X	X	X	X	X	X	X	X
BB004	644439	-21.949577,119.793472	2024-02-09	2024-02-10	2	X	X	.	.	X	.	X	X
BB005	636494	-22.003422,119.817451	2024-02-09	2024-02-10	2	X	.	.	.	X	X	X	X
BB006	644436	-22.025839,119.844109	2024-02-09	2024-02-10	2	X	.	.	.	X	X	.	.
BB007	636494	-22.053459,119.824661	2024-02-11	2024-02-12	2	X	X	.	.	.	X	.	.
BB008	S4U11657	-32.816600,116.379770	2024-02-11	2024-02-12	2	X	X	.	.	X	X	X	X
BB009	S4U11723	-32.911090,116.475810	2024-02-11	2024-02-12	2	.	X	.	.	X	X	X	.
BB010	S4U06478	-32.816600,116.379770	2024-02-11	2024-02-12	2	X	X	.	.	X	X	X	.
BB011	S4U06478	-32.816600,116.379770	2024-02-09	2024-02-10	2	X	X	.	.	X	X	X	X
BB012	S4U06484	-32.830550,116.357890	2024-02-11	2024-02-12	2	.	.	.	.	X	X	X	.
BB013	S4U11651	-22.114890,119.916880	2024-02-11	2024-02-12	2	X	.	X	X	X	X	X	.
BB014	644439	-22.209053,119.813850	2024-02-07	2024-02-08	2	.	.	.	.	X	.	X	.
BB015	S4U11658	-32.791420,116.382810	2024-02-09	2024-02-10	2	X	X	.	.	X	X	X	X
BB016	S4U11651	-22.114890,119.916880	2024-02-05	2024-02-06	2	X	X	X	.	X	X	.	X
BB017	644440	-22.231794,119.898666	2024-02-07	2024-02-08	2	X	X	.	.	X	X	X	.
BB019	636488	-22.175192,119.854073	2024-02-07	2024-02-08	2	X	X	.	.	X	X	.	X
BB020	S4U11651	-22.114890,119.916880	2024-02-07	2024-02-08	2	X	.	.	.	X	X	.	X
BB021	S4U11658	-32.791420,116.382810	2024-02-11	2024-02-12	2	X	.	X	.	X	X	X	.
BB022	S4U06478	-32.816600,116.379770	2024-02-07	2024-02-08	2	X	X	X	.	X	X	X	X
BB023	S4U06484	-32.830550,116.357890	2024-02-07	2024-02-08	2	X	X	.	.	X	X	X	X
BB024	S4U06484	-32.830550,116.357890	2024-02-05	2024-02-06	2	.	.	.	.	.	X	X	.

						C. gouldii	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**								
BB025	S4U11723	-32.911090,116.475810	2024-02-05	2024-02-06	2	X	X	X	.	X	X	X	X
BB026	S4U11657	-32.816600,116.379770	2024-02-05	2024-02-06	2	X	X	.	.	X	X	X	X
BB027	S4U06478	-32.816600,116.379770	2024-02-05	2024-02-06	2	X	.	.	.	.	X	X	.
BB028	S4U11658	-32.791420,116.382810	2024-02-05	2024-02-06	2	.	.	.	.	.	X	.	.
BB029	S4U11659	-32.781330,116.495450	2024-02-05	2024-02-06	2	X	X	X	.	X	X	X	.
BB030	636494	-22.011641,119.931221	2024-02-05	2024-02-06	2	X	.	.	.	X	.	X	.
BB031	636488	-22.015392,119.875801	2024-02-09	2024-02-10	2	X	.	.	.	X	.	X	.
BB032	644436	-22.145529,119.928078	2024-02-05	2024-02-06	2	X	.	.	.	.	X	.	.
BB033	644440	-21.964575,119.868095	2024-02-11	2024-02-12	2	X	.	.	.	X	X	.	X
BB034	S4U11651	-22.114890,119.916880	2024-02-09	2024-02-10	2	X	.	.	.	X	X	X	X
BB035	S4U06484	-32.830550,116.357890	2024-02-09	2024-02-10	2	X	X	.	.	X	X	X	.
BB036	644440	-22.033985,119.914337	2024-02-05	2024-02-06	2	X	X	.	.	X	X	X	X
BB037	644440	-22.045576,119.883087	2024-02-09	2024-02-10	2	X	.	.	.	X	.	X	.
BB038	636494	-22.209028,119.868584	2024-02-07	2024-02-08	2	X	X	.	.	X	X	X	X
BB039	S4U11659	-32.781330,116.495450	2024-02-11	2024-02-12	2	X	.	.	X	X	X	X	X
BB040	644439	-22.058601,119.935104	2024-02-05	2024-02-06	2	X	.	.	.	X	X	X	.

Table 7. Species detected at each site in March 2024 ('BB' sites; continued next page).

						C. gouldii	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**								
BB002	S4U11651	-22.112400,119.871900	2024-03-22	2024-03-23	2	.	.	.	.	X	.	X	.
BB004	644439	-21.949398,119.793747	2024-03-18	2024-03-19	2	X	.	.	.	X	X	X	X
BB006	S4U11657	-21.951290,119.792600	2024-03-21	2024-03-22	2	X	X	.	.	X	X	X	X
BB007	636488	-22.051115,119.825081	2024-03-18	2024-03-19	2	X	.	.	.	X	X	.	.
BB008	S4U11657	-21.951290,119.792600	2024-03-25	2024-03-26	2	X	.	.	.	X	.	X	X
BB009	S4U06478	-22.079100,119.814400	2024-03-25	2024-03-26	2	X	X	.	.	X	X	X	.
BB014	655145	-22.210754,119.813789	2024-03-23	.	1	.	.	.	.	X	.	.	.
BB015	S4U11659	-22.079630,119.814300	2024-03-21	2024-03-22	2	X	X	.	.	X	X	.	X
BB016	S4U11723	-22.199810,119.920150	2024-03-17	2024-03-19	3	X	X	X	.	X	X	X	.
BB017	S4U11723	-22.199810,119.920150	2024-03-20	2024-03-22	3	X	X	.	.	X	X	.	X
BB018	636473	-22.247828,119.842186	2024-03-23	2024-03-24	2	X	.	.	.	X	X	.	X
BB019	S4U11723	-22.199810,119.920150	2024-03-23	2024-03-24	2	X	X	.	.	X	X	X	.
BB021	S4U11651	-22.112400,119.871900	2024-03-24	2024-03-25	2	X	.	X	.	X	X	X	X
BB022	S4U06484	-22.102180,119.825030	2024-03-23	2024-03-24	2	X	X	.	.	X	X	.	X
BB023	644439	-21.975859,119.996063	2024-03-26	2024-03-27	2	X	X	X	.	X	X	.	.
BB024	S4U11651	-22.112400,119.871900	2024-03-26	2024-03-27	2	X	.	X	.	X	X	X	.
BB025	S4U11659	-22.079630,119.814300	2024-03-26	2024-03-27	2	X	.	X	.	X	X	.	.
BB026	636488	-21.906364,119.951920	2024-03-26	2024-03-27	2	X	X	X	.	X	X	X	.
BB027	S4U06484	-22.102180,119.825030	2024-03-26	2024-03-27	2	.	.	.	.	.	.	X	.
BB028	S4U11658	-21.919290,119.783830	2024-03-26	2024-03-27	2	X	X	.	.	.	X	X	.
BB029	S4U11657	-21.951290,119.792600	2024-03-23	2024-03-24	2	.	.	.	.	X	X	X	.
BB030	S4U11723	-22.199810,119.920150	2024-03-26	2024-03-27	2	X	.	X	.	X	X	X	X
BB031	S4U11658	-21.919290,119.783830	2024-03-21	2024-03-22	2	X	.	.	.	X	X	X	.
BB032	644439	-22.145163,119.928123	2024-03-21	2024-03-22	2	X	X	.	.	X	X	.	.

						C. gouldii	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**								
BB033	S4U11658	-21.919290,119.783830	2024-03-23	2024-03-24	2	.	.	.	.	.	.	.	.
BB034	S4U11659	-22.079630,119.814300	2024-03-23	2024-03-24	2	X	.	.	.	X	.	X	X
BB036	644439	-22.034061,119.914505	2024-03-23	2024-03-24	2	X	.	X	.	X	X	X	X
BB037	636488	-22.045712,119.883575	2024-03-23	2024-03-24	2	.	.	.	.	.	.	X	.
BB038	636472	-22.208471,119.869171	2024-03-23	2024-03-24	2	.	X	.	.	X	X	.	.
BB039	S4U06484	-22.102180,119.825030	2024-03-18	2024-03-19	2	X	.	.	.	X	X	.	X
BB040	S4U06478	-22.079100,119.814400	2024-03-23	2024-03-24	2	X	.	.	.	.	.	X	X

Table 8. Species detected at each site in March 2024 ('BDDP' sites).

						C. gouldii	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**								
BB003/BDDP16	S4U11658	-21.919290,119.783830	2024-03-18	2024-03-20	3	X	X	.	.	X	X	X	X
BDDP14	S4U11657	-21.951290,119.792600	2024-03-19	.	1	X	X	.	.	X	X	X	.
BDDP15	636494	-22.029480,119.826431	2024-03-18	2024-03-20	3	.	.	.	.	.	.	.	.
BDDP17	S4U11651	-22.112400,119.871900	2024-03-19	2024-03-21	3	.	X	.	.	X	.	X	.
BDDP18	636488	-21.893881,119.785057	2024-03-20	2024-03-22	3	X	.	.	.	X	X	X	X
BDDP19	S4U11659	-22.079630,119.814300	2024-03-17	2024-03-19	3	X	.	.	.	X	X	.	X
BDDP20	S4U06478	-22.079100,119.814400	2024-03-17	2024-03-19	3	X	X	.	.	X	X	X	X
BDDP22	S4U06478	-22.079100,119.814400	2024-03-20	2024-03-22	3	X	.	.	.	X	X	X	.
BDDP23	S4U11651	-22.112400,119.871900	2024-03-16	2024-03-18	3	X	.	.	.	X	X	X	X
DBOPP1	636472	-21.900614,119.884453	2024-03-26	2024-03-27	3	X	X	.	.	X	X	X	X

Table 9. Summary of analyses of the acoustic lure recordings (Chorus bat detector and two infrared camera traps per site).

Site	Chorus	Coordinates	Video timestamp
BDGB01	641036	-22.034065 119.914177	.
BDGB02	636474	-21.888155 119.781609	.
BDGB03	rec fail	.	18:52:22 and 18:52:54
BDGB04	641036	-22.100115 119.988914	.
BDGB05	636473	-21.905867 119.865448	.
BDGB06	641036	-21.975908 119.999283	.
BDGB07	636474	-21.915771 120.013268	.

Table 10. Summary of detections of the Pilbara Diamond-faced Bat from all sites (blue highlight aid inspection by separating sites; continued next page).

Site-unit	Night of	Passes	Sunset	Dusk	Dawn	Sunrise	Time of first detection	Time of last detection	Time since sunset	Time until sunrise
May 2023										
BBD01 MDSM4-02	27/05/2023	8	27/05/2023 17:25	27/05/2023 17:49	28/05/2023 6:07	28/05/2023 6:31	20:38:32	1:39:06	3H 13M 4S	4H 52M 50S
BBD02 MDSM4-03	28/05/2023	1	28/05/2023 17:25	28/05/2023 17:49	29/05/2023 6:08	29/05/2023 6:32	20:11:13	20:11:13	2H 45M 58S	10H 21M 9S
BBD06 MDSM4-07	30/05/2023	1	30/05/2023 17:24	30/05/2023 17:49	31/05/2023 6:09	31/05/2023 6:33	23:29:49	23:29:49	6H 4M 55S	7H 3M 25S
BDBAT01 MDSM4-06	28/05/2023	1	28/05/2023 17:25	28/05/2023 17:49	29/05/2023 6:08	29/05/2023 6:32	23:29:31	23:29:31	6H 4M 16S	7H 2M 51S
BDDP03 MDSM4-01	23/05/2023	1	23/05/2023 17:26	23/05/2023 17:50	24/05/2023 6:06	24/05/2023 6:30	23:25:59	23:25:59	5H 59M 32S	7H 4M 11S
BDDP06 MDSM4-05	26/05/2023	1	26/05/2023 17:25	26/05/2023 17:49	27/05/2023 6:07	27/05/2023 6:31	20:34:04	20:34:04	3H 8M 23S	9H 57M 26S
BDDP06 MDSM4-05	27/05/2023	9	27/05/2023 17:25	27/05/2023 17:49	28/05/2023 6:07	28/05/2023 6:31	19:53:28	2:01:34	2H 28M 0S	4H 30M 22S
BDDP06 MDSM4-05	28/05/2023	10	28/05/2023 17:25	28/05/2023 17:49	29/05/2023 6:08	29/05/2023 6:32	21:00:22	2:01:46	3H 35M 7S	4H 30M 36S
BDDP06 MDSM4-05	29/05/2023	21	29/05/2023 17:25	29/05/2023 17:49	30/05/2023 6:08	30/05/2023 6:32	21:13:34	1:23:40	3H 48M 30S	5H 9M 8S
BDDP07 MDSM4-04	27/05/2023	1	27/05/2023 17:25	27/05/2023 17:49	28/05/2023 6:07	28/05/2023 6:31	21:02:40	21:02:40	3H 37M 12S	9H 29M 16S
October 2023										
BDDP13 MDSM4-02	14/10/2023	1	14/10/2023 18:04	14/10/2023 18:26	15/10/2023 5:06	15/10/2023 5:29	0:21:28	0:21:28	6H 17M 24S	5H 8M 10S
BB011 MDSM4-03	16/10/2023	17	16/10/2023 18:04	16/10/2023 18:27	17/10/2023 5:05	17/10/2023 5:27	22:34:05	2:31:13	4H 29M 12S	2H 56M 42S
BB011 MDSM4-03	17/10/2023	6	17/10/2023 18:05	17/10/2023 18:28	18/10/2023 5:04	18/10/2023 5:27	21:36:50	1:45:44	3H 31M 32S	3H 41M 21S
BB036 MDSM4-07	13/10/2023	3	13/10/2023 18:03	13/10/2023 18:26	14/10/2023 5:07	14/10/2023 5:30	20:02:06	23:09:58	1H 58M 25S	6H 20M 32S

