Warrawoona Gold Project: Level 1 Vertebrate Fauna Survey, and Desktop SRE and Subterranean Assessment

Calidus Resources Limited

December 2017

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EXECUTIVE SUMMARY

Calidus Resources Limited (Calidus) commissioned Biologic Environmental Survey (Biologic) to undertake a Level 1 vertebrate fauna assessment, and a Short-range Endemic invertebrate fauna (SRE) and subterranean fauna desktop assessment for their Warrawoona Gold Project. The Study Area for the project, covers approximately 1,822 ha and is located approximately 20 km south of Marble Bar within the Pilbara region of Western Australia. The overarching objective of this assessment was to identify the potential occurrence of conservation significant vertebrate fauna species, and their supporting habitats, and to determine the likelihood of occurrence for SRE and subterranean fauna and advise on the requirement for future survey work. This report summarises the field work undertaken in 2017, and also refers to additional opportunistic species records from 2018 (Biologic, 2019c) and additional habitat mapping conducted in 2019 (Biologic, 2019b). The results of these additional surveys can be found in their respective reports.

A review of all available literature and database relevant to the Study Area was undertaken to compile a list of vertebrate fauna species with the potential to occur with the Study Area. A total of ten assessments were reviewed and four databases searched. The literature review and database searches identified a total of 319 species of vertebrate fauna, which have previously been recorded and/ or have the potential to occur within the Study Area. This comprised 37 native mammals, nine non-native mammals, 156 birds, 103 reptiles, ten amphibians and four fish species.

A total of eight broad fauna habitat types (excluding disturbed areas) have now been recorded and mapped across the Study Area. This comprised, in increasing order of extent, Claypan, Medium Drainage Line, Rocky Breakaway, Minor Drainage Line, Sandplain, Rounded Hills, Stony Plain, and Hillcrest/ Hillslope. Two of these habitats, Rocky Breakaway and Sandplain are considered of high significance due to the ability to provide habitat for species of conservation significance. Rocky Breakaway provides potential denning and foraging habitat for the Northern Quoll (*Dasyurus hallucatus*) and the Pilbara Olive Python (*Liasis olivaceous barroni*). The Sandplain habitat provides potential habitat for Greater Bilby (*Macrotis lagotis*), Night Parrot (*Pezoporus occidentalis*), Spectacled Hare-Wallaby (*Lagorchestes conspicillatus leichardti*), and Brush-tailed Mulgara (*Dasycercus blythi*). Five habitats were considered of moderate significance, Medium Drainage Line, Minor Drainage Line, Hillcrest/ Hillslope, Rounded Hills, and Stony Plain, for the ability to provide supporting habitat for species of conservation of significance. The Medium and Minor Drainage Line habitats provide suitable dispersal and foraging habitat for the Northern Quoll, Pilbara Olive Python, Ghost Bat (*Macroderma gigas*), and Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*). The Hillcrest/ Hillslope and Rounded Hills habitat contains small rocky breakaways that provide additional denning habitat of the Northern Quoll, although such features are small in extent and sparsely distributed. Stony Plain habitat provides potential habitat for the Spectacled Hare-Wallaby and Western Pebble-mound Mouse (*Pseudomys chapmani*) and contains some suitable areas of habitat for the Night Parrot.

A total of 29 species of conservation significance have been confirmed or have the potential to occur within the Study Area, based on the results of the desktop assessment and the current field survey, comprising nine mammals, 18 birds and two reptiles. Two of these species have previously been

recorded within the Study Area, the Ghost Bat and Pilbara Leaf-nosed Bat, and two were recorded during this survey, the Northern Quoll and the Western Pebble Mound Mouse. Based on distribution, previous records and the habitats present, one species was deemed highly likely to occur, four were deemed likely to occur, four were deemed possible to occur, five may rarely occur and 11 are unlikely to occur.

Habitats of the Study Area are moderately common throughout the region. Ten surveys from the surrounding area were used in the literature review to provide contextual information on the species and habitat likely to occur; however, many others, although not all are publicly available, have been conducted. Given this, the vertebrate fauna assemblages occurring within the habitats present are relatively well-understood and documented.

The SRE database searches listed no species as having been previously recorded within the Study Area; however, the databases identified the occurrence of many groups prone to short-range endemism within the surrounding area indicating some likelihood of such groups occurring. Using broad vertebrate fauna habitat mapping, there is a high to moderate suitability for SRE's within the Study Area, particularly within the Rocky Breakaway habitats. Refer to Biologic (2019a in prep) for the faunal results of a two-phase SRE survey conducted within the Study Area after the completion of the current 2017 survey, including the full extent of any habitats suitable for SRE invertebrate fauna.

The Pilbara is regarded as being a hotspot for subterranean species both in terms of species diversity and occurrence, and as such the potential for the occurrence of such species within most landscape is relatively high. The database searches conducted did not find any subterranean fauna species previously recorded within the Study Area. Based on a review of the geologies within the Study Area, and their ability to support subterranean fauna outside the Study Area, there is a moderate potential for subterranean species to be present. Refer to Biologic (2019d in prep.) for the results of a two-phase subterranean fauna survey conducted in the Study Area after the completion of the current survey.

1 INTRODUCTION

1.1 Background

Calidus Resources Limited (Calidus) commissioned Biologic Environmental Survey Pty Ltd (Biologic) to undertake a Level 1 vertebrate fauna assessment, and a Short-range Endemic invertebrate fauna (SRE) and subterranean fauna desktop assessment for their Warrawoona Gold Project (hereafter referred to as the Study Area). The Study Area for the project covers approximately 1,822 ha is located approximately 20 km south of Marble Bar within the Pilbara region of Western Australia (Figure 1.1).

The Study Area is known to support colonies of two bat species of conservation significance, the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), and the Ghost Bat (*Macroderma gigas*). Since the current study was completed, numerous studies have been undertaken to document the occurrence and habitat of these species, including the concurrent targeted bat survey (Biologic, 2017), and specific details relating to these species can be found in these reports (Biologic, 2018, 2019e, 2019f, 2019g). As such, these species are not discussed in detail within this report.

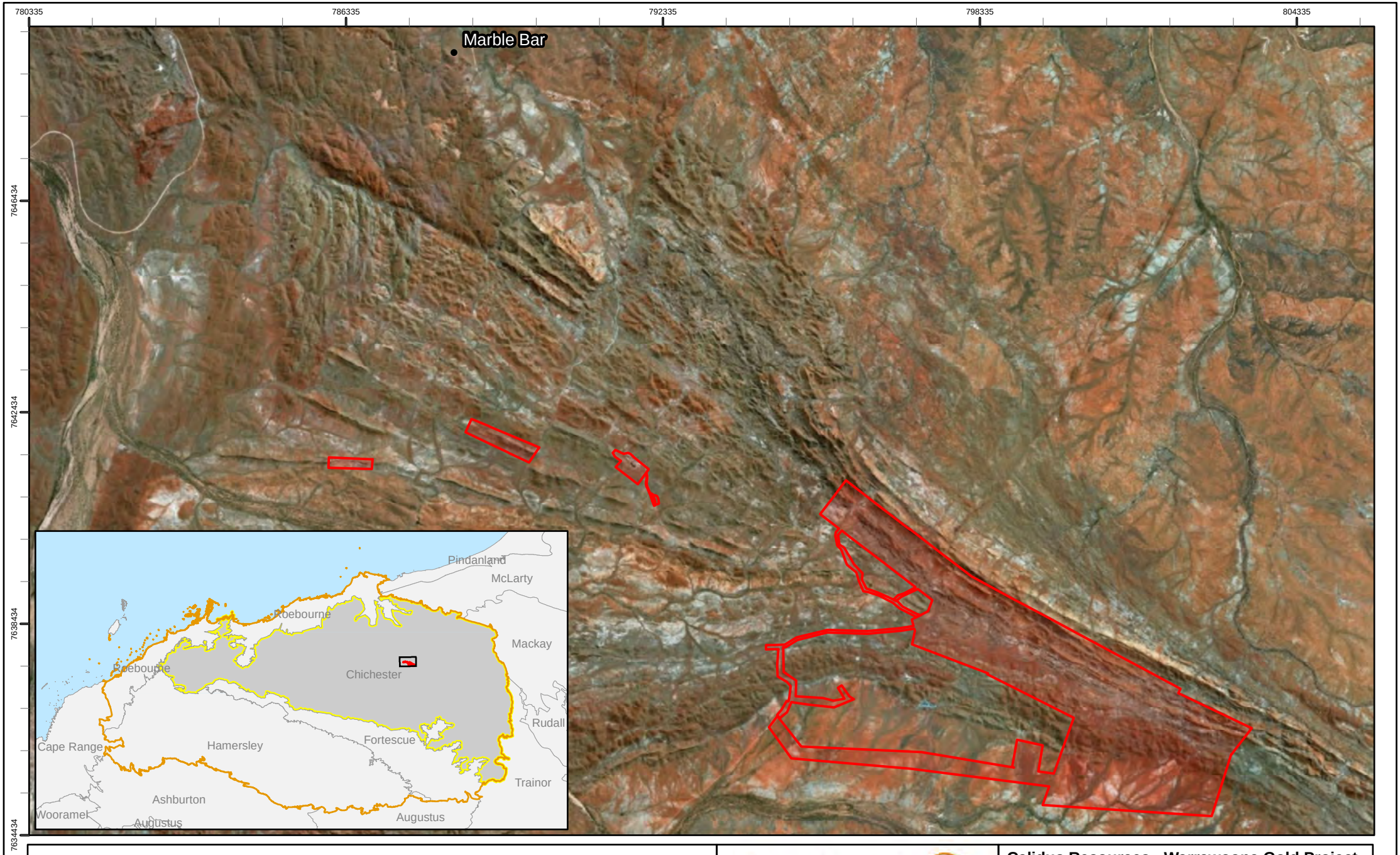
1.2 Objectives

The overarching objective of this assessment was to identify the potential occurrence of conservation significant vertebrate fauna species, and their supporting habitats, and to determine the likelihood of occurrence for SRE and subterranean fauna and advise on the requirement for future survey work. Specifically, this report provides:

- a review of vertebrate fauna recorded within the vicinity of the Study Area as an indication of species that are likely to occur within the Study Area;
- mapping of broad vertebrate fauna habitats occurring across the Study Area;
- the likelihood of occurrence for fauna considered of conservation significance (under state and federal legislation);
- a review of SRE fauna recorded within the vicinity of the Study Area, and broad fauna habitats in the Study Area, to indicate whether SRE species are likely to occur within the Study Area.
- a review of subterranean fauna recorded within the vicinity of the Study Area, of the broad geology's which comprise the Study Area, to indicate whether subterranean fauna are likely to occur within the Study Area.

This assessment was carried out in a manner consistent with the following documents from the Western Australian Environmental Protection Authority (EPA):

- Environmental Protection Authority (EPA, 2016b) Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna.
- EPA (2016e): Technical Guidance: Terrestrial Fauna Surveys
- EPA (2016c) Sampling of Short-range Endemic Invertebrate Fauna
- EPA (2016d) Technical Guidance: Subterranean Fauna Survey
- EPA (2016a) Sampling Methods for Subterranean Fauna



Legend

- Study Area
- Marble Bar

biologic Environmental Survey

N

1:90,000

0 1 2 4 km

Calidus Resources - Warrawoona Gold Project

Level 1 Fauna Assessment

Figure 1.1: Study Area and regional location

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

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1.3 Background to Protection of Fauna

1.3.1 Conservation Significance

Within Western Australia, native fauna are protected under the *Biodiversity Conservation Act 2016* (BC Act) and at a national level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action that has the potential to impact on native fauna needs to be approved by relevant state and/or federal departments as dictated by the state *Environmental Protection Act 1986* (EP Act).

Some species of fauna that are determined to be at risk of extinction or decline are afforded extra protection under these Acts. For the purposes of this report, these species are deemed to be of conservation significance. A summary of applicable legislation and status codes is provided in Table 1.1 and additional information on status codes is provided in Appendix A. A number of migratory bird species are also prioritised for conservation under international agreements and therefore protected under the EPBC Act and BC Act as Migratory.

For some species, there is insufficient information to determine their status. These species are generally considered by the EPA/DBCA as being of conservation significance for all development related approvals and are listed on a 'Priority List' that is regularly reviewed and maintained by the DBCA (Table 1.1).

Table 1.1: Definitions and terms for fauna of conservation significance

Agreement, Act or List	Status Codes
Federal	
***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)** The Department of the Environment and Energy (DoEE) lists threatened fauna, which are determined by the Threatened Species Scientific Committee (TSSC) per criteria set out in the Act. The Act lists fauna that are considered to be of conservation significance under one of eight categories (listed under 'Status Codes').	• Extinct (EX) • Extinct in the Wild (EW) • Critically Endangered (CE) • Endangered (EN) • Vulnerable (VU) • Conservation Dependent (CD) • Migratory (MG) • Marine (MA)
State	
***Biodiversity Conservation Act 2016* (BC Act)** At a state level, native fauna are protected under the *Biodiversity Conservation Act 2016*. Species in need of conservation are given a ranking ranging from Critically Endangered to Vulnerable.	• Extinct (EX) • Extinct in the Wild (EW) • Critically Endangered (CE) • Endangered (EN) • Vulnerable (VU) • Migratory (MI) • Conservation Dependent (CD) • Other Specially Protected (OS)
DBCA Priority List DBCA produces a list of Priority species that have not been assigned statutory protection under the *Wildlife Conservation Act 1950*. This system gives a ranking from Priority 1 to Priority 4.	• Priority 1 (Poorly-known species) (P1) • Priority 2 (Poorly-known species) (P2) • Priority 3 (Poorly-known species) (P3) • Priority 4 (Rare, Near Threatened, and other species in need of monitoring) (P4)

1.3.2 Short-range Endemism

Endemism refers to the restriction of a species to a particular area, whether it is at the continental, national or local scale, the latter being commonly referred to as short-range endemism (Allen *et al.*, 2006; Harvey, 2002). Short-range endemism is influenced by several factors including life history, physiology, habitat requirements, dispersal capabilities, biotic and abiotic interactions and historical conditions which not only influence the distribution of a species, but also the tendency for differentiation and speciation (Ponder & Colgan, 2002).

In recent years a number of taxonomic groups of invertebrates have been highlighted as comprising a high proportion of species likely to be regarded as SREs (i.e. Harvey, 2002; terrestrial snails, Johnson *et al.*, 2004; Mygalomorph spiders, Main *et al.*, 2000; freshwater snails, Ponder & Colgan, 2002). This identification of restricted taxonomic groups has led to SRE invertebrate fauna being recognised as a potentially significant biodiversity issue, and that SRE fauna "may be at a greater risk of changes in conservation status as a result of habitat loss or other threatening processes" (EPA, 2016c).

Harvey (2002) proposed a range criterion for terrestrial SRE species at less than 10,000 km^2 (or 100 km x 100 km), which has been adopted by regulatory authorities in Western Australia (EPA, 2016c). SRE invertebrate species often share similar biological, behavioural and life history characteristics that influence their restricted distributions and limit their wider dispersal (Harvey, 2002). For example, burrowing taxa such as mygalomorph spiders and *Urodacus* scorpions may only leave their burrows (or a narrow home territory around the burrow) as juveniles dispersing from the maternal burrow, or when males search for a mate. In other cases, SRE taxa are dispersal-limited because of their slow pace of movement and cryptic habitats (such as isopods, millipedes and snails), while some specialised taxa can be limited by very specific habitat requirements, such as selenopid spiders within fractured rocky outcrops.

An increasingly large number of terrestrial invertebrates are discovered to exhibit short-range endemism in Western Australia. While protection for listed species (species of conservation significance) and/ or Threatened or Priority Ecological Communities is provided under state and federal legislation (see Section 1.3.1), the majority of SRE species and communities are not currently listed. This is due largely to incomplete taxonomic or ecological knowledge. As such, the assessment of conservation significance for SRE is guided primarily by expert advice provided by the Western Australian Museum (WAM) and other taxonomic experts.

1.3.3 Subterranean Fauna

Subterranean fauna are animals that live underground. In Western Australia, subterranean fauna are mainly invertebrates such as crustaceans, insects, arachnids, myriapods, worms, and snails, but a small number of vertebrate taxa such as fish and reptiles have also been recorded (EPA, 2016d; Humphreys, 1999). Subterranean fauna are grouped into two major ecological categories:

- stygofauna - aquatic animals that inhabit groundwater in caves, aquifers and water-saturated interstitial voids; and
- troglofauna - air-breathing animals that inhabit air-filled caves and smaller voids above the water table.

Terrestrial and sub-surface habitats exist within a series of environmental gradients from fully aquatic (groundwater) to fully terrestrial (air-filled cavities), as well as fully above-ground (epigean) to fully below-ground (hypogean). There are some types of fauna that move between these habitats at different times in their life cycles (trogloxenes and stygoxenes), and others that can be found within any of these habitat strata at any given time (troglophiles or stygophiles) (Christiansen, 2012; Stanford & Ward, 1993). The EPA (2016d) assessment guidelines consider only obligate subterranean fauna during environmental impact assessment (EIA); comprising troglobites and stygobites (i.e. animals which live their entire lives in the hypogean zone).

Obligate subterranean species, which cannot occur on the surface or in soil habitats, are considered most likely to be SRE, based on the often-restricted extent of their geological or hydrogeological habitats (Harvey, 2002; Howarth, 1983; Humphreys *et al.*, 2009). This high propensity for short-range endemism in troglobites and stygobites increases the possibility that species may be negatively impacted as a result of a proposed development (EPA, 2016d).

Troglobites and stygobites often display evolutionary adaptations to underground life, for example reduced pigment, reduced or vestigial wings, reduced cuticle thickness, elongation of sensory appendages, and reduced eyes or eyelessness. Additional adaptations to underground life can include changes to physiology, lifecycle, metabolism, feeding and behaviour (Christiansen, 2012; Coineau, 2000; Gibert & Deharveng, 2002).

Western Australia's subterranean fauna is considered globally significant due to an unprecedented richness of species and high levels of short-range endemism (EPA, 2016d). While protection for listed species (species of conservation significance) and/ or Threatened or Priority Ecological Communities is provided under state and federal legislation (see Section 1.3.1), the majority of subterranean species and communities are not currently listed. This is due largely to incomplete taxonomic or ecological knowledge. As such the assessment of conservation significance for SRE is guided primarily by expert advice provided by the WAM and other taxonomic experts. Consideration of range-restricted subterranean fauna is therefore important, as these have a higher potential of being SRE species (following Eberhard *et al.*, 2009; and Harvey, 2002).

2 ENVIRONMENT

2.1 Biogeography

The Study Area is located within the Pilbara bioregion (Figure 1.1), as defined by the Interim Biogeographic Regionalisation of Australia (IBRA; Thackway & Cresswell, 1995). The Pilbara bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges (Thackway & Cresswell, 1995). Vegetation is predominantly mulga low woodlands or snappy gum over bunch and hummock grasses (Bastin, 2008).

Within the Pilbara bioregion the Study Area is located within the Chichester (PIL 1) subregion. The Chichester subregion is comprised of undulating Archaean granite and basalt plains with areas of basaltic ranges (Kendrick & McKenzie, 2001). The plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur through the ranges (Kendrick & McKenzie, 2001).

2.2 Climate

The Pilbara bioregion has a semi-desert to tropical climate, with rainfall occurring sporadically throughout the year, although mostly during summer (Thackway & Cresswell, 1995). Summer rainfall is usually the result of tropical storms in the north or tropical cyclones that impact upon the coast and move inland (Leighton, 2004). The winter rainfall is generally lighter and is the result of cold fronts moving north easterly across the state (Leighton, 2004). The average annual rainfall ranges from 200-350 mm, although there are significant fluctuations between years (BoM, 2017), with up to 1,200 mm falling in some locations in some years (McKenzie *et al.*, 2009).

Long-term climatic data is not available for the Study Area itself; however, long term climatic data is available from the Bureau of Meteorology (BoM) weather station at Marble Bar located approximately north of the Study Area (BoM, 2017). The Marble Bar weather station is expected to provide the most accurate long-term average (LTA) dataset for climatic conditions experienced within the Study Area (Figure 2.1).

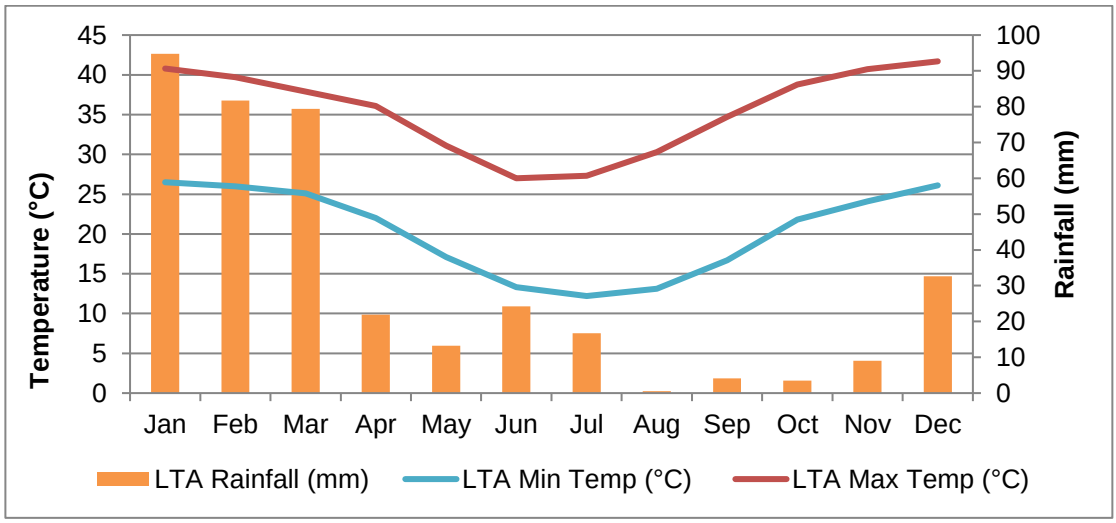


Figure 2.1: Long-term monthly average rainfall and temperature from Marble Bar (BoM 2017)

2.3 Topography and Drainage

The average annual rainfall at Marble Bar weather station is 381.2 mm, but rainfall occurs mainly as intense tropical summer storms, and annual totals vary greatly. Watercourses flow only after prolonged heavy rain as short-duration flooding with rapid peaks and slightly less rapid decline.