Site-unit	Night of	Passes	Sunset	Dusk	Dawn	Sunrise	Time of first detection	Time of last detection	Time since sunset	Time until sunrise
BB03 TC39-644439	15/10/2023	11	15/10/2023 18:04	15/10/2023 18:27	16/10/2023 5:05	16/10/2023 5:28	19:32:11	3:50:51	1H 27M 43S	1H 37M 55S
BB03 TC39-644439	16/10/2023	6	16/10/2023 18:04	16/10/2023 18:27	17/10/2023 5:05	17/10/2023 5:27	19:30:17	3:08:43	1H 25M 24S	2H 19M 12S
February 2024										
BB03	9/02/2024	1	9/02/2024 18:44	9/02/2024 19:08	10/02/2024 5:24	10/02/2024 5:47	20:30:37	20:30:37	1H 46M 0S	9H 17M 21S
BB13	11/02/2024	1	11/02/2024 18:43	11/02/2024 19:06	12/02/2024 5:25	12/02/2024 5:49	2:16:32	2:16:32	7H 32M 58S	3H 32M 38S
BB39	11/02/2024	2	11/02/2024 18:43	11/02/2024 19:06	12/02/2024 5:25	12/02/2024 5:49	3:04:05	3:04:27	8H 20M 31S	2H 44M 43S

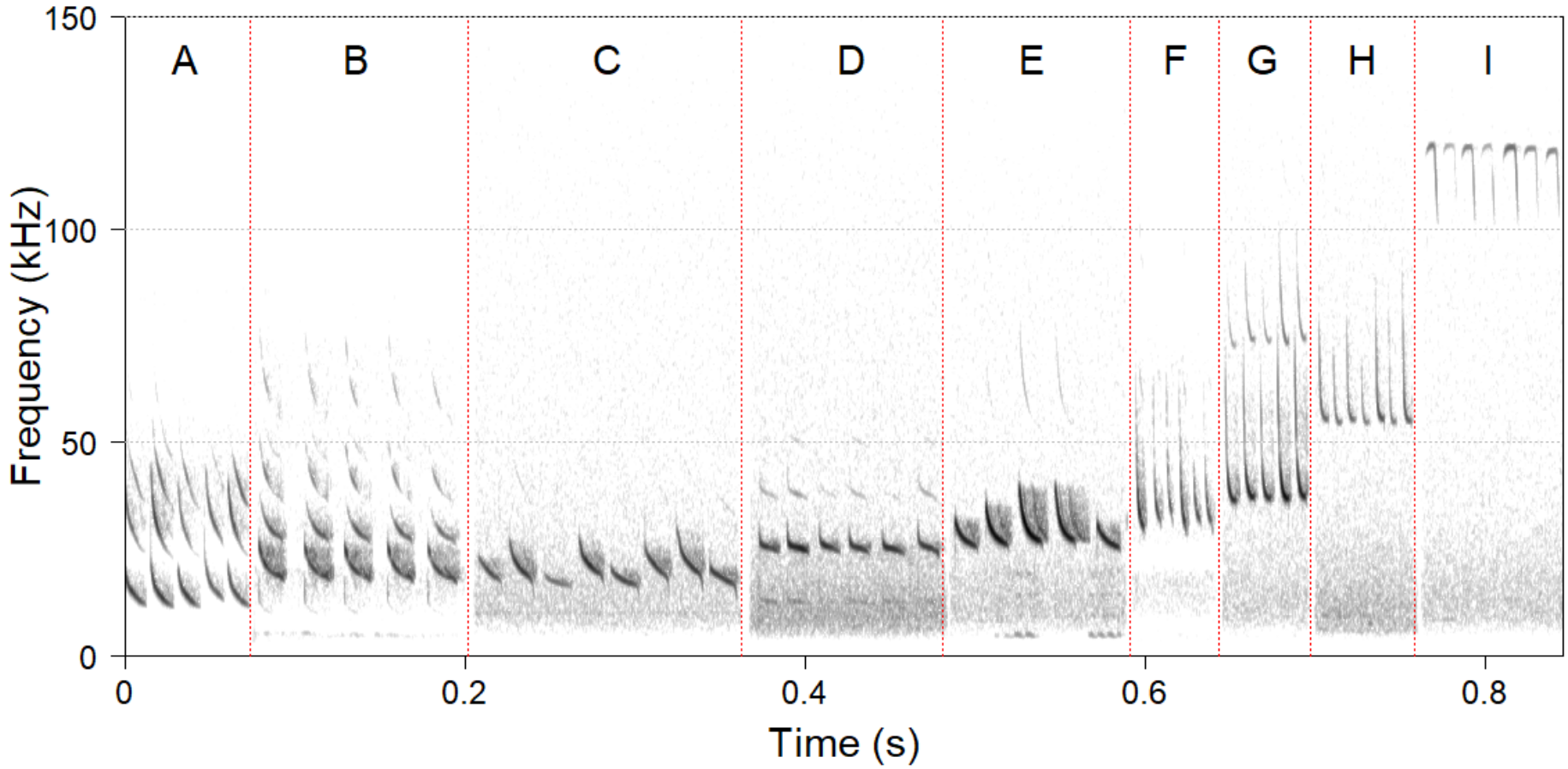

Figure 2. Representative echolocation call sequence portions of the species identified (**A**: *Austronomus australis;* **B**: *Saccolaimus flaviventris*; **C**: *Chaerephon jobensis*; **D**: *Taphozous georgianus*; **E**: *Ozimops lumsdenae*; **F**: *Chalinolobus gouldii*; **G**: *Scotorepens greyii*; **H**: *Vespadelus finlaysoni*; **I**: *Rhinonicteris aurantia*; time between pulses has been compressed).

Figure 3. Composite image of a 'fly-by' by one Ghost Bat at site BDGB03. No bat detector recordings were available from this site to confirm the observation, but the likelihood that this was a Ghost Bat is high (based on recognition of: anterior parts resembling long ears; the broadness of the wings, and lack of a distinct tail).

Figure 4. Examples of organisms that had features inconsistent with those of the Ghost Bat (**Top and middle**: Spotted Nightjar; **Bottom**: moth).

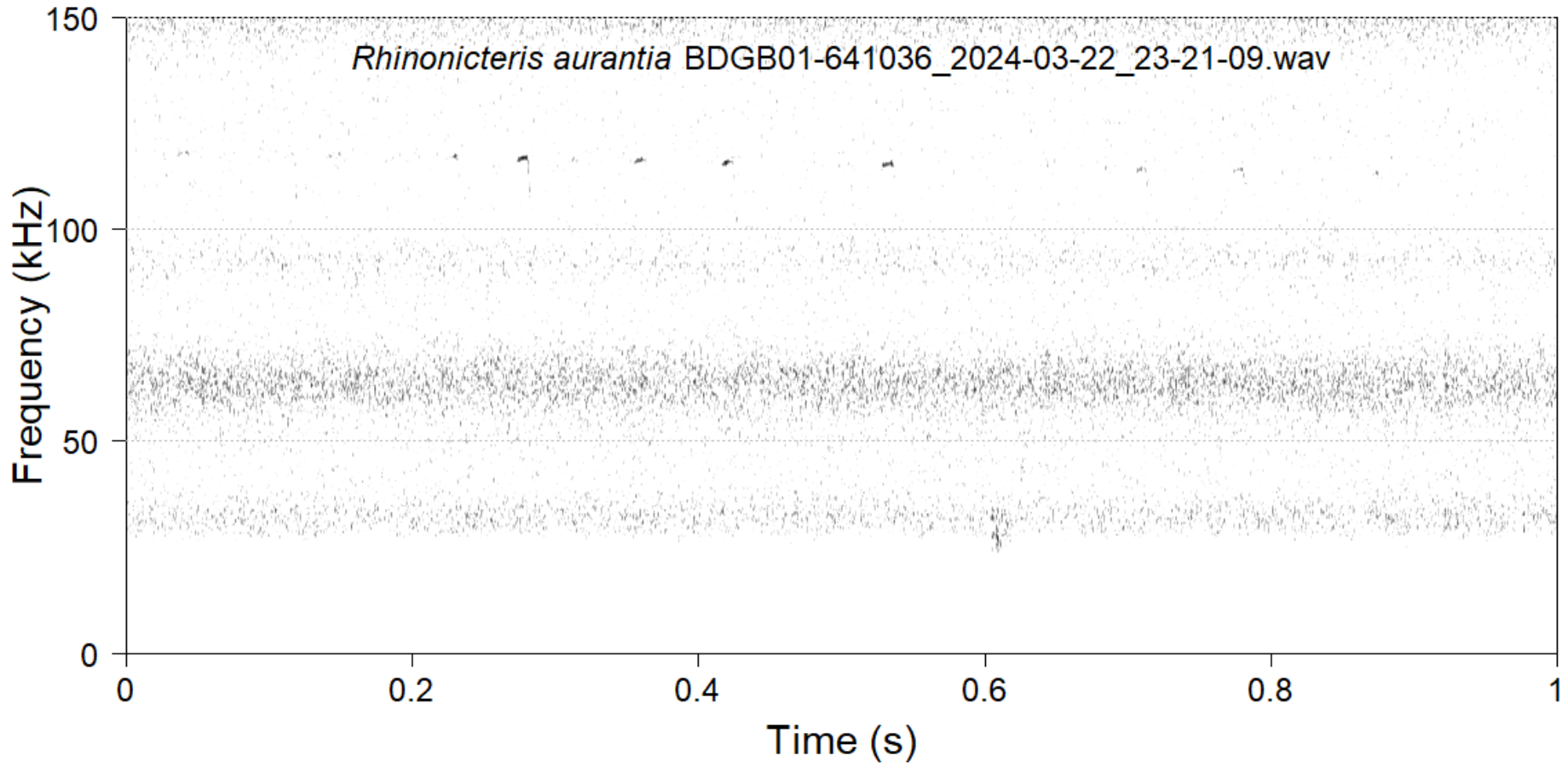

Figure 5. Representative echolocation call sequence portion of the Pilbara Diamond-faced Bat from acoustic lure site BDGB01.

Appendix 1. Summarising collision risk—a possible starting point

To understand the 'collision risk' of different bat Pilbara bat species, it might be useful to apply a modified generic risk matrix. I have provided a possible starting point for the development of a scheme in this appendix. In place of 'Probability' (rows), I have used the frequency of detection values calculated across all sites surveyed in 2023 – 2024, as sorted into four frequency ranges between 0 and 1; and in place of 'Consequence' (columns), I have used three likelihood categories of the species being present above 50 metres in altitude (turbine absent). The latter is an authoritative estimate based on my own accumulated casual field observations. The final score in the matrix is then divided into three risk categories. The final Risk Score and Collision Risk for each species is given in **Table A1**; and predictions for species not detected on the survey are given in **Table A2**. The Risk Scores and their Collision Risk categorisation seem to be sensible outcomes, though greater sampling effort for the Ghost Bat will give a more robust understanding of Collision Risk for this species.

	Likelihood of presence above 50 metres altitude	**Low**	**Medium**	**High**
Frequency of detection		1	2	3
0 – 0.25	1	1	2	3
0.25 – 0.50	2	2	4	6
0.50 – 0.75	3	3	6	9
0.75 – 1.0	4	4	8	12

Risk Score	**Collision Risk**
0 – 2	Low risk
3 – 6	Medium risk
7 – 12	High risk

Table A1. Calculated Risk Scores for each species based on the surveys in 2023 – 2024.

		High altitude likelihood	Altitude category	Frequency across all surveys	Frequency category	Risk Score	Collision Risk
MEGADERMATIDAE							
Ghost Bat	*Macroderma gigas*	Medium	2	0.14	1	2	Low
RHINONYCTERIDAE							
Pilbara Diamond-faced Bat	*Rhinonicteris aurantia*	Low	1	0.10	1	1	Low
EMBALLONURIDAE							
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	Medium	2	0.71	3	6	Medium
Common Sheath-tailed Bat	*Taphozous georgianus*	High	3	0.70	3	9	High
VESPERTILIONIDAE							
Gould's Wattled Bat	*Chalinolobus gouldii*	Low	1	0.85	4	4	Medium
Little Broad-nosed Bat	*Scotorepens greyii*	Low	1	0.85	4	4	Medium
Finlayson's Cave Bat	*Vespadelus finlaysoni*	Low	1	0.53	3	3	Medium
MOLOSSIDAE							
White-striped Free-tailed Bat	*Austronomus australis*	High	3	0.07	1	3	Medium
Greater Northern Free-tailed Bat	*Chaerephon jobensis*	Medium	2	0.55	3	6	Medium
Northern Free-tailed Bat	*Ozimops lumsdenae*	Medium	2	0.18	1	2	Low

Table A2. Predicted Risk Score and Collision Risk categories for Pilbara species of bat not observed on the survey (based on distributions given by Milne et al. 2023; 'estimated frequency' was 'imagined' based on records of occurrence in the Atlas of Living Australia).

		High altitude likelihood	'Estimated frequency'	Risk Score	Collision Risk
Black Flying-fox	*Pteropus alecto*	High	0.30	6	Medium
Little Red Flying-fox	*Pteropus scapulatus*	High	0.10	3	Medium
Hill's Sheath-tailed Bat	*Taphozous hilli*	High	0.20	3	Medium
Pallid Long-eared Bat	*Nyctophilus daedalus*	Low	0.10	1	Low
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	Low	0.90	4	Medium
Northern Coastal Free-tailed Bat	*Ozimops cobourgianus*	Medium	0.00	0	Low

Appendix 2. Use of acoustic lures

Specialised Zoological provided the equipment for the acoustic lure surveys, and provided advice on how set and use it. The equipment and procedure are broadly consistent with recently released guidelines in the Northern Territory for the use of acoustic lures for Ghost Bat detection (Ruykys et al. 2024). In the Introduction to these guidelines, the authors state that "…*it is expected that further application across the species' distribution will improve its generality and functionality.*"; (see also section 2.8). Given my own experience with the use of this method on several projects, and some practical considerations, I have provided advice in the present survey that I consider to be important improvements. These include:

1. The use of a bat detector directly under the portable speaker to detect the echolocation calls of a Ghost Bat that approaches and might briefly circle the post with this equipment. I address the five cautions articulated in the third 'author's tip' in section 2.6 of the guidelines:

   i. **"ghost bats do not consistently use echolocation when in flight"** Indeed Ghost Bats are thought not to echolocate continuously while in flight, but they are more likely to echolocate when approaching an object of their attention. In my own experience (not yet in the public domain; n = >20; exact number not given to preserve project anonymity), 74% of approaches could be validated unambiguously by the concurrent detection of an echolocation sequence on a bat detector placed under the speaker. For the remaining 26% of sites, it is possible that echolocation calls were not detected because of a combination of the low amplitude of the calls and the direction of flight relative to the zone of sound reception of the microphone.

   ii. **"the acoustic lure may mask any echolocation pulses from ghost bats"** This is not the case. No echolocation calls are part of the broadcast sequence used. Further, echolocation pulses are of a different frequency range than the various social calls, and overlapping of broadcast social calls and the echolocation calls of an approaching bat does not prevent them from being distinguished, either buy casual observation in a spectrogram, or the semi-automated analysis method used by Specialised Zoological.

   iii. **"no ghost bats were detected acoustically during the study by Ruykys et al. (2023), despite ghost bats routinely flying with 1 m of bat detectors"** In that study, bat detectors were not placed in an ideal position (see underlined segments) for recording echolocation calls, and consequently the usefulness of bat detectors is under-emphasised in the guidelines:

   "*To determine whether the echolocation calls of lured ghost bats could be passively detected, a bat detector (Anabat Swift, Titley Scientific, Queensland, Australia) was deployed on the reference tree at each survey site for both the control and active treatment. Detectors were deployed at chest height, with the ultrasonic omnidirectional microphone placed on the far side of the tree, away from the speaker. The microphone was angled at 45° down from vertical.*" (Ruykys et al. 2023; my underline)

iv. **"expertise is required to identify bats – particularly ghost bats – via their echolocation call"** Specialised Zoological has a long track record of being able to identify these calls reliably, using an efficient semi-automated method, and being able to distinguish them from signals of similar shape produced by other cave-roosting bat species.

v. **"the analysis of acoustic recordings will add significant analysis time to a project"** The analysis of bat detector recordings from acoustic lure sites using Specialised Zoological's semi-automated method is efficient, requiring relatively little time for analysis, and certainly far less than a full manual inspection of the dataset. Most importantly, a validation of observations from videos from an independent, unambiguous identification based on diagnostic echolocation calls is extremely valuable. While some visitations of Ghost Bats might be very clearly of this species in the videos, there can be uncertainty with others. Echolocation call detection provides adequate validation.

In addition, there is comment in the guidelines about the difficulty of recognising juvenile Ghost Bats in videos, and consequently a recommendation to avoid using the technique when juveniles are likely to be present (section 2.3.1; p. 15). This is unnecessary because juveniles can also be recognised by echolocation calls in the same way as adults.

2. Much detail is given in the guidelines about the density of sampling and the probability of detection—especially for a 'first stage' survey (see section 2). But it should be noted that probability of detection is likely to be different in other landscapes, given the number of nearby roosts, and the colony size in those roosts. In addition, the effective broadcast range of the acoustic lure is relatively limited, and has not yet been properly estimated (or standardised), though a diameter of 200 metres seems reasonable. The size of this stimulus zone might be too small for some situations, especially where different habitats and landscape features might need to be investigated to address specific requirements. Thus, increased sampling density consistent with the notion of the 'second stage' survey might be required for questions such as '*Which habitats do Ghost Bats use in this study area?*' or '*Do Ghost Bats visit this feature?*' The notion of the appropriate sampling density for different regions and study objectives is deserving of more discussion. This is acknowledged in section 2.8 of the guidelines.

3. Further empirical observations will provide a better understanding of the potential impact of the technique on the Ghost Bat, which will either support or diminish concern for the various ethical considerations mentioned throughout the guidelines. In my own experience in one comprehensive study, visitations typically involved either a single pass of the speaker, or else presence of a few seconds only, and typically less than one minute. Key to understanding impacts is knowing how many individuals might be detected (this information cannot be determined), the total visitation time, number of visitations per night, associated behaviours, and whether a roost site is likely to be nearby (relevant for the time when broadcasts are started). At present, I have recommended that broadcasts continue for longer than is recommended in the guidelines because the aim is to maximise the chance of detection in relatively large,

complex geological terrains. In my experience, the time of first detection of a Ghost Bat can be anytime throughout the night, though certainly most detections are within the first 2 – 3 hours after sunset.

4. The equipment described and illustrated in the guidelines comprises a single video camera. I recommend two 4K video cameras placed at right angles so that a second view of any approaching bat is available for situations where an identification is ambiguous. It also provides redundancy in case of equipment set-up issues, given the high cost of remote field surveys. I also recommend speakers that play from a micro-SD card rather than Bluetooth. The equipment set-up used on the present survey has been used successfully elsewhere, though it has several constraints, and the system will likely keep evolving with experience, feedback and the availability of newer technology.

5. In the guidelines there is an emphasis on the manual review of video streams and how this should be undertaken. The semi-automated analysis conducted by Specialised Zoological represents a significant improvement over manual reviews, and is undertaken with a different set of considerations designed to maximise robustness. Most of the information in section 2.6 on page 20 is not relevant to the present study.

6. I consider that effort for the discovery of diurnal roost sites is still the primary consideration for environmental impact assessments, but that the acoustic lure method is useful for confirming presence both near roosts and away from them, and for characterising the use of a study area for foraging.

7. Specialised Zoological has had minimal input into the sampling design and level of sampling intensity in this study.

This study used squabble calls provided by Dr Nicola Hanrahan with permission. I have confirmed with her that no registration number is required for this project because it began before the guidelines were released.

Specialised Zoological

Identification of bat species from Bonney Downs South, Western Australia

Prepared for **Spectrum Ecology Pty Ltd**

Version **3 September 2024 (2024-09-03rev2)**

SZ project reference **SZ716**

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

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Version history

Date	Version	Note
2024-09-02	2024-09-02	Final version
2024-09-03	2024-09-03	Updated version
2024-09-03	2024-09-03rev2	Updated version

Summary

Bat identifications from acoustic recordings are provided from the Bonney Downs South project area, in the Pilbara region of Western Australia. The datasets reported on here are from two surveys:

- **October 2023**—a total of 17 survey sites, 40 recording nights and 118,500 WAV files
- **April 2024**—a total of 12 survey sites, 35 recording nights and 54,483 WAV files

Particular attention was given to the detection of two bat species of conservation significance: Ghost Bat *Macroderma gigas* (Megadermatidae) and Pilbara Leaf-nosed Bat *Rhinonicteris aurantia* (Rhinonycteridae).

Eight species of bat were detected (**Tables 1** – **3**; **Figure 1**), which includes the Pilbara Leaf-nosed Bat. The Ghost Bat was not detected.

The Pilbara Leaf-nosed Bat was detected well after sunset and well before sunrise at three sites in October 2023 (**Table 4**) and two sites in April 2024 (**Table 5**).

Methods

The data provided were recorded in full spectrum WAV format from Wildlife Acoustics Song Meter SM4BAT bat detectors (sampling rate 384 kHz, set to turn on automatically at sunset and off at sunrise).

The echolocation calls of the Pilbara Leaf-nosed Bat were detected by scanning all WAV files with the software SCAN'R version 1.8.3 (Binary Acoustic Technology) using search parameters optimised to find calls of this species. All WAV files containing putative calls of the Pilbara Leaf-nosed Bat were inspected in Adobe Audition 23.1 software, and listings of files containing false positive identifications were discarded. Custom [R] language scripts assisted with summarisation of the remaining data, and the calculation of times of first detection after sunset and last detection before sunrise.

Searches for the echolocation calls of the Ghost Bat were also made by scanning all WAV files with the software SCAN'R version 1.8.3 (Binary Acoustic Technology) using search parameters optimised to find calls of this species. The outputs were then used to determine if putative bat pulses measured in SCAN'R could be attributed to the Ghost Bat. This was done using a custom [R] language application (Armstrong et al. 2021a,b) that performed three tasks:

1. undertook a Discriminant Function Analysis on training data from representative calls of Pilbara cave-roosting bat species (K.N. Armstrong unpublished dataset);

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

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

The remaining bat species were identified in Titley Scientific Anabat Insight software version 2.1.2 using a semi-automated Decision Tree process optimised for Pilbara echolocating bat species. Identifications were verified by examination of examples in spectrograms.

Species were identified based on information in the author's own unpublished material. Nomenclature follows Jackson and Groves (2015). Identifications were supported by distribution information in a curated source of distribution records maintained by the Australasian Bat Society, Inc. (https://www.ausbats.org.au/batmap.html) (Milne et al. 2023).

Limitations

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

1. The identifications made herein were based on the ultrasonic acoustic data recorded and provided by a 'third party' (the client named on the front of this report).
2. The scope of this report extended to providing information on the identification of bat species in bulk ultrasonic recordings. Further extended comment on these species and the possible impacts of a planned project on bat species were not part of the scope.
3. In the case of the present report, the recording equipment was not set up and supplied by Specialised Zoological. The equipment was operated by the third party during the survey.
4. Other than the general location of the study area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.
5. Specialised Zoological has had no input into the overall design and timing of this bat survey, recording site placement, nor the degree of recording site replication.
6. While Specialised Zoological has made identifications to the best of our ability given the available materials, and reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort or non-invasive methods such as video recordings. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.
7. There are a variety of factors that affect the 'detectability' of each bat species, given the frequency, power and shape characteristics of their calls. Further information on the analysis and the various factors that can impinge on the reliability of identifications can be provided upon request.
8. The analysis of ultrasonic recordings is one of several methods that can be used to survey for bats, and comprehensive surveys typically employ more than one method. If an identification in the present report is ambiguous or in question, a trapping programme would help to resolve the presence of the possibilities in the project area.
9. The most reliable way of detecting the Ghost Bat with bat detectors is to place the equipment with the microphone facing into a potential cave roosting site. The echolocation calls of this species are of low amplitude, and therefore most detectable when a Ghost Bat flies close to the bat detector as it exits the underground structure. If there is uncertainty about whether Ghost Bats are present in a cave, then video recordings can be a useful addition to the survey. The detection of Ghost Bats with bat detectors away from cave entrances is less reliable, unless an approach based on an acoustic lure is used (Ruykys et al. 2023; Hanrahan et al. 2023).
10. Predictions about whether the Pilbara Leaf-nosed Bat roosts within a particular surveyed cave (where a bat detector was placed at the entrance), or somewhere nearby, based on the time of first detection should be considered indicative only. If unambiguous confirmation of diurnal roosting of this species is required, this should be undertaken using the entrance sheeting method that is described in DEWHA (2010).
11. This version of the document supersedes any previous version. Previous drafts are not authorised by us for submission to the regulator or the public domain.

References

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Table 1. Species identified in the present survey from all sites combined.

RHINONYCTERIDAE	
Pilbara Leaf-nosed Bat (Pilbara Diamond-faced Bat)	*Rhinonicteris aurantia*
EMBALLONURIDAE	
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*
Common Sheath-tailed Bat	*Taphozous georgianus*
VESPERTILIONIDAE	
Gould's Wattled Bat	*Chalinolobus gouldii*
Little Broad-nosed Bat	*Scotorepens greyii*
Finlayson's Cave Bat	*Vespadelus finlaysoni*
MOLOSSIDAE	
Greater Northern Free-tailed Bat	*Chaerephon jobensis*
Northern Free-tailed Bat	*Ozimops lumsdenae*

Table 2. Species identifications for all nights at each recording site in October 2023 (see *Table 1* for full species names).

						C. gouldii	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**								
BDS02	SM4-6081	50K 804618 7545083	18/10/2023	19/10/2023	2	X	X	.	.	X	X	X	X
BDS04	SM4-6081	50K 787844 7536107	20/10/2023	21/10/2023	2	.	.	.	.	X	X	.	X
BDSOPP16EM	SM4-6081	50K 802603 7546267	22/10/2023	23/10/2023	2	X	X	.	.	X	X	X	.
BDS12	SM4-6174	50K 787900 7540955	20/10/2023	21/10/2023	2	X	X	X	.	X	X	X	.
BDS03	SM4-6186	50K 794222 7539582	18/10/2023	19/10/2023	2	X	X	X	.	.	X	X	.
BDS CAMP	SM4-6186	50K 802622 7543944	21/10/2023	23/10/2023	3	X	X	.	.	.	X	.	X
BDS11	SM4-6253	50K 798305 7540215	18/10/2023	19/10/2023	2	X	X	.	.	.	.	X	X
BDS06	SM4-6253	50K 797776 7542441	20/10/2023	21/10/2023	2	X	X	X	X	.	X	X	X
Windmill2	SM4-6253	50K 790459 7543663	22/10/2023	23/10/2023	2	X	X	.	X	X	X	X	X
BDS08	SM4-6257	50K 816139 7536999	18/10/2023	19/10/2023	2	X	.	.	.	X	X	.	X
Windmill1	SM4-6257	50K 816639 7537199	20/10/2023	23/10/2023	4	X	.	.	.	X	X	.	X
BDS10	SM4-6266	50K 801551 7535295	18/10/2023	19/10/2023	2	X	.	.	.	X	X	X	X
BDSOPP13EM	SM4-6266	50K 789249 7544301	22/10/2023	23/10/2023	2	X	X	.	X	X	X	.	X
BDS07	SM4-6270	50K 814167 7535310	18/10/2023	19/10/2023	2	X	.	.	.	X	X	X	.
BDS09	SM4-6270	50K 799693 7545402	20/10/2023	22/10/2023	3	X	X	.	.	X	X	.	X
BDS05	SM4-6285	50K 800735 7542320	18/10/2023	19/10/2023	2	X	X	X	X	X	X	X	X
BDSOPP06	SM4-6285	50K 800986 7542234	20/10/2023	23/10/2023	4	X	X	X	X	X	X	X	X

Table 3. Species identifications summarised across all nights for each recording site in April 2024 (see *Table 1* for full species names).

						C. gouldii	*C. jobensis*	*O. lumsdenae*	*R. aurantia*	*S. flaviventris*	*S. greyii*	*T. georgianus*	*V. finlaysoni*
Site	**Detector serial**	**Coordinates**	**First night**	**Last night**	**Nights**								
BDS 08-Bat2	SM4 6081	50K 799667 7545407	2024-04-07	2024-04-09	3	X	X	X	.	X	X	.	X
BDS OPP2-Bat2	SM4 6081	50K 782735 7529320	2024-04-10	2024-04-12	3	X	X	.	.	X	X	X	X
BDS S2-Bat2	SM4 6259	50K 806364 7550244	2024-04-10	2024-04-12	3	X	.	.	X	.	X	.	X
BDS 09-Bat2	SM4 6259	50K 801745 7535217	2024-04-07	2024-04-09	3	X	X	X	.	X	X	X	X
BDS 03-Bat2	SM4 6262	50K 794172 7539619	2024-04-07	2024-04-09	3	X	X	.	.	X	X	X	X
BDS 05-Bat2	SM4 6262	50K 797781 7542444	2024-04-11	2024-04-13	3	X	X	.	.	X	X	X	X
BDS 11-Bat2	SM4 6266	50K 787814 7540945	2024-04-07	2024-04-09	3	X	.	.	.	.	X	.	X
BDS OPP1-Bat2	SM4 6266	50K 790401 7543707	2024-04-12	2024-04-12	1	X	X	X	.	X	X	X	X
BDS 10-Bat2	SM4 6269	50K 798358 7540023	2024-04-07	2024-04-09	3	X	X	.	.	X	X	.	X
BDS OPP3-Bat2	SM4 6269	50K 791266 7538715	2024-04-10	2024-04-12	3	X	.	.	.	.	X	X	X
BDS 03-Bat1	SM4 6282	50K 787861 7536092	2024-04-07	2024-04-10	4	X	.	.	.	.	X	.	.
BDS Dam-Bat2	SM4 6282	50K 800885 7542269	2024-04-11	2024-04-13	3	X	X	.	X	X	X	X	X

Table 4. Summary of detections of the Pilbara Leaf-nosed Bat from all sites in October 2023.