The Brockman Hay Cutting Creek, which intersects the south-western section of the Study Area (Figure 2.2), runs west into Coongan River, a tributary of the De Grey River system. The Warrawoona Range runs along the north-eastern border of the Study Area. Areas in the south-west of the Study Area, and to the north-west beyond the Study Area are comparatively low lying with elevations of 230-300 m (Figure 2.2). The highest peak in the area is Warrawoona Peak with an elevation of 398 m.

2.4 Vegetation

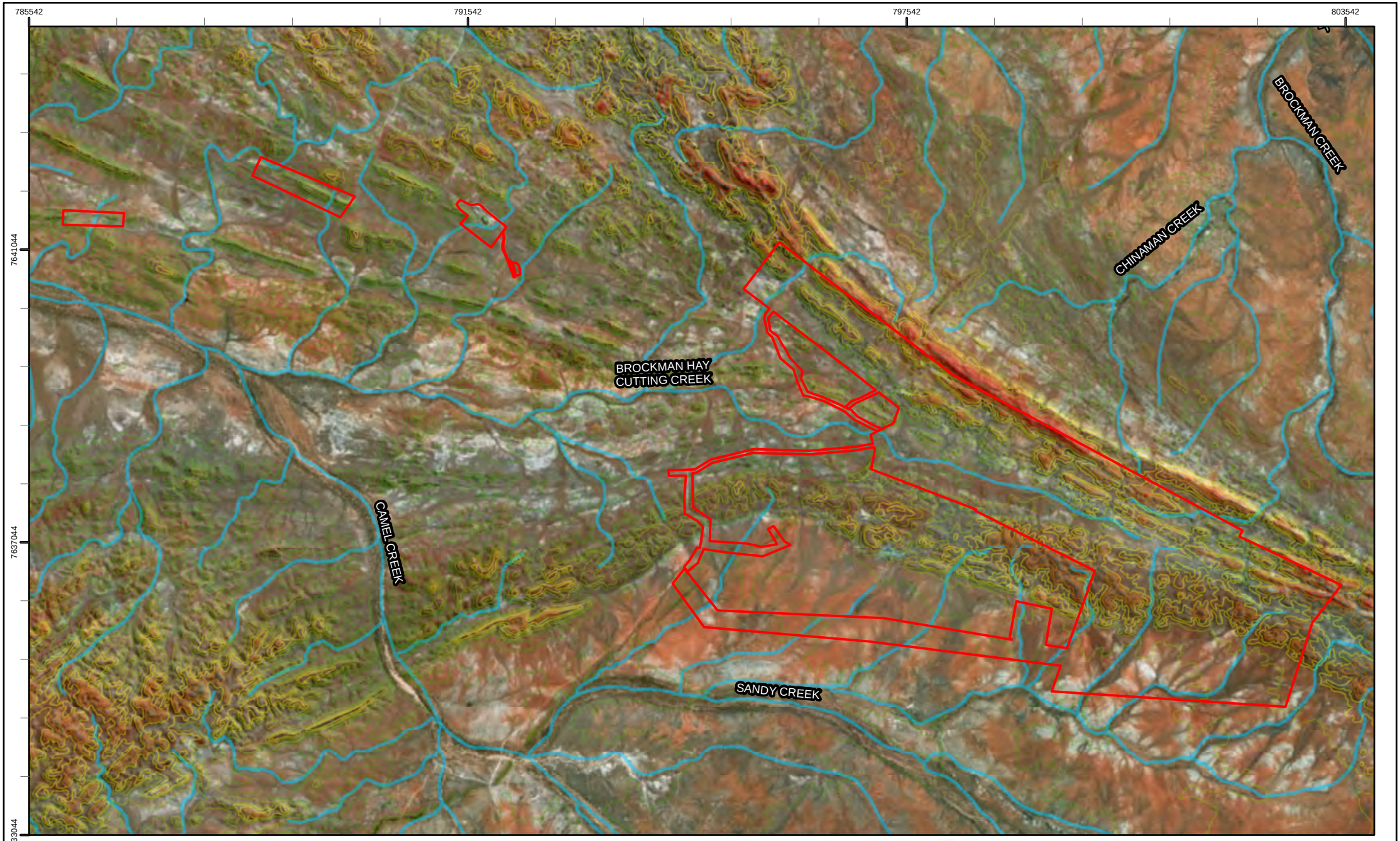
The Study Area is situated in the George Ranges, which forms part of the Pilbara Botanical District in the Eremaean Botanical Province of Western Australia (Beard, 1975). Two broad vegetation associations are described from the Study Area; George Ranges (82; Hummock grasslands with low tree steppe of snappy gum over *Triodia wiseana*) and Abydos Plain (93; Hummock grasslands, shrub steppe; kanji over soft spinifex) (Figure 2.3). This vegetation association is common at the subregional and regional level and widespread through both the Chichester and Hamersley IBRA subregion (Shepherd *et al.*, 2002).

2.5 Land Systems

The land systems of the Pilbara region are classified according to similarities in landform, soil, vegetation, geology and geomorphology, following van Vreeswyk *et al.* (2004). Three land systems are mapped across the Study Area, categorised by two distinct land types; hills and ranges with spinifex grasslands, and Stony plains with spinifex grasslands (Table 2.1: Figure 2.4). The most dominant land system within the Study Area is the Talga land system, defined as hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands, which occurs across 58.62 % of the Study Area.

Table 2.1: Land Systems of the Study Area

Land System	Land Type	Description	Extent in Study Area	
			Ha	%
Talga	Hills and ranges with spinifex grasslands	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.	1068	58.62
Rocklea	Hills and ranges with spinifex grasslands	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands.	255	14.00
Macroy	Stony plains with spinifex grasslands	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands.	499	27.38
Total			1822	100



Legend

- Study Area
- Watercourses

Elevation Contours

- 230-260 meters
- 260-280 meters
- 280-300 meters
- 300-330 meters
- 330-390 meters

biologic Environmental Survey

N

1:65,000

0 0.75 1.5 3 km

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Figure 2.2: Topography and drainage of the Study Area

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

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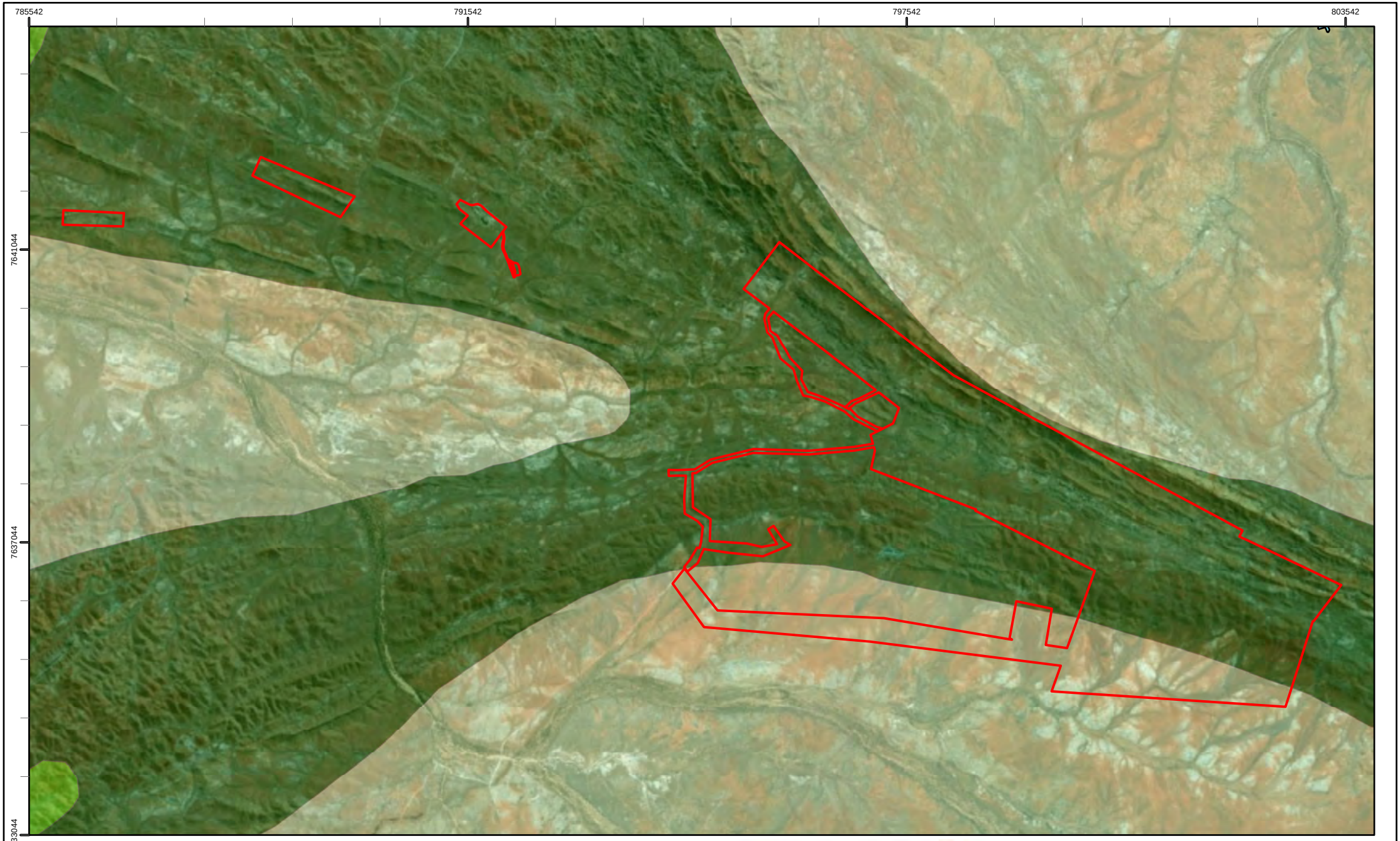