Bat detector serial	Night of	Passes	Sunset	Dusk	Dawn	Sunrise	Time of first detection	Time of last detection	Time since sunset	Time until sunrise
SM4-6253	21/10/2023	1	21/10/2023 18:07	21/10/2023 18:30	22/10/2023 5:01	22/10/2023 5:24	23:07:16	23:07:16	5H 0M 7S	6H 17M 33S
SM4-6253	22/10/2023	14	22/10/2023 18:07	22/10/2023 18:30	23/10/2023 5:01	23/10/2023 5:24	21:42:48	2:18:22	3H 35M 13S	3H 5M 42S
SM4-6253	23/10/2023	2	23/10/2023 18:08	23/10/2023 18:30	24/10/2023 5:00	24/10/2023 5:23	23:52:07	2:26:46	5H 44M 4S	2H 56M 34S
S4U06285	19/10/2023	2	19/10/2023 18:06	19/10/2023 18:29	20/10/2023 5:03	20/10/2023 5:26	23:09:44	23:10:59	5H 3M 27S	6H 15M 22S
S4U06285	20/10/2023	8	20/10/2023 18:06	20/10/2023 18:29	21/10/2023 5:02	21/10/2023 5:25	22:10:22	0:05:02	4H 3M 40S	5H 20M 33S
S4U06285	21/10/2023	10	21/10/2023 18:07	21/10/2023 18:30	22/10/2023 5:01	22/10/2023 5:24	21:49:59	1:07:33	3H 42M 50S	4H 17M 16S
S4U06285	22/10/2023	11	22/10/2023 18:07	22/10/2023 18:30	23/10/2023 5:01	23/10/2023 5:24	22:47:15	2:15:52	4H 39M 40S	3H 8M 12S
S4U06285	23/10/2023	20	23/10/2023 18:08	23/10/2023 18:30	24/10/2023 5:00	24/10/2023 5:23	21:38:00	0:59:04	3H 29M 57S	4H 24M 16S
SM46266	23/10/2023	2	23/10/2023 18:08	23/10/2023 18:30	24/10/2023 5:00	24/10/2023 5:23	0:31:19	1:39:24	6H 23M 16S	3H 43M 56S

Table 5. Summary of detections of the Pilbara Leaf-nosed Bat from all sites in April 2024.

Site Detector unit	Night of	Passes	Sunset	Dusk	Dawn	Sunrise	Time of first detection	Time of last detection	Time since sunset	Time until sunrise
BDS S2-Bat2 S4U06259	11/04/2024	1	11/04/2024 17:52	11/04/2024 18:15	12/04/2024 5:50	12/04/2024 6:12	23:28:40	23:28:40	5H 36M 1S	6H 44M 14S
BDS Dam-Bat2 S4U06282	13/04/2024	4	13/04/2024 17:50	13/04/2024 18:13	14/04/2024 5:51	14/04/2024 6:13	0:52:22	1:29:04	7H 1M 27S	4H 44M 31S

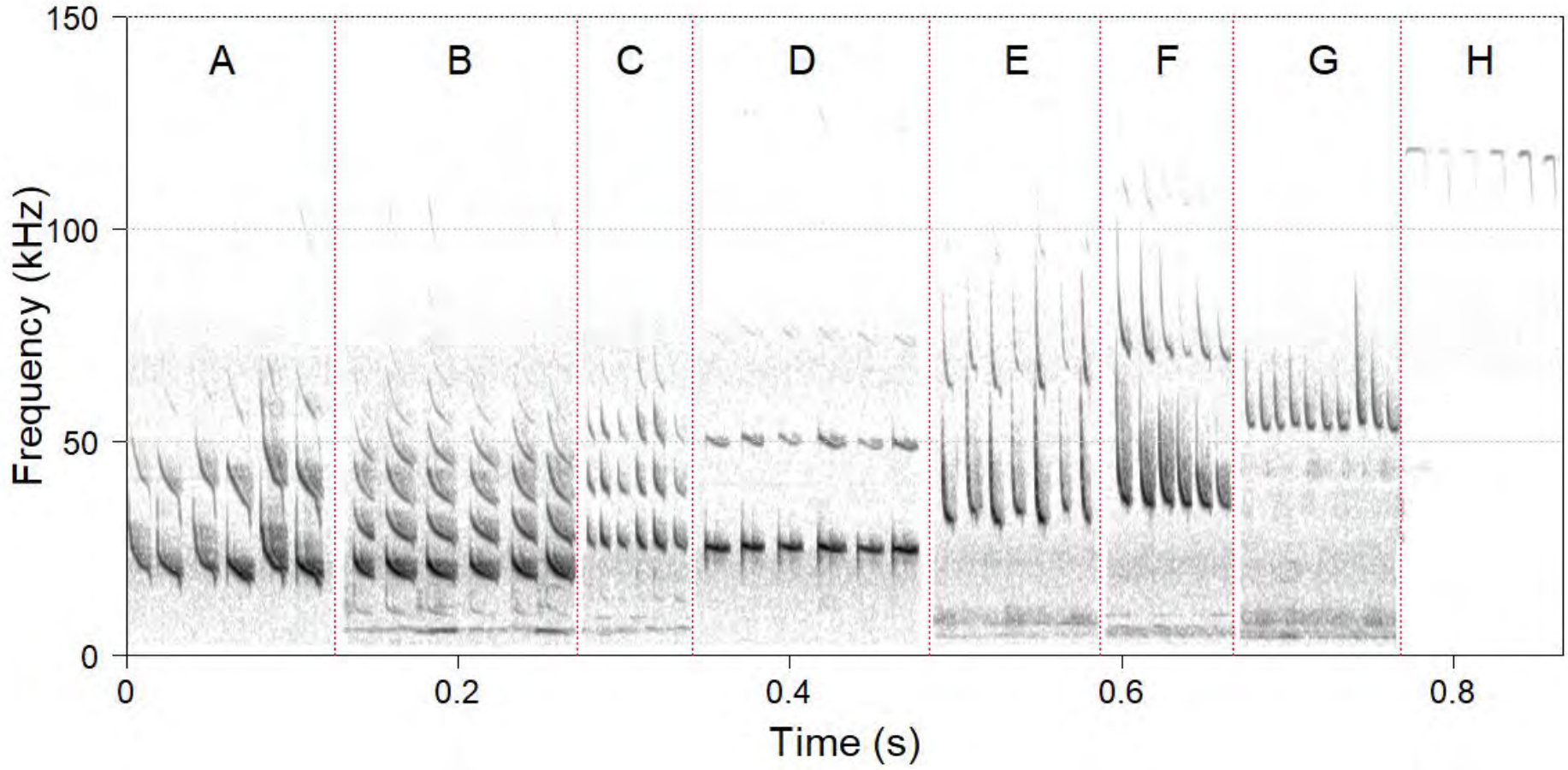

Figure 1. Representative echolocation call sequence portions of the species identified (**A**: *Chaerephon jobensis;* **B**: *Saccolaimus flaviventris*; **C**: *Taphozous georgianus*; **D**: *Ozimops lumsdenae*; **E**: *Chalinolobus gouldii*; **F**: *Scotorepens greyii*; **G**: *Vespadelus finlaysoni*; **H**: *Rhinonicteris aurantia*; time between pulses has been compressed).

Appendix E Fauna habitat assessments

BDBAT01

Date	28/05/2023		
Site type	Habitat assessment		
Coordinate	-22.02800799, 119.834838		
Habitat type	Drainage Line/River/Creek (major)		
Habitat type (other)			
Habitat description	Major creekline, with standing water over sandy clay soils. Banks highly disturbed by cattle and invested with low grazed buffel grass. Tall Eucalypts and medium Melaleuca line banks over low scattered shrubs over tussocks grasses and buffel grass.		
Habitat condition	Good		
Suitability for significant species	Grey falcon, Pilbara olive python, Northern Quoll dispersal, Bat forforaging		
Evidence of significant species	No		
Disturbance	Major cattle trampling and buffel grass investation along banks.		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	Yes		
Tree hollows	Yes		
Landform	Creek	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Brown	**Soil texture**	Sandy clay
Bare soil	< 10	**Drainage**	Major creek (5-30 m)
Rock type	Basalt	**Rock size**	Mixed
Rock abundance	10 – 30		
Upper stratum	Scattered tall trees		
Middle stratum	Scattered low shrubs		
Lower stratum	Tussock grass land / sedgeland / herbland		

BBD02

Date	28/05/2023
Site type	Habitat assessment
Coordinate	-21.97385503, 119.925104
Habitat type	Drainage Line/River/Creek (major)
Habitat type (other)	
Habitat description	Creekline with semi-permanent water, lined with basalt bedrock and large eucalypts.
Habitat condition	Good
Suitability for significant species	POP
Evidence of significant species	No
Disturbance	Cattle, weeds
Time since fire	No evidence
Leaf litter cover	< 10
Woody debris	< 10
Rocky crevices/caves	< 10
Large trees	Yes
Tree hollows	Yes
Landform	Creek
Slope	Negligible
Soil colour	Brown
Bare soil	< 10
Rock type	Basalt
Rock abundance	30 – 70
Upper stratum	Tall open woodland
Middle stratum	Open shrubland
Lower stratum	Tussock grass land / sedgeland / herbland

Landform (other)	
Aspect	NA
Soil texture	Sand
Drainage	Major creek (5-30 m)
Rock size	Boulders (> 265 mm)

BBD03

Date	30/05/2023
Site type	Habitat assessment
Coordinate	-21.96400696, 119.867175
Habitat type	Plain (stony/gibber)
Habitat type (other)	
Habitat description	Undulating stony plain supporting open shrubland over hummock grassland
Habitat condition	Good
Suitability for significant species	
Evidence of significant species	No
Disturbance	Cattle grazing
Time since fire	> 5 yrs
Leaf litter cover	< 10
Woody debris	< 10
Rocky crevices/caves	NA
Large trees	No
Tree hollows	No
Landform	Undulating plain
Landform (other)	
Slope	Gentle
Aspect	North
Soil colour	Red
Soil texture	Clay loam
Bare soil	10 – 30
Drainage	NA
Rock type	Mixed
Rock size	Cobbles (64-256 mm)
Rock abundance	30 – 70
Upper stratum	
Middle stratum	Open shrubland
Lower stratum	Open hummock grassland

BBD04

Date	30/05/2023		
Site type	Habitat assessment		
Coordinate	-21.95355196, 119.936995		
Habitat type	Plain (stony/gibber)		
Habitat type (other)			
Habitat description	Undulating stony plain supporting open shrubland over hummock grassland		
Habitat condition	Very Good		
Suitability for significant species			
Evidence of significant species	No		
Disturbance	Cattle		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Undulating plain	**Landform (other)**	
Slope	Gentle	**Aspect**	Northwest
Soil colour	Red	**Soil texture**	Clay loam
Bare soil	10 – 30	**Drainage**	NA
Rock type	Mixed	**Rock size**	Cobbles (64-256 mm)
Rock abundance	> 70		
Upper stratum			
Middle stratum	Open shrubland		
Lower stratum	Open hummock grassland		

BBD05

Date	30/05/2023
Site type	Habitat assessment
Coordinate	-22.05059504, 119.848587
Habitat type	Plain (stony/gibber)
Habitat type (other)	
Habitat description	Undulating stony plain supporting open shrubland over hummock grassland
Habitat condition	Very Good
Suitability for significant species	
Evidence of significant species	No
Disturbance	Cattle
Time since fire	> 5 yrs
Leaf litter cover	< 10
Woody debris	< 10
Rocky crevices/caves	NA
Large trees	No
Tree hollows	No
Landform	Undulating plain
Slope	Gentle
Soil colour	Red
Bare soil	10 – 30
Rock type	Mixed
Rock abundance	30 – 70
Upper stratum	Scattered trees
Middle stratum	Open shrubland
Lower stratum	Open hummock grassland

Landform (other)	
Aspect	Northwest
Soil texture	Clay loam
Drainage	NA
Rock size	Cobbles (64-256 mm)

BBD06

Date	30/05/2023		
Site type	Habitat assessment		
Coordinate	-22.07395499, 119.853415		
Habitat type	Drainage Line/River/Creek (major)		
Habitat type (other)			
Habitat description	Minor creekline with open shrubland of tall eucalypts over medium myrtacae shrubs over spinifex hummocks. Infestation of buffel grass along banks and around bore in vicinity.		
Habitat condition	Good		
Suitability for significant species			
Evidence of significant species	No		
Disturbance	Cattle, weeds		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	Yes		
Tree hollows	Yes		
Landform	Creek	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Brown	**Soil texture**	Sandy clay loam
Bare soil	10 – 30	**Drainage**	Major creek (5-30 m)
Rock type	Mixed	**Rock size**	Cobbles (64-256 mm)
Rock abundance	< 10		
Upper stratum	Tall open woodland		
Middle stratum	Tall open shrubland		
Lower stratum	Scattered hummock grassland		

BBD07

Date	30/05/2023
Site type	Habitat assessment
Coordinate	-22.10184904, 119.845078
Habitat type	Drainage Line/River/Creek (major)
Habitat type (other)	
Habitat description	Creekline with Eucalypts over open shrubland ovwr tussock and hummock grasses.
Habitat condition	Good
Suitability for significant species	
Evidence of significant species	No
Disturbance	Cattle, weeds
Time since fire	> 5 yrs
Leaf litter cover	< 10
Woody debris	< 10
Rocky crevices/caves	NA
Large trees	Yes
Tree hollows	Yes
Landform	Creek
Landform (other)	
Slope	Negligible
Aspect	NA
Soil colour	Reddish brown
Soil texture	Sandy clay loam
Bare soil	10 – 30
Drainage	Major creek (5-30 m)
Rock type	Mixed
Rock size	Cobbles (64-256 mm)
Rock abundance	10 – 30
Upper stratum	Tall open woodland
Middle stratum	Tall open shrubland
Lower stratum	Scattered hummock grassland