Legend

Study Area

Vegetation Associations

- 587 - George Ranges
- 93 - Abydos Plain
- 82 - George Ranges

biologic Environmental Survey

N

1:65,000

0 0.75 1.5 3 km

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Level 1 Fauna Assessment

Figure 2.3: Pre-European vegetation of the Study Area

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

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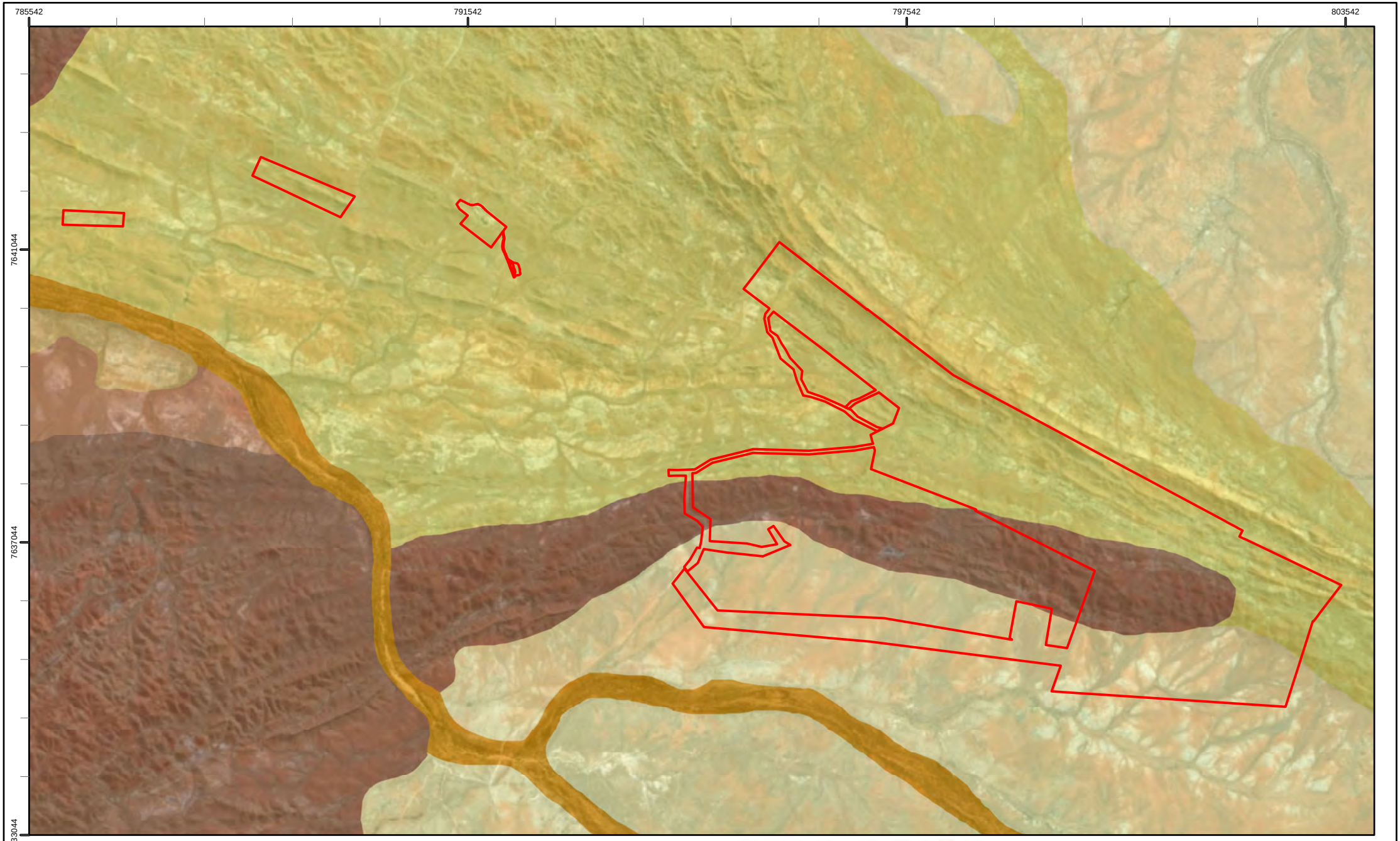

Legend

- Study Area
- **Land Systems**
- Boolgeeda
- Calcrete
- Macroy
- River
- Rocklea
- Talga

biologic Environmental Survey

N

1:65,000

0 0.75 1.5 3 km

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Level 1 Fauna Assessment

Figure 2.4: Land Systems of the Study Area

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

Size A4. Created 09/07/2019

3 METHODOLOGY

3.1 Vertebrate Fauna

3.1.1 Desktop Assessment

Literature Review

A review of all available literature relevant to the Study Area was undertaken to compile a list of vertebrate fauna species with the potential to occur with the Study Area (Appendix B). A total of ten fauna assessments undertaken prior to the current 2017 survey were reviewed, comprising eight Level 2 surveys, one long-term research focussed survey and one targeted Pilbara Leaf-nosed Bat and Ghost Bat survey (Table 3.1).

Table 3.1: Literature sources used for the review

Survey Title	Reference	Survey Type	Distance from Study Area (km)
Corunna Downs Project: Terrestrial Vertebrate Fauna Survey	MWH (2016)	Level 2	~26 km SW
Panorama Project Area Baseline Fauna Study as Part of the Sulphur Springs Feasibility	Bamford Consulting Ecologists (2001)	Level 2	~59 km NWW
Giralia Resources NL Mount Webber Iron Ore Project Vertebrate Fauna Assessment	ecologia Environment (2010)	Level 2	63 km SW
Panorama Project Mine Site and Haul Road Corridor Targeted Fauna Survey	Biota (2007)	Level1 – Plains Access Road and Level 2 - Valley Access Road	~69 km NWW
Field survey for conservation significant bats near Sulphur Springs, Pilbara	Molhar (2007)	Targeted Survey for Pilbara Leaf-nosed Bat and Ghost Bat	~69 km NWW
Fauna Assessment of the BC Iron Nullagine Iron Ore Project	Bamford Consulting Ecologists (2009b)	Level 2	~70 km SSE
Fauna Assessment of the Abydos DSO Project	Bamford Consulting Ecologists (2009a)	Level 2	~77 km NW
Abydos DSO Project Terrestrial Vertebrate Fauna Baseline Survey	Outback Ecology (2011)	Level 2	~77 km NW
Ecological Survey of Abydos-Woodstock Reserve, Pilbara Region, Western Australia	How *et al.* (1991a)	Long Term Scientific Study	90 km W
North Star Project Level 2 Terrestrial Vertebrate Fauna Assessment	ecologia Environment (2012)	Level 2	~100 km NWW

Database Searches

Four fauna databases were searched (Table 3.2), two to obtain information on all species previously recorded (NatureMap and Birdlife Birdata), one to identify species of conservation significance previously recorded (Department of Biodiversity Conservation and Attractions

(DBCA Threatened Fauna Database), and one to identify species of conservation significance known or likely to occur within the region (Protected Matters Database).

Table 3.2: Details of database searches conducted

Provider	Reference	Database	Parameters
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA (2017b)	NatureMap. Accessed 11 October 2017	Circle of radius 40 km centred on the coordinates: 21° 20' 08" S, 119° 53' 16" E,
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA (2017c)	Threatened Fauna Database. Received 14 November 2017	Circle of radius 50 km centred on the coordinates: -21.3355 S, 119.8877 E
BirdLife Australia	Birdlife Australia (2017)	Birdata Custom Bird Atlas. Received 13 October 2017	Circle of radius 40 km centred on the coordinates: -21.3355 S, 119.8877 E
Department of Environment and Energy (DoEE)	DoEE (2017)	Protected Matters Database Search Tool. Accessed 11 October 2017	Circle of radius 40 km centred on the coordinates: -21.3355 S, 119.8877 E

3.1.2 Field Survey

The assessment was undertaken from the 20th to 24th of September 2017 by two senior zoologists, Morgan O'Connell and Thomas Rasmussen, whom both have extensive experience with fauna in the Pilbara.

The field survey was conducted concurrently to a targeted bat survey conducted across the Study Area (Biologic, 2017). Additional opportunistic species records were also noted during the 2018 Northern Quoll and Night Parrot Targeted Survey (8th - 15th July 2018; Biologic, 2019c); and additional habitat mapping was conducted during the 2019 Northern Quoll, Night Parrot and Greater Bilby Targeted Survey (5th - 10th April 2019; Biologic, 2019b). The results of these additional surveys can be found in their respective reports.

Habitat Assessments and Mapping

Habitat assessments across the Study Area were undertaken at 12 locations during the survey, as well as an additional four by Biologic (2019c) and 40 by Biologic (2019b) (Figure 3.1). Habitats in the Study Area were assessed using methodology and terminology modified from the Australian Soil and Land Survey Field Handbook (National Committee on Soil and Terrain, 2009). The characteristics recorded during the habitat assessments were:

- site information, photo and location;
- landform: slope, relative inclination of slope, morphological type and landform type;
- vegetation: leaf litter %, twig litter %, wood litter, dead stags and hollow bearing trees, broad floristic formation, vegetation structure (tall, mid and low), and dominant species;
- land surface: micro relief, sheet erosion, rill erosion, gully erosion, gully depth, abundance and size of coarse fragments, rock outcropping, water bodies, comments on nests, burrows, roosts and diggings;

- soil: texture, colour;
- substrate: bare ground, rock size, rock type, rock outcropping; and
- disturbance: time since last fire, evidence of weeds, grazing, or human disturbances.

The extent and continuity of habitat extending beyond the habitat assessments was assessed with the aid of a remotely piloted aircraft. (RPA, Figure 3.1)

Fauna habitats were assessed for the likelihood that they may support conservation significant fauna. All major fauna habitats present within the Study Area were rated (High, Moderate or Low) per the criteria in Table 3.3.

Table 3.3: Fauna habitat significance assessment criteria

Score	**Possible criteria** (score results from any possible criterion being met)
High	Fauna listed as threatened on the EPBC Act or BC Act have been recorded within the habitat.
	Habitat is known to be suitable core habitat for EPBC listed species, and there are records of the species within 50 km. If survey work in the vicinity of the Study Area has been limited, then the species will be considered likely to be present, using a precautionary approach.
	Habitat is uncommon (regionally) and considered critical for DBCA listed Priority fauna. For example, if the habitat for a Priority species is limited in the region and the extent within the Study Area forms a large proportion of the known habitat, it would be scored 'high'.
	Habitat that only occurs in small, isolated geographic areas.
Moderate	Habitat is known to supports DBCA listed Priority fauna that do not occur in any of the other habitat types.
	Habitat that supports EPBC Act listed Migratory fauna. Habitat may be used by EPBC Act listed fauna but it is not their core habitat (i.e. may be used periodically/ seasonally or for dispersal).
	Habitat supports a particularly diverse and uncommon faunal assemblage. Habitat that occurs throughout region, and does not occur in small or isolated areas, is excluded.
Low	Habitat is widespread, common, and does not solely support any significant fauna.

Motion Cameras

Thirteen Bushnell Trophy Cam motion cameras were deployed during the current 2017 survey for a total of 34 sampling nights to survey for species of conservation significance, specifically the Northern Quoll (Appendix B). The configuration of sites and the sampling effort followed recommendations of DoE (2016). Cameras were baited, allowing detailed inspection of an individual's patterning to assist with future population estimates.