BDHA1

Date	28/05/2023		
Site type	habitat assessment		
Coordinate	50K 793048.19 mE 7561364.05 mN		
Habitat type	Hummock Grassland		
Habitat type (other)			
Habitat description	Undulating plain with spinifex grassland.		
Habitat condition	Good		
Suitability for significant species			
Evidence of significant species	No		
Disturbance	cattle		
Time since fire	No evidence		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Undulating plain	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Light brown	**Soil texture**	Sandy clay
Bare soil	10 – 30	**Drainage**	NA
Rock type	Basalt	**Rock size**	Cobbles (64-256 mm)
Rock abundance	< 10		
Upper stratum			
Middle stratum	Tall open shrubland		
Lower stratum	Mid-dense hummock grassland		

BHA01

Date	28/05/2023		
Site type	Habitat assessment		
Coordinate	50K 804114.38 mE 7566381.58 mN		
Habitat type	Plain (stony/gibber)		
Habitat type (other)			
Habitat description	Undulating stony plain with scattered eucalypts and corymbias over acacias and hakeas over Triodia hummock grassland		
Habitat condition	Excellent		
Suitability for significant species	PMM		
Evidence of significant species	No		
Disturbance	NA		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Undulating plain	**Landform (other)**	
Slope	Gentle	**Aspect**	East
Soil colour	Dark red	**Soil texture**	Clay loam
Bare soil	< 10	**Drainage**	NA
Rock type	Mixed	**Rock size**	Cobbles (64-256 mm)
Rock abundance	> 70		
Upper stratum	Scattered trees		
Middle stratum	Tall open shrubland		
Lower stratum	Hummock grassland		

BHA02

Date	28/05/2023		
Site type	Habitat assessment		
Coordinate	50K 803454.51 mE 7573050.82 mN		
Habitat type	Plain (stony/gibber)		
Habitat type (other)			
Habitat description	Undulating stony plain supporting open shrubland over hummock grassland		
Habitat condition	Excellent		
Suitability for significant species	PMM		
Evidence of significant species	No		
Disturbance	NA		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Undulating plain	**Landform (other)**	
Slope	Gentle	**Aspect**	North
Soil colour	Dark red	**Soil texture**	Clay loam
Bare soil	< 10	**Drainage**	NA
Rock type	Mixed	**Rock size**	Cobbles (64-256 mm)
Rock abundance	> 70		
Upper stratum			
Middle stratum	Open shrubland		
Lower stratum	Open hummock grassland		

BHA03

Date	28/05/2023		
Site type	Habitat assessment		
Coordinate	50K 814471.55 mE 7572835.84 mN		
Habitat type	Plain (Cracking clays)		
Habitat type (other)			
Habitat description	Gilgai plains associated with the Wona Landsystem. Self mulching cracking clays supporting scsttered shrubs over herbs and tussock grasses.		
Habitat condition	Very Good		
Suitability for significant species	Leggadina lakedownensis		
Evidence of significant species	Yes		
Disturbance	Cattle grazing		
Time since fire	No evidence		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Gilgai	**Landform (other)**	
Slope	Gentle	**Aspect**	East
Soil colour	Reddish brown	**Soil texture**	Cracking clay
Bare soil	< 10	**Drainage**	NA
Rock type	Mixed	**Rock size**	Cobbles (64-256 mm)
Rock abundance	> 70		
Upper stratum			
Middle stratum	Scattered shrubs		
Lower stratum	Tussock grass land / sedgeland / herbland		

BPHA01

Date	31/05/2023
Site type	Habitat assessment
Coordinate	50K 807839.34 mE 7564376.98 mN
Habitat type	Drainage Line/River/Creek (major)
Habitat type (other)	
Habitat description	Permanent water in major creekline lined with rock face walls with crevices, banks lined with tall eucalypts, acacia shrubs and buffel grass/sedges.
Habitat condition	Good
Suitability for significant species	Northern quoll dispersal/habitat in rocky faces on banks. Olive python habitat. Bat foraging.
Evidence of significant species	No
Disturbance	Buffel grass infestation and cattle trampling.
Time since fire	No evidence
Leaf litter cover	10 – 40
Woody debris	10 – 40
Rocky crevices/caves	< 10
Large trees	Yes
Tree hollows	Yes
Landform	Creek
Landform (other)	
Slope	Negligible
Aspect	NA
Soil colour	Reddish brown
Soil texture	Sandy clay loam
Bare soil	< 10
Drainage	Major creek (5-30 m)
Rock type	Mixed
Rock size	Mixed
Rock abundance	< 10
Upper stratum	Open woodland
Middle stratum	Tall open shrubland
Lower stratum	Tussock grass land / sedgeland / herbland

BDDP01

Date	31/05/2023		
Site type	Fauna trapping site		
Coordinate	50K 797543.28 mE 7559313.23 mN		
Habitat type	Plain (Cracking clays)		
Habitat type (other)			
Habitat description	Gilgai soils with cracking clay. Acacia over spinifex grassland.		
Habitat condition	Good		
Suitability for significant species	northern short-tailed mouse		
Evidence of significant species	No		
Disturbance	cattle		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Plain	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Brown	**Soil texture**	Clay loam
Bare soil	30 – 70	**Drainage**	NA
Rock type	Basalt	**Rock size**	Mixed
Rock abundance	30 – 70		
Upper stratum			
Middle stratum	Scattered shrubs		
Lower stratum	Mid-dense hummock grassland		

BDDP02

Date	31/05/2023		
Site type	Fauna trapping site		
Coordinate	50K 798857.56 mE 7567673.56 mN		
Habitat type	Hummock Grassland		
Habitat type (other)			
Habitat description	Triodia apactia grassland with scattered acacia shrubs and isolated low eucalypts.		
Habitat condition	Very Good		
Suitability for significant species			
Evidence of significant species	No		
Disturbance	cattle		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Plain	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Brown	**Soil texture**	Clay loam
Bare soil	10 – 30	**Drainage**	NA
Rock type	NA	**Rock size**	NA
Rock abundance	NA		
Upper stratum	Scattered trees		
Middle stratum	Scattered shrubs		
Lower stratum	Mid-dense hummock grassland		

BDDP03

Date	31/05/2023		
Site type	Fauna trapping site		
Coordinate	50K 800682.48 mE 7569245.51 mN		
Habitat type	Plain (Cracking clays)		
Habitat type (other)			
Habitat description	Low open shrubland over open tussock grassland/herbland with minor depressions of cracking clay banked by herbs. Wona land system with self-mulching cracking clays.		
Habitat condition	Excellent		
Suitability for significant species	Northern short tailed mouse captures. Potential grey falcon and bat foraging.		
Evidence of significant species	Yes		
Disturbance	Cattle tracks and grazing.		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Undulating plain	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Reddish brown	**Soil texture**	Clay loam
Bare soil	< 10	**Drainage**	NA
Rock type	Mixed	**Rock size**	Mixed
Rock abundance	30 – 70		
Upper stratum	Low open woodland		
Middle stratum	Low open shrubland		
Lower stratum	Open tussock grassland / sedgeland / herbland		

BDDP04

Date	29/05/2023
Site type	Fauna trapping site
Coordinate	50K 799970.41 mE 7552678.01 mN
Habitat type	Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)
Habitat type (other)	
Habitat description	Low rocky outcrop with caves and crevices suitable for the northern quoll. Isolated eucalypts over scattered shrubs with spinifex understorey.
Habitat condition	Excellent
Suitability for significant species	northern quoll
Evidence of significant species	Yes
Disturbance	
Time since fire	No evidence
Leaf litter cover	< 10
Woody debris	< 10
Rocky crevices/caves	10 – 30
Large trees	No
Tree hollows	No
Landform	Low hill
Landform (other)	
Slope	Gentle
Aspect	North
Soil colour	Brown
Soil texture	Sandy loam
Bare soil	30 – 70
Drainage	NA
Rock type	Ironstone
Rock size	Mixed
Rock abundance	> 70
Upper stratum	Scattered low trees
Middle stratum	Scattered shrubs
Lower stratum	Mid-dense hummock grassland

BDDP05

Date	31/05/2023		
Site type	Fauna trapping site		
Coordinate	50K 795764.74 mE 7562262.13 mN		
Habitat type	Hummock Grassland		
Habitat type (other)			
Habitat description	Mid-dense large unburnt spinifex grassland with minor drainage, scattered low eucalypts over scattered acacia shrubs.		
Habitat condition	Excellent		
Suitability for significant species	Bat and grey falcon foraging.		
Evidence of significant species	No		
Disturbance	Cattle tracks and grazing, buffel grass pockets.		
Time since fire	No evidence		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Undulating plain	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Reddish brown	**Soil texture**	Loamy sand
Bare soil	< 10	**Drainage**	Drainage line
Rock type	Mixed	**Rock size**	Mixed
Rock abundance	10 – 30		
Upper stratum	Scattered trees		
Middle stratum	Scattered low shrubs		
Lower stratum	Mid-dense hummock grassland		

BDDP06

Date	29/05/2023		
Site type	Fauna trapping site		
Coordinate	50K 796913.16 mE 7562587.64 mN		
Habitat type	Drainage Line/River/Creek (major)		
Habitat type (other)			
Habitat description	Creekline supporting large eucalyps over open shrubland over triodia hummock grasses and tussock grasses. evidence of cattle use and buffel grass present. grey falcons recorded in the vicinity.		
Habitat condition	Good		
Suitability for significant species	grey falcon		
Evidence of significant species	Yes		
Disturbance	cattle, buffel grass		
Time since fire	No evidence		
Leaf litter cover	< 10		
Woody debris	10 – 40		
Rocky crevices/caves	NA		
Large trees	Yes		
Tree hollows	Yes		
Landform	Creek	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Brown	**Soil texture**	Sand
Bare soil	30 – 70	**Drainage**	Major creek (5-30 m)
Rock type	Basalt	**Rock size**	Pebbles (2-64 mm)
Rock abundance	30 – 70		
Upper stratum	Scattered trees		
Middle stratum	Scattered shrubs		
Lower stratum	Open hummock grassland		

BDDP07

Date	29/05/2023		
Site type	Fauna trapping site		
Coordinate	50K 807723.55 mE 7563397.88 mN		
Habitat type	Drainage Line/River/Creek (minor)		
Habitat type (other)			
Habitat description	Open eucalypt and acacia woodland over acacia shrubland over a predominantly buffel tussock and hummock grassland, adjacent to a minor creekline with standing water		
Habitat condition	Poor		
Suitability for significant species	Bat and grey falcon foraging, low potential quoll and POP dispersal		
Evidence of significant species	No		
Disturbance	Profuse buffel grass cover, cattle trampling and grazing		
Time since fire	> 5 yrs		
Leaf litter cover	10 – 40		
Woody debris	10 – 40		
Rocky crevices/caves	NA		
Large trees	Yes		
Tree hollows	Yes		
Landform	Creek	**Landform (other)**	
Slope	Negligible	**Aspect**	
Soil colour		**Soil texture**	Sandy clay
Bare soil	< 10	**Drainage**	Minor creek (< 5 m)
Rock type	Mixed	**Rock size**	Mixed
Rock abundance	< 10		
Upper stratum	Open woodland		
Middle stratum	Tall open shrubland		
Lower stratum	Tussock grass land / sedgeland / herbland		

BDDP08

Date	31/05/2023
Site type	Fauna trapping site
Coordinate	50K 798740.46 mE 7556310.49 mN
Habitat type	Plain (stony/gibber)
Habitat type (other)	
Habitat description	Undulating stony plain supporting open shrubland over long unburnt triodia hummock grassland
Habitat condition	Excellent
Suitability for significant species	
Evidence of significant species	No
Disturbance	
Time since fire	No evidence
Leaf litter cover	< 10
Woody debris	< 10
Rocky crevices/caves	NA
Large trees	No
Tree hollows	No
Landform	Undulating plain
Slope	Gentle
Soil colour	Red
Bare soil	10 – 30
Rock type	Mixed
Rock abundance	> 70
Upper stratum	Scattered low trees
Middle stratum	Scattered shrubs
Lower stratum	Hummock grassland

Landform (other)	
Aspect	Northeast
Soil texture	Clay loam
Drainage	NA
Rock size	Pebbles (2-64 mm)

BDDP09

Date	29/05/2023		
Site type	Fauna trapping site		
Coordinate	50K 796366.93 mE 7563997.19 mN		
Habitat type	Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)		
Habitat type (other)			
Habitat description	Low rocky outcrop with caves and crevices suitable for the northern quoll. Isolated eucalypts over scattered shrubs with spinifex understorey.		
Habitat condition	Excellent		
Suitability for significant species	northern quoll		
Evidence of significant species	No		
Disturbance			
Time since fire	No evidence		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	10 – 30		
Large trees	No		
Tree hollows	No		
Landform	Low hill	**Landform (other)**	
Slope	Gentle	**Aspect**	East
Soil colour	Brown	**Soil texture**	Sandy loam
Bare soil	< 10	**Drainage**	NA
Rock type	Ironstone	**Rock size**	Mixed
Rock abundance	> 70		
Upper stratum			
Middle stratum	Scattered shrubs		
Lower stratum	Mid-dense hummock grassland		

BDDP10

Date	29/05/2023
Site type	Fauna trapping site
Coordinate	50K 803316.93 mE 7557100.11 mN
Habitat type	Hills/Ranges/Plateaux
Habitat type (other)	
Habitat description	Low hills with slight breakaways and rocky crevices in top extent of landform. Drainage lines of larger Eucalypts over low Acacia shrubs cut through low rolling hills of open hummock grassland.
Habitat condition	Excellent
Suitability for significant species	Northern quoll capture. Grey falcon and bat foraging potential.
Evidence of significant species	Yes
Disturbance	No evidence
Time since fire	> 5 yrs
Leaf litter cover	< 10
Woody debris	< 10
Rocky crevices/caves	10 – 30
Large trees	Yes
Tree hollows	Yes
Landform	Low hill
Landform (other)	
Slope	Moderate
Aspect	West
Soil colour	Reddish brown
Soil texture	Clay loam
Bare soil	< 10
Drainage	Drainage line
Rock type	Ironstone
Rock size	Mixed
Rock abundance	30 – 70
Upper stratum	Scattered trees
Middle stratum	Scattered low shrubs
Lower stratum	Open hummock grassland