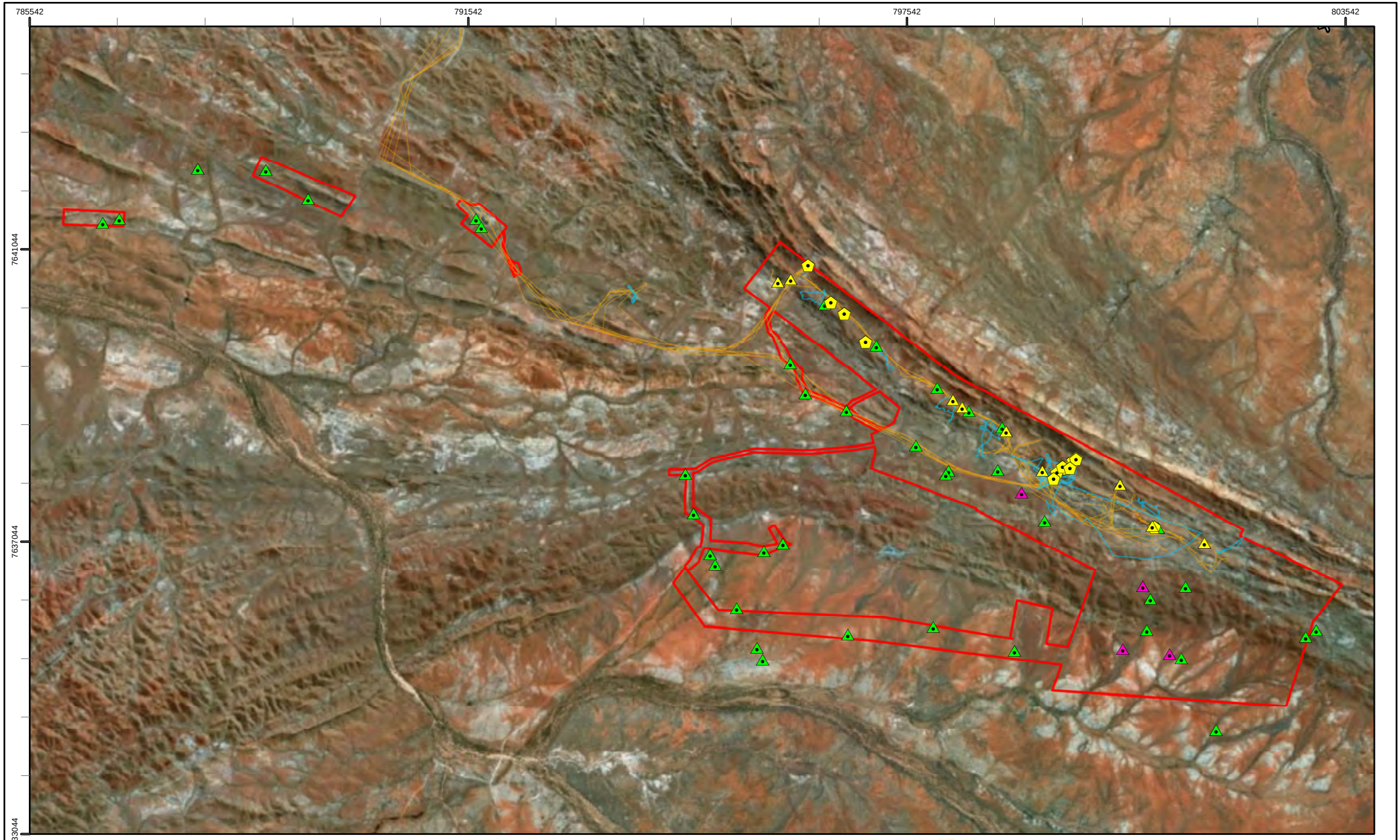
Opportunistic Vertebrate Fauna Records

Opportunistic records of vertebrate species encountered during the survey were documented. Birds were recorded on a presence/absence basis, determined by call identification, visual identification and/or tracks and traces.

Taxonomy and Nomenclature

The latest checklist of mammal, reptile and amphibian names published by the Western Australian Museum (WAM, 2017b) was used as a guide to the current taxonomy and

nomenclature of these groups. For birds, the current checklist of Australian birds maintained by Birds Australia (based on Christidis & Boles, 2008) was used in conjunction with the WAM species list (WAM, 2017b).



Legend

- Study Area
- RPA Flight Paths
- Tracks Covered for Field Personal

Current Survey

- Habitat Assessment
- Motion Camera

July 2018 (Biologic, 2019b)

- Habitat Assessment

April 2019 (Biologic, 2019a)

- Habitat Assessment

biologic Environmental Survey

N

1:65,000

0 0.75 1.5 3 km

Calidus Resources - Warrawoona Gold Project

Level 1 Fauna Assessment

Figure 3.1: Vertebrate fauna sampling locations within the Study Area

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

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3.1.3 Likelihood of Occurrence for Fauna of Conservation Significance

Conservation significant fauna species recorded from the databases and previous reports were assessed for their likelihood to occur within the Study Area using the decision matrix below (Table 3.4).

Table 3.4: Species likelihood of occurrence decision matrix

Range categories:	Habitat Categories				
	Core habitat known to occur	**Foraging habitat known to occur**	**Dispersal habitat known to occur**	**Potential dispersal habitat**	**No known habitat occurs**
Species recorded <5 km	Highly Likely	Likely	Likely	Possible	Possible
Species recorded 5-10 km	Likely	Likely	Possible	Possible	Rarely
Species recorded 10-40 km	Likely	Possible	Possible	Rarely	Unlikely
Species recorded >40 km	Possible	Possible	Rarely	Rarely	Unlikely
Species rarely recorded in region	Possible	Rarely	Unlikely	Unlikely	Highly Unlikely

This decision matrix is only intended to be an indicative guide, and was applied with the following considerations:

- The range categories are subject to interpretation based on the known range of each species and its natural dispersal capabilities (for example, >50km range may be a significant distance for a fossorial skink, but not a migratory bird);
- Both the range categories and the habitat categories can vary markedly for different types of fauna such as birds, reptiles, mammals, and amphibians, and fauna with different ecological niches within each of these groups;
- The degree of habitat specificity for each species is a major determining factor for each of the habitat categories, and this in turn is dependent on the current state of ecological knowledge of the species. For example, core habitat for Ghost Bat is only certain caves within mountainous terrains, whereas core habitat for the *Anilios ganei* can be most habitat types in the Pilbara. This may also differ between different populations of the same species in different bioregions, such as Northern Quoll, which has a broader core habitat in the Northern Pilbara (comprising gorges/ gullies, drainage lines, and hills/ ridges) than in the Hamersley Ranges (core habitat is primarily gorges/ gullies);
- The amount and location of previous sampling is a major factor influencing the applicability of the range categories, as well as the amount of effort that has been expended in (and the accessibility of) the area in question for sampling;

- The current state of taxonomy is another major factor for species that are poorly known taxonomically and thus difficult to identify accurately, as well as for any recent changes of classification and/or conservation category. Such taxonomic changes can affect the reliability of previous records within fauna databases, the conservation status of the newly defined species/ populations, and the assumptions regarding species ranges and habitat preferences; and
- The language used in each of the habitat and range categories may be useful for some taxa and not for others (for example, 'rarely' occurrences may be useful for describing birds or fauna which can traverse large distances, but in the case of fauna with more limited dispersal capabilities such as reptiles, there is no basis for 'rarely' occurrences. Such likelihoods may be more likely to represent range extensions.

3.2 Short-range Endemic Invertebrate Fauna

3.2.1 Desktop Assessment

Three databases were searched for SRE invertebrate fauna records within and surrounding the Study Area to determine the likely SRE fauna values (Table 3.5).

Table 3.5: Databases used for the review

Database	Date Accessed	Parameters
NatureMap (DBCA, 2017b)	11 October 2017	40 km radius from point: -21.33556, 119.88778
WAM Arachnida/ Myriapoda (WAM, 2017a)	3 October 2017	Bounding Box (40,000km^2) using points: Northwest -20.873353°S, 119.402942°E Southeast -21.759124°S, 120.383664°E
WAM Crustacea and Mollusca (WAM, 2017c, 2017d)	3 October 2017	Bounding Box (40,000km^2) using points: Northwest -20.873353°S, 119.402942°E Southeast -21.759124°S, 120.383664°E

Within these databases, records of mygalomorph spiders, selenopid spiders, pseudoscorpions, scorpions, millipedes, terrestrial snails, and isopods were targeted. Within the WAM databases, a distribution criterion of 40,000 km^2 was applied (following Harvey, 2002), thereby selecting species within these groups where the known records occur within 40,000 km^2. Indeterminate records were excluded, except where generic level characters and distribution information was sufficient to point to a high likelihood that the species could be SRE.

3.3 Subterranean Fauna

3.3.1 Desktop Assessment

Three databases were searched for subterranean fauna records (Table 3.6). All records were filtered based on collection methods and known stygofauna/ troglofauna taxonomic groups where information on subterranean status (i.e. hypogean subterranean/ soil fauna/ surface fauna) was not present.

Table 3.6: Databases searched for subterranean fauna records

Database	Date Accessed	Parameters
NatureMap (DBCA, 2017b)	11 October 2017	40 km radius from point: -21.33556, 119.88778
WAM Arachnida/ Myriapod (WAM, 2017a)	3 October 2017	Bounding Box (40,000km^2) using points: Northwest -20.873353°S, 119.402942°E Southeast -21.759124°S, 120.383664°E
WAM Crustacea and Molluscs (WAM, 2017c, 2017d)	3 October 2017	Bounding Box (40,000km^2) using points: Northwest -20.873353°S, 119.402942°E Southeast -21.759124°S, 120.383664°E

3.4 Limitations

The EPA (2016e) outlines several potential limitations to vertebrate fauna surveys. These aspects are assessed and discussed in Table 3.7 below. The likelihood of conservation significant fauna occurring was based on such interpretation, in conjunction with previous records from within and surrounding the Study Area. Regarding SRE and subterranean fauna, this desktop assessment was based on the finding from previous literature sources and database searches only, and no field assessment was conducted to verify information from third-party sources.

Table 3.7: Survey limitations and constraints

Potential limitation or constraint	Applicability to this survey
Experience of personnel.	The field personnel involved in the survey, Senior Zoologists Morgan O'Connell and Thomas Rasmussen, both have extensive experience with fauna surveys in the Pilbara, with more than 10 years of fauna survey experience in the Pilbara.
Scope (faunal groups sampled and whether any constraints affect this)	The scope was a Level 1 survey and was conducted within that framework. Limited targeted searching was undertaken by the field personal; this reduced the ability to detect all species present, particularly species of conservation significance. Additionally, the survey was undertaken over one season reducing the ability to detect some fauna. However the survey was completed in line with the scope or a Level 1 survey (EPA, 2016b, 2016e).
Proportion of fauna identified	All observed fauna were identified at the point of observation.
Sources of information (recent or historic) and availability of contextual information	A significant amount of survey work has been undertaken in the wider local area and the surrounding region, and the majority of these previous survey results were available for review. DBCA has also undertaken the Pilbara Biological Survey, which provided information on regional distribution of selected species. These reports were available at the time of reporting.
Proportion of the task achieved	A Level 1 survey of the Study Area was completed and related to the results of surveys in the broader area.
Disturbances (e.g. fire or flood)	No temporary disturbance impinged on the results of the Survey. The Study Area has experienced historical disturbance which is likely to influence the species present. However, this is a feature of the Study Area.
Intensity of survey	A Level 1 survey was undertaken across the Study Area to assist with decisions on the level and requirement for future survey work.
Completeness of survey	The survey was adequately completed to meet the requirements of a Level 1.
Resources (e.g. degree of expertise available)	All resources required to complete the survey were available.
Remoteness or access issues	The majority of the Study Area was accessible either by vehicle or on foot, thus the sampling techniques used during this survey were unconstrained by accessibility or remoteness.