BDDP11

Date	12/11/2023		
Site type	Fauna trapping site		
Coordinate	50K 794075.87 mE 7554608.78 mN		
Habitat type	Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)		
Habitat type (other)			
Habitat description	Rocky escarpment with small caves and crevices suitable for quolls. Scattered corymbia over isolated low shrubs over spinifex.		
Habitat condition	Excellent		
Suitability for significant species	northern quoll		
Evidence of significant species			
Disturbance			
Time since fire	2 – 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	10 – 30		
Large trees	No		
Tree hollows	No		
Landform	Hill	**Landform (other)**	
Slope	Moderate	**Aspect**	North
Soil colour	Red	**Soil texture**	Sandy loam
Bare soil	< 10	**Drainage**	NA
Rock type	Ironstone	**Rock size**	Mixed
Rock abundance	30 – 70		
Upper stratum	Scattered low trees		
Middle stratum	Scattered low shrubs		
Lower stratum	Hummock grassland		

BDDP12

Date	13/10/2023		
Site type	Fauna trapping site		
Coordinate	50K 794577.72 mE 7556630.35 mN		
Habitat type	Plain (stony/gibber)		
Habitat type (other)			
Habitat description	Undulating stony plain supporting open shrubland over triodia hummock grassland		
Habitat condition	Excellent		
Suitability for significant species	northern quoll, perigren falcon?, grey falcon?, POP?, WPMM?		
Evidence of significant species	No		
Disturbance	na		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	10 – 30		
Large trees	No		
Tree hollows	No		
Landform	Hill	**Landform (other)**	
Slope	Steep	**Aspect**	NA
Soil colour	Reddish brown	**Soil texture**	Sandy clay
Bare soil	< 10	**Drainage**	NA
Rock type	Ironstone	**Rock size**	Mixed
Rock abundance	> 70		
Upper stratum	Scattered low trees		
Middle stratum	Low open shrubland		
Lower stratum			

BDDP13

Date	13/10/2023		
Site type	Fauna trapping site		
Coordinate	50K 802018.58 mE 7570490.94 mN		
Habitat type	Plain (Cracking clays)		
Habitat type (other)			
Habitat description	Acacia synchronisia shrub mid stratum, shared with Vachelia farnesiana (weed), lower stratum tussok grass dominated, shared with triodia		
Habitat condition	Good		
Suitability for significant species	Leggadina		
Evidence of significant species	No		
Disturbance	Cattle		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Plain	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Reddish brown	**Soil texture**	Sandy loam
Bare soil	< 10	**Drainage**	NA
Rock type	Basalt	**Rock size**	Pebbles (2-64 mm)
Rock abundance	> 70		
Upper stratum			
Middle stratum	Scattered shrubs		
Lower stratum	Tussock grass land / sedgeland / herbland		

BDDP14

Date	18/03/2024
Site type	Fauna trapping site
Coordinate	-21.9514869, 119.7962016
Habitat type	Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)
Habitat type (other)	
Habitat description	Rocky ridgeline/hill with scattered low Eucalypt trees over scattered Acacia shrubs over Triodia grassland
Habitat condition	Excellent
Suitability for significant species	Quoll
Evidence of significant species	No
Disturbance	
Time since fire	2 – 5 yrs
Leaf litter cover	< 10
Woody debris	< 10
Rocky crevices/caves	< 10
Large trees	No
Tree hollows	No
Landform	Ridge
Landform (other)	
Slope	Moderate
Aspect	West
Soil colour	Reddish brown
Soil texture	Clay loam
Bare soil	< 10
Drainage	NA
Rock type	Mixed
Rock size	Mixed
Rock abundance	30 – 70
Upper stratum	Scattered low trees
Middle stratum	Scattered low shrubs
Lower stratum	Hummock grassland

BDDP15

Date	18/03/2024
Site type	Fauna trapping site
Coordinate	-22.02975369, 119.8260531
Habitat type	Drainage Line/River/Creek (major)
Habitat type (other)	
Habitat description	Major drainage line with Acacia and Eucalypts over scattered shrubs and Triodia
Habitat condition	Good
Suitability for significant species	Quoll, Grey Falcon, Peregrine Falcon, Ghost Bat, Pilbara Leaf-nosed Bat
Evidence of significant species	No
Disturbance	Cattle, buffel grass
Time since fire	> 5 yrs
Leaf litter cover	< 10
Woody debris	10 – 40
Rocky crevices/caves	NA
Large trees	Yes
Tree hollows	Yes
Landform	Creek
Slope	Negligible
Soil colour	Light brown
Bare soil	30 – 70
Rock type	Mixed
Rock abundance	10 – 30
Upper stratum	Scattered trees
Middle stratum	Scattered shrubs
Lower stratum	Open hummock grassland

Landform (other)	
Aspect	NA
Soil texture	Sandy loam
Drainage	Major creek (5-30 m)
Rock size	Mixed

BDDP16

Date	18/03/2024		
Site type	Fauna trapping site		
Coordinate	-21.91962376, 119.7825883		
Habitat type	Drainage Line/River/Creek (major)		
Habitat type (other)			
Habitat description	Major creekline with Eucalypts and Meleleuca, buffel grass with occasional Triodia hummock		
Habitat condition	Good		
Suitability for significant species	Quoll, Grey Falcon, Peregrine Falcon, Ghost Bat, Pilbara Leaf-nosed Bat		
Evidence of significant species	No		
Disturbance	Cattle, buffel grass		
Time since fire	> 5 yrs		
Leaf litter cover	10 – 40		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	Yes		
Tree hollows	Yes		
Landform	River	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Brown	**Soil texture**	Sand
Bare soil	30 – 70	**Drainage**	Major creek (5-30 m)
Rock type	Mixed	**Rock size**	Mixed
Rock abundance	10 – 30		
Upper stratum	Open woodland		
Middle stratum	Shrubland		
Lower stratum	Tussock grass land / sedgeland / herbland		

BDDP17

Date	19/03/2024		
Site type	Fauna trapping site		
Coordinate	-21.89581201, 119.783736		
Habitat type	Hummock Grassland		
Habitat type (other)			
Habitat description	Sparse low Eucalypt over scattered Acacia shrubs over Triodia grassland		
Habitat condition	Very Good		
Suitability for significant species	Peregrine Falcon		
Evidence of significant species	No		
Disturbance	Cattle		
Time since fire	> 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Valley	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Grey	**Soil texture**	Clay loam
Bare soil	< 10	**Drainage**	NA
Rock type	Mixed	**Rock size**	Pebbles (2-64 mm)
Rock abundance	30 – 70		
Upper stratum	Scattered low trees		
Middle stratum	Scattered shrubs		
Lower stratum	Hummock grassland		

BDDP18

Date	19/03/2024		
Site type	Fauna trapping site		
Coordinate	-21.89461831, 119.7856959		
Habitat type	Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)		
Habitat type (other)			
Habitat description	Rocky ridgeline/hill with low shrubs over Triodia grassland		
Habitat condition	Excellent		
Suitability for significant species	Quoll		
Evidence of significant species	No		
Disturbance			
Time since fire	2 – 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	10 – 30		
Large trees	No		
Tree hollows	No		
Landform	Hill	**Landform (other)**	
Slope	Moderate	**Aspect**	West
Soil colour	Light brown	**Soil texture**	Sandy loam
Bare soil	< 10	**Drainage**	NA
Rock type	Ironstone	**Rock size**	Mixed
Rock abundance	> 70		
Upper stratum			
Middle stratum	Scattered low shrubs		
Lower stratum	Hummock grassland		

BDDP19

Date	17/03/2024		
Site type	Fauna trapping site		
Coordinate	-22.08602332, 119.7991386		
Habitat type	Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways)		
Habitat type (other)			
Habitat description	Rocky ridgeline/hill with Eucalypts over Triodia		
Habitat condition	Excellent		
Suitability for significant species	Quoll, dunnart		
Evidence of significant species	No		
Disturbance			
Time since fire	2 – 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	10 – 30		
Large trees	No		
Tree hollows	Yes		
Landform	Hill	**Landform (other)**	
Slope	Moderate	**Aspect**	South
Soil colour	Light brown	**Soil texture**	Sandy loam
Bare soil	30 – 70	**Drainage**	NA
Rock type	Ironstone	**Rock size**	Mixed
Rock abundance	> 70		
Upper stratum	Scattered trees		
Middle stratum	Scattered shrubs		
Lower stratum	Hummock grassland		

BDDP20

Date	17/03/2024		
Site type	Fauna trapping site		
Coordinate	-22.08052839, 119.8132339		
Habitat type	Hummock Grassland		
Habitat type (other)			
Habitat description	Eucalypts over Triodia grassland with minor drainage lines		
Habitat condition	Excellent		
Suitability for significant species	Ghost Bat, Pilbara Leaf-nosed Bat		
Evidence of significant species	No		
Disturbance	Minor cattle evidence		
Time since fire	> 5 yrs		
Leaf litter cover	10 – 40		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	Yes		
Tree hollows	Yes		
Landform	Plain	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Light brown	**Soil texture**	Clay loam
Bare soil	30 – 70	**Drainage**	Drainage line
Rock type	Ironstone	**Rock size**	Mixed
Rock abundance	10 – 30		
Upper stratum	Scattered trees		
Middle stratum	Open shrubland		
Lower stratum	Mid-dense hummock grassland		

BDDP21

Date	26/03/2024		
Site type	Fauna trapping site		
Coordinate	-22.02653026, 119.8256633		
Habitat type	Hummock Grassland		
Habitat type (other)			
Habitat description	Eucalypts over Triodia grassland with minor drainage lines		
Habitat condition	Excellent		
Suitability for significant species	Grey Falcon, Western Pebble-mound Mouse, Gane's Blind Snake		
Evidence of significant species	No		
Disturbance	Cattle tracks		
Time since fire	2 – 5 yrs		
Leaf litter cover	< 10		
Woody debris	< 10		
Rocky crevices/caves	NA		
Large trees	No		
Tree hollows	No		
Landform	Undulating plain	**Landform (other)**	
Slope	Negligible	**Aspect**	NA
Soil colour	Reddish brown	**Soil texture**	Clay loam
Bare soil	< 10	**Drainage**	NA
Rock type	Ironstone	**Rock size**	Mixed
Rock abundance	> 70		
Upper stratum	Scattered trees		
Middle stratum	Scattered low shrubs		
Lower stratum	Open hummock grassland		

BDDP22

Date	28/03/2024
Site type	Fauna trapping site
Coordinate	-22.10035883, 119.9887742
Habitat type	Drainage Line/River/Creek (major)
Habitat type (other)	
Habitat description	Open Eucalypt and Melaleuca woodland over open Acacia shrubland over open, mixed Triodia and Buffel grassland
Habitat condition	Degraded
Suitability for significant species	Grey falcon
Evidence of significant species	No
Disturbance	Buffel grass, cattle
Time since fire	No evidence
Leaf litter cover	< 10
Woody debris	< 10
Rocky crevices/caves	NA
Large trees	Yes
Tree hollows	Yes
Landform	Creek
Slope	Negligible
Soil colour	Reddish brown
Bare soil	30 – 70
Rock type	Mixed
Rock abundance	< 10
Upper stratum	Open woodland
Middle stratum	Open shrubland
Lower stratum	Open hummock grassland

Landform (other)	
Aspect	NA
Soil texture	Loamy sand
Drainage	Major creek (5-30 m)
Rock size	Pebbles (2-64 mm)

BDDP23

Date	17/03/2024
Site type	Fauna trapping site
Coordinate	-22.11209798, 119.8715194
Habitat type	Woodland (open)
Habitat type (other)	
Habitat description	Mulga woodland, with isolated Eucalypts over Triodia grassland.
Habitat condition	Excellent
Suitability for significant species	No
Evidence of significant species	No
Disturbance	Road nearby, minor cattle evidence
Time since fire	> 5 yrs
Leaf litter cover	< 10
Woody debris	< 10
Rocky crevices/caves	NA
Large trees	No
Tree hollows	No
Landform	Plain
Slope	Negligible
Soil colour	Reddish brown
Bare soil	30 – 70
Rock type	Ironstone
Rock abundance	30 – 70
Upper stratum	Scattered low trees
Middle stratum	Tall open shrubland
Lower stratum	Hummock grassland

Landform (other)	
Aspect	NA
Soil texture	Clay loam
Drainage	NA
Rock size	Pebbles (2-64 mm)

Site	Habitat Type	Landform	Substrate	Vegetation Description	Easting	Northing	Site Photo
BDSS1	Major Creeklines	Major drainage	Clay, loam	Large, dense *Eucalyptus camaldulensis*, *E. victrix*, *Melaleuca* sp. woodland, over *Acacia* sp. open shrubland, over Buffel grass **Cenchrus ciliaris* and *Triodia* sp. mixed native grassland. Large water pool present. Little wood and leaf litter.	806684	7550454	
BDS02	Major Creeklines	Major drainage	Clay	*Eucalyptus victrix* woodland, over *Acacia* sp. open shrubland, over heavily grazed Buffel grass **Cenchrus ciliaris* and adjacent *Triodia* sp. mixed native grassland. Some wood and leaf litter.	804616	7545084	

Site	Habitat Type	Landform	Substrate	Vegetation Description	Easting	Northing	Site Photo
BDS03	Plain (Cracking Clay)	Plain	Basalt, cracking clay	Isolated shrubs of *Acacia inaequilatera* over isolated tussock grasses with patches of hummock grasses *Triodia longiceps* on cracking clay. Large rocks, no wood or leaf litter.	794272	7539586	
BDS04	Plain (Cracking Clay)	Plain	Clay	Isolated shrubs of *Acacia inaequilatera,* over sparse tussock grasses. Large rocks and boulders on cracking clay. No wood or leaf litter.	787811	7536109	

Site	Habitat Type	Landform	Substrate	Vegetation Description	Easting	Northing	Site Photo
BDS05	Rocky Escarpments	Mesa	Rocky stony loam	Mixed shrubland of *Acacia monticola* and scattered *A. inaequilatera* over mixed moderately dense hummock grassland on bedrock with continuous layer of pebbles and rocks. Sparse wood and leaf litter.	800493	7542383	
BDS06	Rocky Escarpments	Mesa/Breakaway	Rocky, stoney sand	Isolated shrubs of *Acacia pruinocarpa* over sparse *A. aptaneura* over sparse hummock *Triodia* sp. grassland on rocky slope with sections of exposed rock. No wood or leaf litter present.	797872	7542485	

Site	Habitat Type	Landform	Substrate	Vegetation Description	Easting	Northing	Site Photo
BDS07	Mulga Woodland	Plain	Clay	Moderately dense shrubland of *Acacia aneura* (Mulga), with scattered *A. pruinocarpa*, over *Triodia epactia* hummock grassland. Plenty of wood litter and some leaf litter on hard clay with plenty of small pebbles.	814110	7535287	
BDS08	Mulga Woodland	Plain	Clay	Scattered *Corymbia* sp. over scattered *Acacia pruinocarpa* and over closed shrubland of *Acacia aneura* (Mulga) over patches of mixed hummock and tussock grassland. Plenty of wood litter, some leaf litter underneath shrubs on hard clay. No rocks or pebbles.	816126	7537054	

Site	Habitat Type	Landform	Substrate	Vegetation Description	Easting	Northing	Site Photo
BDS09	Plain (stony/gibber)	Undulating Hills	Rocky, sandy loam	Sparse shrubland of *Acacia inaequilatera,* over moderate to dense tussock grassland of *Triodia* sp. on rocky clay. No wood or leaf litter.	799715	7545309	
BDS10	Plain (stony/gibber)	Plain	Clay, Sandy loam	Isolated trees of *Corymbia hamersleyana over,* sparse shrubland of *Acacia inaequilatera and Hakea chordophylla,* over mixed hummock grassland. Some wood and leaf litter on sandy substrate.	801524	7535149	

Site	Habitat Type	Landform	Substrate	Vegetation Description	Easting	Northing	Site Photo
BDS11	Plain (stony/gibber)	Plain	Clay, Stony loam	Scattered shrubs of *Acacia inaequilatera*, over moderate tussock grassland of *Triodia* sp. Few wood and leaf litter. Plenty of pebbles on sandy clay.	798283	7540228	
BDS12	Major Creeklines	Major drainage	Sandy loam	*Eucalyptus victrix, Melaleuca argentia* sp. woodland, over *Acacia* sp. open shrubland, over Buffel grass **Cenchrus ciliaris* closed hummock grassland.	788164	7540954	

Appendix F Night parrot call analysis.

Results of acoustic surveys conducted for Night Parrot (*Pezoporus occidentalis*) Bonney Downs July-October 2023

Report to:

Ecologia

Prepared by:

Nick Leseberg

Adaptive NRM

19th May 2024

1. Summary

Between July and October 2023, autonomous recording units (ARUs) were deployed at nine sites in the Bonney Downs project area to survey for Night Parrots (*Pezoporus occidentalis*). The project area is approximately 70 km northeast of Fortescue Marsh, within the Chichester bioregion of Western Australia. Resulting acoustic data was analysed using signal parameters optimised for detecting Night Parrot calls. No Night Parrot calls were detected during the analysis.

2. Survey effort

Analysis of historical Night Parrot records suggest it was formerly found throughout arid central Australia, before undergoing a significant decline and range contraction during the late-19th and early-20th centuries (Leseberg *et al*. 2021). The species is now known from a small area in western Queensland, and the central and northern inland of Western Australia. There are several historical reports from the Chichester bioregion, although none that are considered of high veracity (Leseberg *et al*. 2021). There are several contemporary records from the Fortescue Marsh which is only 70 km southwest of the project area (Leseberg 2022), so it is feasible that if suitable habitat exists, Night Parrots could be resident in the survey area.

Research in western Queensland has demonstrated Night Parrots occupy long-term stable roost sites for periods of up to several years. These long-term stable roost sites support both roosting and breeding. The birds also have predictable year-round calling periods at dusk and dawn (Murphy *et al*. 2017a, Leseberg *et al*. 2019). This ensures that if Night Parrots are roosting at a particular site, the likelihood of detecting them using ARUs is very high, provided the ARU is placed for a minimum of four nights in calm weather, and the recorder is set to record during the peak calling periods. During breeding, and following large rain events, calling is more frequent, extends throughout the night, and the likelihood of detection is increased (Murphy *et al*. 2017a). Preliminary results from research in central Western Australia suggest patterns of behaviour in that region are similar (Jackett *et al*. 2017).

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

birds range at night (Murphy *et al*. 2017b). Night Parrots are known to drink, and modelling suggests they may be reliant on free-standing water (or succulent food containing >55% water) during hot weather (Kearney *et al*. 2016). Birds have been detected in the Great Sandy Desert by focusing survey effort at water sources (J. Brown pers. comm.). It is likely this technique will be most effective during periods of water scarcity, when survey effort can focus on just a few possible locations.

The likelihood of detection is also influenced by the type of ARU being used. In calm conditions, a Song Meter 4 (Wildlife Acoustics, MA, USA), is known to be capable of reliably detecting 95% of Night Parrot calls out to a range of around 205 m (Leseberg *et al*. 2022). SM4s were used at seven of the nine sites surveyed. Titley Chorus machines were used at two sites. How these machines compare to SM4s is unclear, although a qualitative assessment of the recordings from these machines suggest their recording radius was less than that of the SM4s.

Ecologia conducted sampling for the Night Parrot across two blocks, during July/August, and also October 2023. A total of nine sites were surveyed in the project area, and a combined total of 60 nights of data was recorded (Table 1). Several different recording programs were used. During the July/August phase, all four machines recorded two periods each night, one at sunset the other at sunrise. Two machines recorded an hour either side of sunset and sunrise, and two recorded ninety minutes either side of sunset and sunrise. While it is recommended that recordings are made from sunset to sunrise, in each case the peak Night Parrot calling period would have been captured, allowing conclusions around the presence or absence of a long-term stable roost site in the immediate vicinity of the ARU. During the October surveys, all five machines recorded from before sunset until after sunrise, capturing the recommended period for Night Parrot surveys. All ARUs recorded a minimum of four non-windy nights. It is likely that any long-term stable roost sites in the vicinity of these ARUs would have been detected.

3. Data analysis

ANRM received the raw acoustic data as '.wav' files. These were scanned using the software Kaleidoscope Pro v5.2.1, targeting the frequency range of 1500 – 3500 Hz, within which all known Night Parrot calls are distributed (Leseberg *et al*. 2019). Search parameters were optimised using a random selection of 250 Night Parrot call examples manually detected from

both Great Sandy Desert and East Murchison datasets, of which 205 (82.0%) were automatically detected. Calls not detected were typically extremely faint. The probability of non-detection of a true-positive call was 18.0%; two true-positive calls was 3.2%; three true-positive calls was 0.6%; etc. Of the data tested, the median number of consecutive (spaced at < 5 minutes apart) calls in a sequence when Night Parrots were recorded was 5 (1–34, n = 29). The probability of at least one call being detected within a sequence of median length, assuming there was variation in the location of the source of the call, was > 99.9%.

Table 1. Bioacoustic recordings analysed from the July/August and October 2023 survey.

Site name	ARU Type	Recording start date (PM)	Recording end date (AM)	Total recording nights
BDNP01	SM4	24-Jul-23	2-Aug-23	9
BDNP02	SM4	24-Jul-23	2-Aug-23	9
BDNP03	Chorus*	27-Jul-23	2-Aug-23	6
BDNP04	Chorus *	27-Jul-23	2-Aug-23	6
BDNP05	SM4	13-Oct-23	19-Oct-23	6
BDNP06	SM4	13-Oct-23	19-Oct-23	6
BDNP07	SM4	13-Oct-23	19-Oct-23	6
BDNP08	SM4	13-Oct-23	19-Oct-23	6
BDNP09	SM4	13-Oct-23	19-Oct-23	6
			Total	60

Potential Night Parrot calls detected during the analysis were compared to a reference library comprising several thousand Night Parrot calls from Western Australia. This library consists of calls recorded at sites where Night Parrots have been confirmed using visual means and is therefore considered of high reliability. The library also comprises multiple examples of all known call types from Western Australia (Leseberg *et al*. 2019).

4. Survey results

No calls attributable to Night Parrots were detected during the analysis.

5. Conclusion

It is unlikely long-term stable Night Parrot roosts exist in the area immediately surrounding the points sampled during this survey at the time of sampling. Additionally, it is unlikely that Night

Parrots were foraging in proximity to these surveyed points at the time of sampling. It is important to reinforce that these results pertain specifically to that area immediately surrounding the survey points, and only for the period during which the survey was conducted. The results of these surveys do not enable robust conclusions about the presence or absence of Night Parrots in the wider landscape.

6. References

Jackett, N. A., B. R. Greatwich, G. Swann, and A. Boyle. 2017. A nesting record and vocalisations of the Night Parrot *Pezoporus occidentalis* from the East Murchison, Western Australia. *Australian Field Ornithology* **34**: 144-150.

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Results of acoustic surveys
Project 2339
Bonney Downs South
Night Parrot Surveys
April 2024

Report to:

Spectrum Ecology

Prepared by:

Nick Leseberg

Adaptive NRM

20th June 2024

1. Summary

In April 2024, autonomous recording units (ARUs) were deployed at six sites within the Bonney Downs South project area, in the Chichester subregion of Western Australia to survey for Night Parrots (*Pezoporus occidentalis*). No Night Parrot calls were detected during the analysis.

2. Survey effort

Analysis of historical Night Parrot records suggest it was formerly found throughout arid central Australia, before undergoing a significant decline and range contraction during the late-19th and early-20th centuries (Leseberg *et al*. 2021). The species is now known from a small area in western Queensland, and the central and northern inland of Western Australia, including the Pilbara. While there are only historical records from the Chichester subregion, there are several historical and contemporary records of Night Parrot from the neighbouring Fortescue subregion, mainly from the Fortescue Marsh area, approximately 50 km southwest of the project area (Leseberg *et al*. 2021). Given this pattern of records, it is feasible that if suitable habitat exists, Night Parrots could be resident in the survey area.

Research in western Queensland has demonstrated Night Parrots occupy long-term stable roost sites for periods of up to several years. These long-term stable roost sites support both roosting and breeding. The birds also have predictable year-round calling periods at dusk and dawn (Murphy *et al*. 2017a, Leseberg *et al*. 2019). This ensures that if Night Parrots are roosting at a particular site, the likelihood of detecting them using ARUs is very high, provided the ARU is placed for a minimum of four nights in calm weather, and the recorder is set to record during the peak calling periods. During breeding, and following large rain events, calling is more frequent, extends throughout the night, and the likelihood of detection is increased (Murphy *et al*. 2017a). Preliminary results from research in central Western Australia suggest patterns of behaviour in that region are similar (Jackett *et al*. 2017).

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

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

The likelihood of detection is also influenced by the type of ARU being used. In calm conditions, the Song Meter 4 (Wildlife Acoustics, MA, USA), which was used at two of the sites surveyed here, is known to be capable of reliably detecting 95% of Night Parrot calls out to a range of around 205 m (Leseberg *et al*. 2022). Song Meter Minis were also used for these surveys. Their performance is comparable to that of an SM4.

Spectrum Ecology conducted sampling at six sites in the project area. All ARUs were set to record from 25 minutes after sunset until 25 minutes before sunrise, and each recorded for a minimum of five nights. These ARUS all recorded at least four calm nights, and for the recommended period when trying to establish the presence of a long-term stable roost site. The number of nights of data collected was sufficient to allow robust conclusions around the presence of long-term stable roost sites in the immediate vicinity of each survey point. Details of the data recorded at each site are given at Table 1.

Table 1. Bioacoustic recordings analysed from the April 2024 survey.

Site name	Recording start date (PM)	Recording end date (AM)	Total recording nights
BDS 01-PAR2	8-Apr-24	14-Apr-24	6
BDS 02-PAR2	8-Apr-24	14-Apr-24	6
BDS 03-PAR2	8-Apr-24	13-Apr-24	5
BDS 06-PAR2	8-Apr-24	14-Apr-24	6
BDS 09-PAR2	7-Apr-24	13-Apr-24	6
BDS 11-PAR2	7-Apr-24	13-Apr-24	6
		Total	35

3. Data analysis

ANRM received the raw acoustic data in '.wav' format. All files were scanned using the software Kaleidoscope Pro v5.2.1, targeting the frequency range of 1500 – 3500 Hz, within

which all known Night Parrot calls are distributed (Leseberg *et al*. 2019), and most other bird calls. These parameters have been tested on a random selection of 250 Night Parrot call examples manually detected from both Great Sandy Desert and East Murchison datasets, of which 205 (82.0%) were automatically detected. Calls not detected were typically extremely faint. The probability of non-detection of a true-positive call was 18.0%; two true-positive calls was 3.2%; three true-positive calls was 0.6%; etc. Of the data tested, the median number of consecutive (spaced at < 5 minutes apart) calls in a sequence when Night Parrots were recorded was 5 (1–34, n = 29). The probability of at least one call being detected within a sequence of median length, assuming there was variation in the location of the source of the call, was > 99.9%.

The resulting 'detections' were then compared to a reference library comprising several thousand Night Parrot calls from Western Australia and Queensland. This library consists of calls recorded at sites where Night Parrots have been confirmed using visual means and is therefore considered of high reliability. The library also comprises multiple examples of all known call types from Western Australia and Queensland (Leseberg *et al*. 2019).

4. Survey results

A total of 35,989 Kaleidoscope detections were manually assessed for Night Parrot vocalisations. No calls attributable to Night Parrots were detected during the analysis.

5. Conclusion

It is unlikely long-term stable Night Parrot roosts exist within approximately 200 m of the six sites that were sampled, at the time of sampling. Additionally, it is unlikely that Night Parrots were foraging in proximity to these surveyed points at the time of sampling. It is important to reinforce that these results pertain specifically to that area immediately surrounding the survey points, and only for the period during which the survey was conducted. The results of these surveys do not enable robust conclusions about the presence or absence of Night Parrots in the wider landscape.

6. References

Jackett, N. A., B. R. Greatwich, G. Swann, and A. Boyle. 2017. A nesting record and vocalisations of the Night Parrot *Pezoporus occidentalis* from the East Murchison, Western Australia. *Australian Field Ornithology* **34**: 144-150.

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Appendix G Post-survey likelihood of occurrence.