4 RESULTS AND DISCUSSION

4.1 Vertebrate Fauna

4.1.1 Desktop Assessment

The literature review and database searches identified a total of 319 species of vertebrate fauna, which have previously been recorded and/ or have the potential to occur within the Study Area. This comprised 37 native mammals, nine non-native mammals, 156 birds, 103 reptiles, ten amphibians and four fish (Appendix C). Note that some of these species are unlikely to occur in the Study Area as the database searches were undertaken over a larger area than the Study Area itself, therefore containing habitats that do not necessarily occur within the Study Area. Additionally, many species tend to be patchily distributed even where appropriate habitats are present, and many species of birds can occur as regular migrants, occasional visitors or vagrants.

Of the 319 species of vertebrate fauna identified as being previously recorded and/ or having the potential to occur, 29 species are of conservation significance, comprising nine mammals, 18 birds and two reptiles (Table 4.1). Two of these species have previously been recorded within the Study Area; Ghost Bat and Pilbara Leaf-nosed Bat (DBCA, 2017c). An additional species *Cyclodomorphus branchialis* (Vulnerable, BC Act) was also identified from a previous study however this species has since undergone taxonomic revision and within the Pilbara is listed as *Cyclodomorphus melanops* (Shea & Miller, 1995), a common and widespread species not considered to be of conservation significance.

Table 4.1: Species of conservation significance identified and their conservation status

Common Name	Scientific Name	Current Conservation Status	
		EPBC Act	BC Act
Mammals			
Northern Quoll	*Dasyurus hallucatus*	EN	EN
Greater Bilby	*Macrotis lagotis*	VU	VU
Ghost Bat	*Macroderma gigas*	VU	VU
Pilbara Leaf-Nosed Bat	*Rhinonicteris aurantia*	VU	VU
Northern Brushtail Possum	*Trichosurus vulpecula arnhemensis*		VU
Spectacled Hare-wallaby	*Lagorchestes conspicillatus leichardti*	-	P3
Brush-tailed Mulgara	*Dasycercus blythi*	-	P4
Long-tailed Dunnart	*Sminthopsis longicaudata*	-	P4
Western Pebble-mound Mouse	*Pseudomys chapmani*	-	P4
Birds			
Curlew Sandpiper	*Calidris ferruginea*	CR/MI	VU/MI
Night Parrot	*Pezoporus occidentalis*	EN	CR

Common Name	Scientific Name	Current Conservation Status	
		EPBC Act	BC Act
Australian Painted Snipe	*Rostratula australis*	EN	EN
Grey Falcon	*Falco hypoleucos*	-	VU
Glossy Ibis	*Plegadis falcinellus*	-	MI
Peregrine Falcon	*Falco peregrinus*	-	OS
Oriental Pratincole	*Glareola maldivarum*	MI	MI
Barn Swallow	*Hirundo rustica*	MI	MI
Common Greenshank	*Tringa nebularia*	MI	MI
Common Sandpiper	*Actitis hypoleucos*	MI	MI
Fork-tailed Swift	*Apus pacificus*	MI	MI
Grey Wagtail	*Motacilla cinerea*	MI	MI
Oriental Plover	*Charadrius veredus*	MI	MI
Pectoral Sandpiper	*Calidris melanotos*	MI	MI
Sharp-tailed Sandpiper	*Calidris acuminata*	MI	MI
Wood Sandpiper	*Tringa glareola*	MI	MI
Yellow Wagtail	*Motacilla flava*	MI	MI
Osprey	*Pandion haliaetus*	MI	MI
Reptiles			
Pilbara Olive Python	*Liasis olivaceus barroni*	VU	VU
Black-lined Ctenotus	*Ctenotus nigrilineatus*		P1

4.1.2 Fauna Habitats

A total of eight broad fauna habitat types are recorded and mapped across the Study Area (excluding disturbed areas). These comprise, in increasing order of extent, Claypan, Medium Drainage Line, Rocky Breakaway, Minor Drainage Line, Sandplain, Rounded Hills, Stony Plain, and Hillcrest/ Hillslope (Table 4.2; Figure 4.1). Two of these habitats, Rocky Breakaway and Sandplain are considered of high significance due to the ability to provide habitat for species of conservation significance. Rocky Breakaway provides potential denning and foraging habitat for the Northern Quoll and the Pilbara Olive Python. The Sandplain habitat provides potential habitat for Greater Bilby, Night Parrot, and Brush-tailed Mulgara.

Five habitats were considered of moderate significance, Medium Drainage Line, Minor Drainage Line, Hillcrest/ Hillslope, Rounded Hills, and Stony Plain, for the ability to provide supporting habitat for species of conservation of significance. The Medium and Minor Drainage Line habitats provide suitable dispersal and foraging habitat for the Northern Quoll, Pilbara Olive Python, Ghost Bat, and Pilbara Leaf-nosed Bat. The Hillcrest/ Hillslope and Rounded Hills habitat contains small rocky breakaways that provide additional denning habitat of the Northern Quoll, although such features are small in extent and sparsely distributed. Stony Plain habitat provides potential habitat for the Spectacled Hare-Wallaby and Western Pebble-mound Mouse

and contains some suitable areas of habitat for the Night Parrot. The remaining habitat (Claypan) was deemed to have a low significance as it either does not support species of high conservation value and/ or such species are not dependent on the habitats at the broad-scale. Descriptions of the distinguishing characteristics and the occurrence inside and outside of the Study Area for each of these habitat types are presented in Table 4.2, and the data from on-site habitat assessments are presented in Appendix F.

The condition of habitats within the Study Area ranged from Excellent to Pristine. The largest disturbance was caused by mining explorations (a large portion of the Study Area has been exposed to historical mining and mineral exploration with 78 registered mines located within the Study Area (a large portion of the Study Area has been exposed to historical mining and mineral exploration with 78 registered mines located within the Study Area, DMIRS, 2017), grazing by Cattle (*Bos taurus*) and clearing of road/ access tracks (Appendix F). The occurrence of weeds, particularly Buffel Grass (*Cenchrus ciliaris*) was apparent in the Medium Drainage Line (north-western portion of the Study Area).

4.1.3 Fauna Habitat Features

No semi-permanent or permanent waterbodies were recorded within the Study Area during the survey. It is likely that temporary waterbodies, such as in the Claypan and Medium Drainage Line habitats, will be present in the Study Area after significant rainfall events.

No significant caves were recorded within the Study Area and none are likely to occur based on the habitats present. However, a concurrent study (Biologic, 2017), aimed at identifying the presence of the Pilbara Leaf-nosed Bat and Ghost Bat, did identify 81 disused mines and mine adits. At the time of this targeted bat study, of the 81 sites identified, 31 were noted as having the potential to provide habitat for bats of conservation significance. These sites were differentiated from other sites because they represented deep shafts or adits and contained suitable foraging resources i.e. water. Further detail on these is presented in Biologic (2017).

Table 4.2: Fauna habitat descriptions

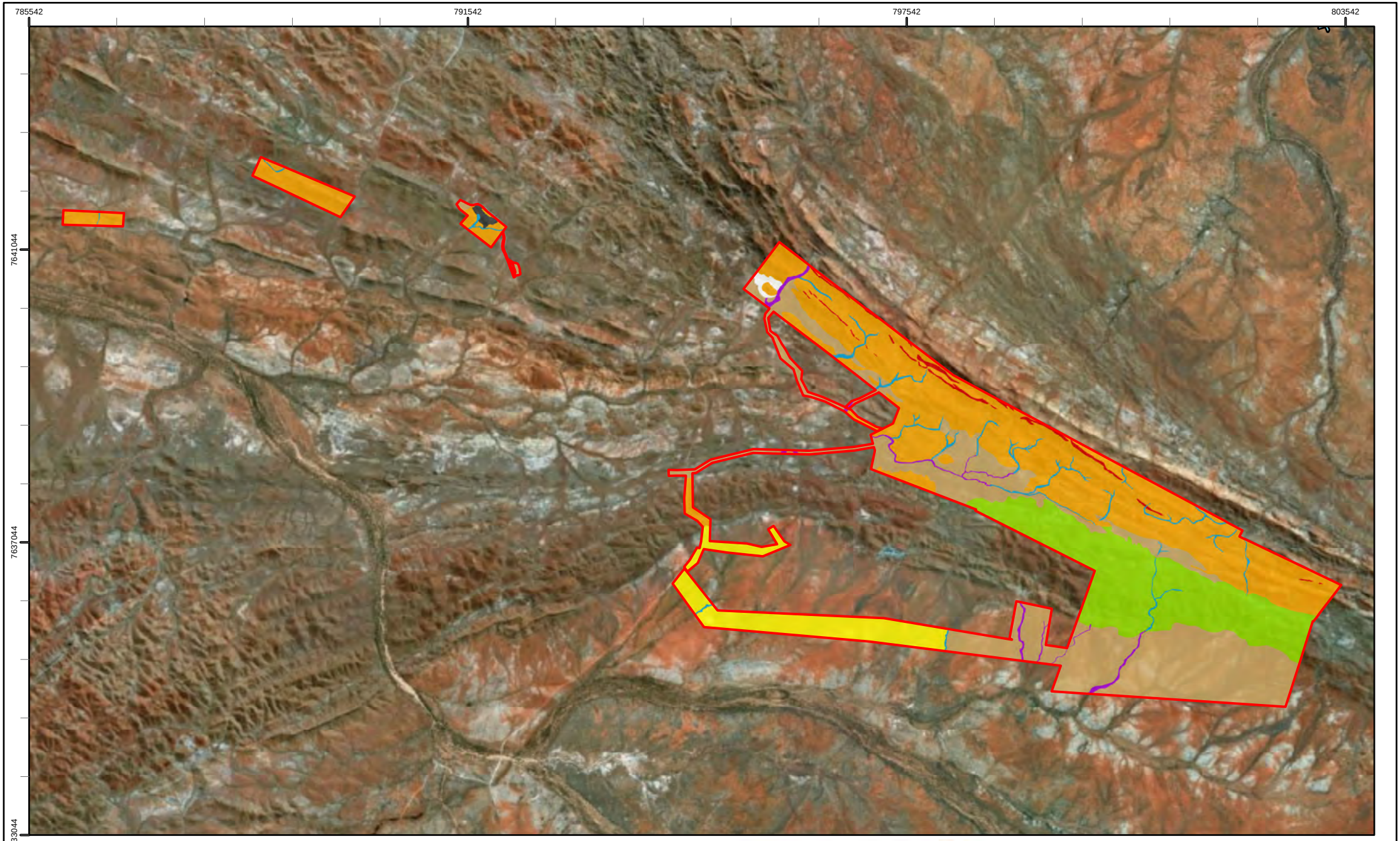
Habitat	Distinguishing habitat characteristics	Extent of the habitat	Conservation Significant Species	Photo
Hillcrest/ Hillslope **718 ha** **39.42 %** **Significance: Moderate**	This habitat comprises hills and undulating plains on the tops of ranges, supporting hard spinifex with a mantle of gravel and pebbles. Vegetation was dominated by a *Triodia* hummock grassland with scattered *Eucalyptus leucophloia* trees and mallee and Acacia and *Grevillea* shrubs. The primary microhabitat is the spinifex hummocks. This habitat was differentiated from the remaining habitat by the lack of rocky outcropping and lack of vegetation diversity.	This habitat was the most widespread and dominant habitat within the Study Area. The habitat comprised the large ranges, characteristic of the region and was intersected by drainage lines. The Hillcrests and Slopes habitat is a characteristic habitat type of the Pilbara region. habitat is scarce outside the Pilbara, at least not with the same composition of biota. The flora and fauna which comprise this habitat are most like Stony Plains that occur at lower altitudes and are common throughout the region. As such the fauna which occupy this habitat type are generally common, widespread at a regional level and are well represented within the regions conservation estate.	Suitable for: • Northern Quoll • Western Pebble-mound Mouse	