Taxon	Common name	WA status	EPBC status	Number of records		Latest record	Preferred habitat type	Comments	Likelihood of occurrence
				DBCA	Fortescue				
BIRD									
Actitis hypoleucos	Common sandpiper	MI	MI	4	6	2020	Inland wetlands and sheltered coastal areas, utilises permanent and ephemeral wetlands.	Closest record (Fortescue) within 3 km of study area, with most records associated with Fortescue Marsh. Permanent habitat does not occur within study area and presence of species is unlikely. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Moderate**
Apus pacificus	Fork-tailed swift	MI	MI	4	25	2014	Occupies low to very high airspace over varied habitat. Aerial specialist.	Closest records (DBCA and Fortescue) 27 km from study area. Species does not utilise terrestrial habitats; however, may utilise the airspace above the study area while transiting.	**Moderate**
Calidris acuminata	Sharp-tailed sandpiper	MI	MI	7	1	2020	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	Closest Fortescue records 11 km from study area, with most records associated with Fortescue Marsh. Permanent habitat does not occur within study area and presence of species is unlikely. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Moderate**
Calidris ruficollis	Red-necked stint	MI	MI	2	1	2017	Edge of sheltered estuaries, beaches and salt lakes both on the mainland and on offshore islands. Occasionally occur on inland salt lakes and freshwater swamps.	Closest records (DBCA) located 24 km from study area, in association with the Fortescue Marsh. Permanent habitat does not occur within study area and presence of species is unlikely. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Moderate**
Charadrius veredus	Oriental plover	MI	MI	4	1	2017	Inland wetlands and sheltered coastal areas, utilises permanent and ephemeral wetlands.	Recorded within 14 km of study area, with most records associated with Fortescue Marsh. Permanent habitat does not occur within study area and presence of species is unlikely. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Moderate**
Falco hypoleucos	Grey falcon	VU	VU	18	20	2024	Resident or nomadic to most of semi-arid interior.	One historical (1977) DBCA database record located within 70m of the study area. Species recorded on 11 occasions in and around the study area during the current surveys, with nine records in/around Bonney Downs North and two records in Bonney Downs South.	**Recorded (current survey)**
Falco peregrinus	Peregrine falcon	OS	-	32	13	2018	Cliffs and gorges, inland drainage systems, lowland plains, *Acacia* shrublands intersected by water courses.	Numerous database records within 10 km of study area, with closest record located 3 km south of Bonney Downs South survey area. All bar one record are located south of study area and study area appears to be located within a region of species distribution with fewer records/less frequent sightings (ALA database). Suitable breeding and foraging habitat present within study area within Drainage Line/River/Creek (major) habitat type. Species not recorded during current surveys.	**High**
Gelochelidon nilotica	Gull-billed tern	MI	MI	10	15	2020	The species utilises sheltered coastal seas, watered flatlands, estuaries, salt lakes, freshwater wetlands, and dams.	Thirteen records within 10 km of study area, with most records associated with Fortescue Marsh. Permanent habitat does not occur within study area and presence of species is unlikely. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Moderate**
Hydroprogne caspia	Caspian tern	MI	MI	2	21	2020	Occurs in sheltered seas, inlands watercourses such as estuaries, tidal creeks, near-coastal salt lakes, and brackish pools in the lower courses of rivers.	Closest Fortescue records located approximately 6 km from study area, with all records associated with Fortescue Marsh. Permanent habitat does not occur within study area and presence of species is unlikely. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Moderate**
Macronectes giganteus	Southern giant petrel	MI	EN	3	0	2011	Widespread throughout the Southern Ocean, utilises offshore islands for breeding.	Three records located approximately 70 km south of study area, south of the Fortescue Marsh. Permanent habitat does not occur within study area and species is considered unlikely to occur. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Low**
Motacilla cinerea	Grey wagtail	MI	MI	1	0	2012	Typically occurs along freshwater habitats such as creeks and streams, however species could occur in any habitats during migration.	A single DBCA record located approximately 62 km from study area. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Low**

Taxon	Common name	WA status	EPBC status	Number of records		Latest record	Preferred habitat type	Comments	Likelihood of occurrence
				DBCA	Fortescue				
Ninox connivens connivens	Barking owl (southwest subpop.)	P3	-	2	0	1981	Occurs primarily in sclerophyll woodland. Nests in large hollows in live eucalypts.	Two historical records located between 75-80 km from the study area. This subspecies is restricted to the south-west of Western Australia and does not occur within the study area based on the current modelled distribution. Historical records instead represent *Ninox connivens peninsularis*, which is not listed under state or national legislation and is considered locally common and widespread.	**Does not occur**
Pandion haliaetus	Osprey	MI	MI	2	0	2012	Usually associated with coastal habitats and occasional visitor to inland water bodies.	Closest record located within 49 km of study area. Permanent habitat does not occur within study area and species is considered unlikely to occur. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Low**
Pezoporus occidentalis	Night parrot	CR	EN	2	1	2005	Old, long unburnt, ring-forming *Triodia* grasslands and/or chenopod shrublands in arid and semi-arid zones.	Species recorded on two occasions (DBCA) within 100 kilometres of study area. Recorded south-west (2005) and northeast of study area (1980). Potential roosting and foraging habitat occurs within the study area, which is located within the High Priority region for night parrot surveys.	**Moderate**
Plegadis falcinellus	Glossy ibis	MI	MI	3	5	2017	The preferred habitat is shallows and adjacent flats of freshwater lakes and swamps, but it is also found in river pools, flooded samphire, and sewage ponds.	Three Fortescue records within 7 km of study area, with all records associated with Fortescue Marsh. Potential usage of habitat within the study area likely to be restricted to transient presence rather than permanent occupancy.	**Moderate**
Polytelis alexandrae	Princess parrot	P4	VU	2	0	2012	Preferred habitat is lightly wooded country, including desert oak (*Casuarina decaisneana*), open mallee-spinifex and open marble gum (*Eucalyptus gongylocarpa*) woodland.	Two records of species identified approximately 63 km from study area. Suitable habitat highly restricted within study area which generally lacks open woodland, desert oak and mallee.	**Low**
Rostratula australis	Australian painted snipe	EN	EN	2	0	2012	Usually found in shallow inland wetlands that are either permanently or temporarily filled.	Two DBCA records of species identified approximately 36 km from study area, in the vicinity of the Fortescue Marsh. Permanent habitat does not occur within study area and species is considered unlikely to occur. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Moderate**
Tringa glareola	Wood sandpiper	MI	MI	16	4	2017	Occurs most commonly in coastal, better-watered regions of the state but will visit areas of suitable habitat in the interior. Occurs around the muddy or grassy margins of freshwater wetlands, including swamps, lagoons, river pools, dams, bore overflows and sewage ponds.	Two DBCA records located approximately 11 km from study area. Permanent habitat does not occur within study area and presence of species is unlikely. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Moderate**
Tringa nebularia	Common greenshank	EN	MI	5	18	2020	Found in shallow, fresh waters (e.g. claypans, swamps, river pools) and salt waters (e.g. estuaries, samphire flats, reef flats).	Closest records (DBCA) located within 3 km of study area, with most records in the vicinity of the Fortescue Marsh. Permanent habitat does not occur within study area and species is considered unlikely to occur. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Moderate**
Tringa stagnatilis	Marsh sandpiper	MI	MI	2	0	2016	Inhabit permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats as well as sewage farms and saltworks.	Closest record located 14 km from study area in the vicinity of the Fortescue Marsh. Permanent habitat does not occur within study area and species is considered unlikely to occur. Potential usage of habitat within the study area restricted to transient presence rather than permanent occupancy.	**Moderate**
Calidris ferruginea	Curlew sandpiper	CR	CR	0	0	?	The species utilises coastal and near-coastal waterbodies including saltmarshes, wetlands, sewage ponds and shallow estuaries.	No known records of species within 40 km of study area. EPBC Act Protected Matters Search identified species/species habitat may occur within study area.	**Low**
Erythrotriorchis radiatus	Red goshawk	VU	EN	0	0	?	The preferred habitat is tall open eucalypt forest and riparian areas, including paperbark forest and gallery forests.	No known records of species within 40 km of study area. EPBC Act Protected Matters Search identified species/species habitat may occur within study area.	**Low**

Taxon	Common name	WA status	EPBC status	Number of records		Latest record	Preferred habitat type	Comments	Likelihood of occurrence
				DBCA	Fortescue				
Motacilla flava	Yellow wagtail	MI	MI	0	0	?	Non-breeding habitat only. Well- watered open grasslands and fringes of wetlands. Roosts in mangroves and dense vegetation.	No known records of species within 40 km of study area. EPBC Act Protected Matters Search identified species/species habitat may occur within study area.	**Low**
MAMMALS									
Dasycercus blythi/*Dasycercus* sp.	Brush-tailed mulgara	P4	-	50	275	2023	Occur in spinifex grasslands throughout much of the arid zone and dig burrows in flats between low sand dunes.	Species recorded at Bonney Downs South during the current surveys, within the Plain (stony gibber) habitat type. Species not recorded at Bonney Downs North.	**Recorded (current survey)**
Dasycercus cristicauda	Crest-tailed mulgara, Minyiminyi	P4	-	2	0	2011	Restricted to central Simpson Desert. Digs and inhabits burrows predominantly in dunes with a sparse cover of Sandhill Canegrass (*Zygochloa paradoxa*) or areas around salt lakes with Nitre Bush (*Nitraria billardieri*).	Two DBCA records from 2011 located 84 km from study area. Study area does not intersect known distribution of the crest-tailed mulgara (previously known as *D. hillieri*) after taxonomic revision undertaken in 2005. Records of the "crest-tailed mulgara" within the study area instead represent the brush-tailed mulgara, *D. blythi* (previously referred to as *D. cristicauda*).	**Does not occur**
Dasyurus hallucatus	Northern quoll	EN	EN	624	310	2024	Rocky escarpments provide denning and shelter habitats, also known to inhabit riverine habitats and utilise drainage lines for distribution.	Numerous records in vicinity of study area, with 85 Fortescue records located within the study area. Species recorded on motion cameras and captured in cage traps within Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways) and Drainage Line/River/Creek (major) habitat types. A single individual was recorded at Bonney Downs South.	**Recorded (current survey)**
Lagorchestes conspicillatus leichardti	Spectacled hare-wallaby (mainland)	P4	-	5	0	2014	Inhabits grasslands, open forests, open woodlands and tall shrublands and shelters during the day under tussocks of *Triodia* spp.	Closest DBCA records located 50.5 km from study area. Suitable habitat generally absent from study area.	**Low**
Leggadina lakedownensis	Short-tailed mouse, Lakeland Downs mouse, kerakenga	P4	-	44	13	2023	Semi-arid habitats including spinifex and tussock grasslands, samphire and sedge lands. *Acacia* shrublands and stony ranges. Known to occur in seasonally inundated areas with red or white sandy clay soils.	Closest Fortescue database record located within 300m of study area (2004). Three captures were recorded at Bonney Downs North within Plain (cracking clays) habitat type and one capture was recorded in Drainage Line/River/Creek (minor) habitat. Four captures recorded at Bonney Downs South within Plain (cracking clay) habitat type.	**Recorded (current survey)**
Macroderma gigas	Ghost bat	VU	VU	133	37	2024	Rocky habitat for roosting, will forage in all habitat types.	Numerous DBCA database records within 10 km of study area. Potential nocturnal refugia present within the Hills/Ranges/Plateaux and Rocky Escarpments habitat types; however, no suitable roosting habitat identified within the study area. Species recorded by a ghost bat lure deployed at acoustic lure site BDGB03 within Drainage Line/River/Creek (major) habitat type during current surveys. Species not recorded at Bonney Downs South.	**Recorded (current survey)**
Macrotis lagotis	Greater bilby, dalgyte, ninu	VU	VU	279	212	2021	Occupies a variety of habitats, including open tussock grasslands, *Acacia* (mulga) shrubland and woodlands, hummock grasslands on plains and alluvial areas and cracking clays	Numerous historical records in vicinity of study area with two historic (1982 & 1984) DBCA records within study area. No evidence of species recorded during current surveys, with limited suitable habitat identified.	**Recorded (historical)**
Pseudomys chapmani	Western pebble-mound mouse, ngadji	P4	-	312	679	2023	Restricted to Pilbara and Gascoyne regions. Occupies stony habitat with hummock grasslands. Constructs large mounds of pebbles on stony slopes, with active mounds characterised by craters.	Two Fortescue records located within study area and numerous records within 10 km of study area. Ten mounds constructed by this species recorded on occasions within the Plain (stony/gibber) and Rocky Escarpments (Ridges/Mesa/Cliffs/Outcrops/Breakaways) habitat types at Bonney Downs North. Two mounds recorded in Plain (stony/gibber) habitat at Bonney Downs South.	**Recorded (current survey)**
Rhinonicteris aurantia (Pilbara form)	Pilbara leaf-nosed bat	VU	VU	1,397	441	2024	Restricted to Pilbara region. Roosts in deep caves and mines with high temperatures and humidity and will forage in all habitat types.	Numerous records in vicinity of study area. Closest database record located approximately 20 kilometres from study area. Echolocation calls recorded at 15 sites (20 nights) at Bonney Downs North and BBSUS survey areas. Echolocation calls recorded at five sites across two phases at Bonney Downs South. No low time calls indicative of a potential roost site recorded during current or previous surveys. May forage in all habitat types. Species appears to utilise waterbodies within the site during the dry season, with very low activity recorded in the post-wet season. Known roost locations occur north of the study area in vicinity of Corunna Downs. No suitable roost caves were recorded during targeted searches in rocky habitats.	**Recorded (current survey)**

Taxon	Common name	WA status	EPBC status	Number of records		Latest record	Preferred habitat type	Comments	Likelihood of occurrence
				DBCA	Fortescue				
Antechinomys longicaudata	Long-tailed dunnart	P4	-	7	3	2011	Rugged, rocky habitat in areas with hummock grasses, shrubs and open shrubland or woodland.	Two DBCA database records (2005) located within 2 km of study area. Suitable rocky habitats occur within the study area.	**High**
REPTILES									
Liasis olivaceus barroni	Pilbara olive python	VU	VU	47	17	2024	Range restricted to Pilbara region, northern Western Australia, and the Dampier Archipelago. Occupies rocky escarpments, gorges, and waterholes.	Recorded within study area on three occasions between 2011- 2019. Species recorded during phase 2 and phase 3 detailed surveys at Bonney Downs North. Species not recorded at Bonney Downs South. Suitable dispersal habitat present within Drainage Line/River/Creek (major) habitat type and permanent and semi-permanent pools provide foraging opportunities for the species. Hills/Range/Plateaux, Gorges/Gullies and Rocky Escarpments within the study area provide shelter and foraging opportunities for the Pilbara olive python.	**Recorded (current survey)**
Anilios ganei	Gane's blind snake (Pilbara)	P1	-	8	1	2024	Often recorded in rocky or stony areas, potentially associated within moist gorges and gullies.	Closest database record (DBCA) within 40 km of the study area. Species recorded within Plain (stony/gibber) habitat type during the phase three detailed fauna survey. Species not recorded at Bonney Downs South.	**Recorded (current survey)**
Ctenotus nigrilineatus	Pin-striped finesnout Ctenotus	P1	-	47	0	2014	Spinifex plains adjacent to granite outcrops and water courses.	Numerous DBCA records 10 kilometres east of study area, in association with extensive granite outcropping. Limited to no suitable habitat present within study area.	**Low**
Liopholis kintorei	Great desert skink	VU	VU	0	0	?	Arid sandflats and clay based, or loamy soils vegetated with spinifex.	No known records of species within 40km of study area. EPBC Act Protected Matters Search identified species/species habitat may occur within study area. Limited to no suitable habitat identified within study area and total absence of records within 100 kilometres makes it unlikely that this species is present within study area.	**Low**