Habitat	Distinguishing habitat characteristics	Extent of the habitat	Conservation Significant Species	Photo
Stony Plain **548 ha** **30.07 %** **Significance: Moderate**	Scattered Acacia and small shrubs over dense spinifex hummock grasslands on red stony clay soil with some exposed outcrops. These are erosional surfaces of gently undulating plains, ridges and associated footslopes. Supporting little to no vegetation besides some scattered trees, with a mantle of gravel and pebbles.	The Stony Plain habitat spans along the western margins of the Study Area. The habitat lies adjacent to the Hillcrest/ Hillslopes in the north and east and intersected by the Minor Drainage Line and Medium Drainage Line habitats. The Stony Plain is one of the most common and widespread habitat types within the Pilbara region. The vegetation and substrate which make up this habitat type are characteristic features of the Pilbara region. Much of this habitat type is contained within conservation estate both at a subregion and regional level.	Suitable for: • Western Pebble-mound Mouse • Spectacled Hare-wallaby • Black-lined Ctenotus • Night Parrot	
Rounded Hills **339 ha** **18.61 %** **Significance: Moderate**	This habitat type comprised a series of undulating rounded hills and gentle to steep slopes rising occasionally to isolated areas of Rocky outcrop, as well as shallow/ open gullies leading to drainage foci in the valleys	This habitat type comprised a large area in the central zone of the Study Area between the main Hillcrest/hillslope and Stony Plain habitat, intersected by Medium Drainage Lines. Rounded Hills as a habitat type are not noted as particularly common in the region; however it may often be continuous with Hillcrest/ hillslope habitat.	Suitable for: • Northern Quoll • Western Pebble-mound Mouse	

Habitat	Distinguishing habitat characteristics	Extent of the habitat	Conservation Significant Species	Photo
Sandplain **137 ha** **7.51 %** **Significance: High**	Sand Plain habitat is characterised by relatively deep sandy soils supporting dense spinifex grasslands and sparse low shrubs. This habitat transitions into patches of Mulga in places. This habitat often occurs as terraces along Medium Drainage Lines and extensive plains.	This habitat type forms an almost continuous band across the southern section of the Study Area and extends south of the Study Area boundary to cover a significant area of the local vicinity. Sandplain is a reasonably common habitat type in the Chichester subregion.	Suitable for: • Greater Bilby • Night Parrot • Brush-tailed Mulgara • Spectacled Hare-Wallaby	
Minor Drainage Line **31 ha** **1.69 %** **Significance: Moderate**	The vegetation of this habitat comprised dense stands of shrubs, often *Acacia* sp. and *Petalostylis* sp. The understorey generally comprised tussock grasses including Buffel Grass. The substrate can be sandy in places but generally consists of a skeletal loam gravel or stone.	The Minor Drainage Line habitat is located throughout the Study Area and represents the small drainage channels within the Stony Plain and Hillcrest/ Hillslope habitat. One of these smaller channels feeds into the Medium Drainage Line in the north-western portion of the Study Area. The Minor Drainage Line habitat is common throughout the Pilbara bioregion particularly within the Chichester and Hamersley subregions where it is associated with the stony habitats. As a drainage-type habitat it is well connected through the landscape	Suitable for: • Northern Quoll • Pilbara Olive Python • Peregrine Falcon • Northern Brushtail Possum • Grey Falcon • Ghost Bat • Pilbara Leaf-nosed Bat	

Habitat	Distinguishing habitat characteristics	Extent of the habitat	Conservation Significant Species	Photo
Rocky Breakaway **18.6 ha** **1.03 %** **Significance: High**	This habitat type comprised all the rocky landforms within the Study Area. This habitat was defined by the presence of extensive outcropping. Due to the high amount of rocky material, this habitat often contains a high number of cracks and crevices which provide shelter sites for various species. The vegetation of the habitat is somewhat variable but usually dominated by a hummock or tussock grassland, with scattered shrubs.	The Rocky Breakaway habitat is isolated to the higher elevation areas on the Study Area, which consists of the Warrawoona range running north-west to south-east within the Study Area. The Rocky Breakaways represent the upper limits of these ranges. This habitat is relatively common throughout the Pilbara and represents a habitat that is relatively unique to the region. While the broad habitat is well-represented outside of the Study Area, throughout the region and in conservation estate. This includes rocky gullies and ranges containing considerable amounts of cracks and crevices for saxicolous species such as the Northern Quoll.	Suitable for: • Northern Quoll • Peregrine Falcon • Long-tailed Dunnart • Pilbara Olive Python	

Habitat	Distinguishing habitat characteristics	Extent of the habitat	Conservation Significant Species	Photo
Medium Drainage Line **18.5 ha** **1.02 %** **Significance: Moderate**	The Medium Drainage Line habitat was defined by large drainage channels lined with large *Eucalyptus* trees. The main drainage channel is often devoid of vegetation or dense Buffel Grasslands. The major feature influencing species composition is the extensive number of large hollows as well as the high vegetation cover, woody debris and leaf litter.	This habitat was only located in the north-western section of the Study Area. The Medium Drainage Line was associated with drainage from the Hillcrest/ Hillslopes and ranges throughout the Study Area. Medium Drainage Lines are common throughout the Pilbara region due to the topography of the region. This habitat is also well represented within the regions conservation estate. Medium Drainage Lines within the Pilbara are somewhat unique to system found in surrounding regions, attributed mainly to the amount and frequency of water that they are exposed to and the habitats in which they intersect. As with most drainage systems, this habitat is well connected within the landscape.	Suitable for: • Northern Quoll • Pilbara Olive Python • Peregrine Falcon • Northern Brushtail Possum • Grey Falcon • Ghost Bat and Pilbara Leaf-nosed Bat	
Claypan **6 ha** **0.33 %** **Significance: Low**	Low lying areas on heavy alluvial soils, sometimes cracking clay. Prone to ponding following significant rainfall events and almost completely devoid of any vegetation. Small low shrubs are present in the ecotone between the claypan and surrounding habitat types	This habitat type is only located in the north-western section of the Study Area adjacent to the Medium Drainage Line. Claypans are relatively uncommon within the Chichester subregion although there are numerous within the neighboring Fortescue subregion.	Provides temporary habitat for: • Sharp-tailed Sandpiper • Common Greenshank • Woodsandpiper	



Legend

- Study Area
- **Fauna Habitats**
- Claypan
- Disturbed
- Hillcrest/Hillslope
- Medium Drainage Line
- Minor Drainage Line
- Rocky Breakaway
- Rounded Hills
- Sandplain
- Stony Plain

biologic Environmental Survey

N

1:65,000

0 0.75 1.5 3 km

Calidus Resources - Warrawoona Gold Project

Level 1 Fauna Assessment

Figure 4.1: Broad fauna habitats within the Study Area

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

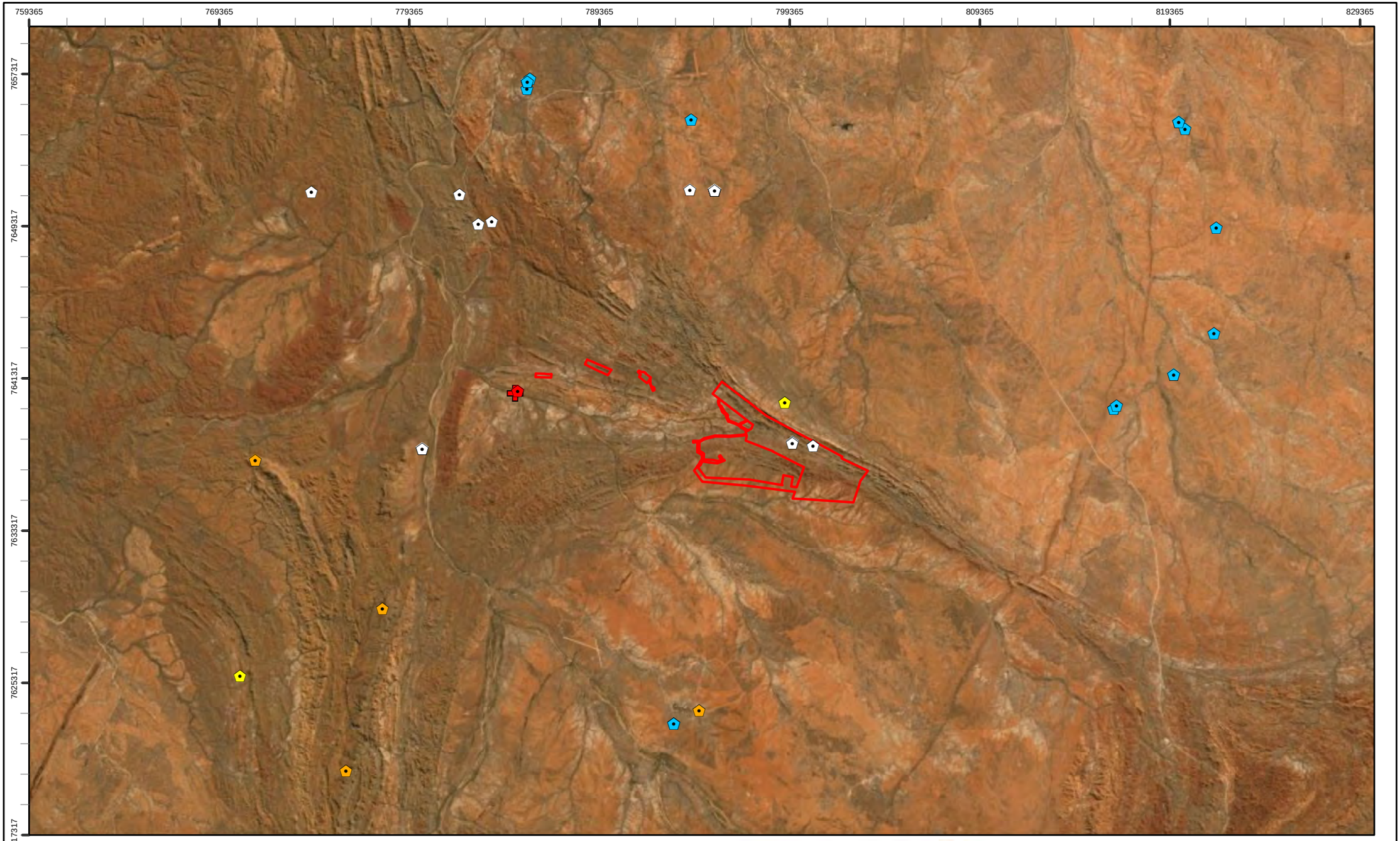
Size A4. Created 09/07/2019

4.1.4 Fauna Recorded

A total of 33 species have been recorded in the Study Area directly and/or via secondary evidence, comprising 11 mammals, 19 birds and 3 reptiles (Table 4.3), including those opportunistically recorded in 2018 (Biologic, 2019c). All the species recorded during the current survey have previously been recorded within the surrounding area (Appendix B).

Table 4.3: Fauna species recorded. Species list comprises all surveys done in Study Area.

Species	Scientific Name	Current Conservation Status		
		EPBC Act	BC Act	DBCA
Mammals				
Northern Quoll	*Dasyurus hallucatus*	EN	S2	
Ghost Bat	*Macroderma gigas*	VU	S3	
Pilbara Leaf-Nosed Bat	*Rhinonicteris aurantia*	VU	S3	
Western Pebble-Mound Mouse	*Pseudomys chapmani*			P4
Common Rock-rat	*Zyzomys argurus*	-	LC	
Short-beaked Echidna	*Tachyglossus aculeatus*	-	LC	
Woolley's Pseudantechinus	*Pseudantechinus woolleyae*	-	LC	
Euro	*Osphranter robustus*	-	LC	
Finlayson's Cave Bat	*Vespadelus finlaysoni*	-	LC	
Common Sheathtail-bat	*Taphozous georgianus*	-	LC	
Dingo	*Canis dingo*	-		
Birds				
Diamond Dove	*Geopelia cuneata*	-	LC	
Galah	*Eolophus roseicapilla*	-	LC	
Little Grassbird	*Poodytes gramineus*	-	LC	
Nankeen Kestrel	*Falco cenchroides*	-	LC	
Singing Honeyeater	*Gavicalis virescens*	-	LC	
Spinifex Pigeon	*Geophaps plumifera*	-	LC	
Striated Grasswren	*Amytornis striatus*	-	LC	
Torresian Crow	*Corvus orru*	-	LC	
Wedge-tailed Eagle	*Aquila audax*	-	LC	
Weebill	*Smicrornis brevirostris*	-	LC	
Willie Wagtail	*Rhipidura leucophrys*	-	LC	
Yellow-throated Miner	*Manorina flavigula*	-	LC	
Zebra Finch	*Taeniopygia guttata*	-	LC	
Painted Finch	*Emblema pictum*	-	LC	
Black faced Woodswallow	*Artamus cinereus*	-	LC	
Horsfield’s Bushlark	*Mirafra javanica*	-	LC	
Little Button Quail	*Turnix velox*	-	LC	
Budgerigar	*Melopsittacus undulatus*	-	LC	
Peaceful Dove	*Geopelia striata*	-	LC	
Reptiles				
Mulga Snake	*Pseudechis australis*	-	LC	
Inland Hooded Snake	*Parasuta monachus*	-	LC	
Ring-Tailed Dragon	*Ctenophorus caudicinctus*	-	LC	



Legend

- Study Area

DBCA Threatened and Priority Fauna

- Greater Bilby
- Ghost Bat
- Grey Falcon
- Northern Quoll
- Peregrine Falcon
- Spectacled Hare-Wallaby (mainland)

Birdlife Australia

- Peregrine Falcon

biologic Environmental Survey

N

1:250,000

0 2.75 5.5 11 km

Calidus Resources - Warrawoona Gold Project

Level 1 Fauna Assessment

Figure 4.2: Species of conservation significance recorded by the desktop assessment

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

Size A4. Created 09/07/2019

4.1.5 Vertebrate Fauna of Conservation Significance

A total of 29 species of conservation significance were identified during the desktop assessment (Section 3.1.1; Figure 4.2), comprising nine mammals, 18 birds and two reptiles (Table 4.4). Two of these species have previously been recorded within the Study Area, the Ghost Bat and Pilbara Leaf-nosed Bat (DBCA, 2017c), and two are recorded from this survey work, the Northern Quoll and the Western Pebble Mound Mouse (Table 4.4, Figure 4.3). Based on distribution, previous records and the habitats present, one species was deemed highly likely to occur, four were deemed likely to occur, four were deemed possible to occur, five may rarely occur and 11 are unlikely to occur (Table 4.4). Species, confirmed, likely or with the possibility to occur are detailed below.

Table 4.4 Conservation significant species likelihood assessment

Species	Conservation Status		Preferred Broad Habitats Within Region	Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Mammals								
Northern Quoll (*Dasyurus hallucatus*)	EN	EN	The species tends to inhabit rocky habitats which offer protection from predators and are generally more productive in terms of availability of resources (Braithwaite & Griffiths, 1994; Oakwood, 2000). Other microhabitat features important to the species include: rock cover; proximity to permanent water and time-since last fire (Woinarski *et al.*, 2008).	Confirmed	Yes	Confirmed within Study Area (current survey)	Yes	Confirmed
Western Pebble-mound Mouse (*Pseudomys chapmani)*	-	P4	This species occurs on the gentler slopes of rocky ranges where the ground is covered with a stony mantle and vegetated by hard spinifex, often with a sparse overstorey of eucalypts and scattered shrubs (Anstee, 1996; Start *et al.*, 2000).	Confirmed	Yes	Confirmed within Study Area (Biologic, 2019c) ~16 km (NEE) – 1957 (DBCA, 2017c)	Yes	Confirmed
Ghost Bat (*Macroderma gigas)*	VU	VU	Ghost Bats roost in deep, complex caves beneath bluffs of low, rounded hills, granite rock piles and abandoned mines (Armstrong & Anstee, 2000). These features often occur within habitats including gorge/gully, hill crest/hill slope and low hills (Armstrong & Anstee, 2000).	Confirmed	Yes	Confirmed within Study Area (Biologic, 2017)	Yes	Confirmed
Pilbara Leaf-Nosed Bat (*Rhinonicteris aurantia)*	VU	VU	Species roosts within caves and abandoned mines with high humidity (95%) and temperature (32 °C)(Armstrong, 2001). Species forages in caves and along waterbodies with fringing vegetation (TSSC, 2016).	Confirmed	Yes	Confirmed within Study Area (Biologic, 2017)	Yes	Confirmed

Species	Conservation Status		Preferred Broad Habitats Within Region	Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Greater Bilby *(Macrotis lagotis)*	VU	VU	Variety of habitats including spinifex hummock grassland and Acacia shrubland, on soft soils (Burrows *et al.*, 2012). In the Pilbara often associated with major drainage line sandy terraces (How *et al.*, 1991b).	Highly Likely	Yes	~14 km (N) – 1984 ~14 km (NEE) – 1967, 2001, 2004 (DBCA, 2017c)	No	Likely
Spectacled Hare-wallaby *(Lagorchestes conspicillatus leichardti)*	-	P3	Within the Pilbara the Spectacled Hare-wallaby is known to occur in tussock and hummock grasslands and *Acacia* shrublands (Ingleby & Westoby, 1992).	Likely	Yes	~1 km (NE) – date not provided (DBCA, 2017c)	No	Likely
Brush-tailed Mulgara *(Dasycercus blythi)*	-	P4	Prefers spinifex *Triodia* spp. grasslands on sand plains and the swales between low dunes (Pavey *et al.*, 2012; Woolley, 2006). Mature spinifex hummocks appear to be important for protection from introduced predators (Körtner *et al.*, 2007).	Highly Likely	Yes	~15 km (SSW) – 1899, 1985 (DBCA, 2017c)	No	Likely
Northern Brushtail Possum *(Trichosurus vulpecula arnhemensis)*		VU	Drainage lines that contain large hollow-bearing Eucalypts (DBCA, 2017b). Within the Northern Territory, the species is omnivorous but often feeding on flowers and insects (Cruz *et al.*, 2012).	Likely	Yes	~26 km SW (DBCA, 2017b)	No	Possible
Long-tailed Dunnart *(Sminthopsis longicaudata)*	-	P4	Typically occurs on plateaus near breakaways and scree slopes, and on rugged boulder-strewn scree slopes (Gibson & McKenzie, 2012). Once considered rare but now shown to be relatively common and widespread in rocky habitats (Burbidge *et al.*, 2008).	Highly Likely	Yes	~17 km (SEE) – 2003 (DBCA, 2017c)	No	Possible

Species	Conservation Status		Preferred Broad Habitats Within Region	Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Birds								
Peregrine Falcon (*Falco peregrinus*)	-	OS	In arid areas, it is most often encountered along cliffs above rivers, ranges and wooded watercourses where it hunts birds (Johnstone & Storr, 1998). It typically nests on rocky ledges occurring on tall, vertical cliff faces between 25 m and 50 m high (Olsen *et al.*, 2004; Olsen & Olsen, 1989).	Likely	Yes	~10 km (W) – 2001 (Birdlife Australia, 2017; DBCA, 2017c)	No	Likely
Grey Falcon (*Falco hypoleucos*)	-	VU	Timbered lowlands, particularly Acacia shrubland and along inland drainage systems. Also frequent spinifex and tussock grassland (Burbidge *et al.*, 2010; Olsen & Olsen, 1986)	Possible	Yes	~41 km (SSE) – 1994 (DBCA, 2017c)	No	Possible
Barn Swallow (*Hirundo rustica*)	MI	MI	The Barn Swallow is a non-breeding summer visitor to the Pilbara. It favours areas near water (Johnstone *et al.*, 2013).	Possible	No	~133 km (NW) – (DBCA, 2017b)	No	Rarely
Fork-tailed Swift (*Apus pacificus*)	MI	MI	Inhabits dry/open habitats, inclusive of riparian woodlands and tea-tree swamps, low scrub, heathland or saltmarsh, as well as treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes (Johnstone & Storr, 1998).	Unlikely	Yes	~73 km (NE) – 2007 (DBCA, 2017b)	No	Rarely
Sharp-tailed Sandpiper (*Calidris acuminata*)	MI	MI	Favours flooded samphire flats and grasslands, mangrove creeks mudflats, beaches, river pools, saltwork ponds, sewage ponds and freshwater soaks (Johnstone *et al.*, 2013).	Possible	No	~14 km (NNE) – 2005 (Birdlife Australia, 2017; DBCA, 2017c)	No	Rarely

Species	Conservation Status		Preferred Broad Habitats Within Region	Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Common Greenshank *(Tringa nebularia)*	MI	MI	Species occurs as a non-breeding summer migrant which occurs throughout the region. Occurs mainly in Tidal mudflats, mangrove creeks, flooded samphire flats, beaches, river pools, and saltwork and sewage ponds (Johnstone *et al.*, 2013).	Temporary Only	Yes	~14 km (NNE) – 2005 (Birdlife Australia, 2017) ~16 km (NNE) – 2005 (DBCA, 2017c)	No	Rarely
Wood Sandpiper (*Tringa glareola)*	MI	MI	Species occurs as a non-breeding summer migrant which occurs throughout the region. Occurs mainly in river pools, sewage ponds, flooded claypans, freshwater lagoons and bore overflows (Johnstone *et al.*, 2013).	Temporary Only	Yes	~15 km (NNE) – 2005 (DBCA, 2017c)	No	Rarely
Curlew Sandpiper *(Calidris ferruginea)*	CR/MI	MI	Inhabits intertidal mudflats in sheltered coastal areas (i.e. estuaries, bays, inlets and lagoons) (Geering *et al.*, 2007). This rare species generally roosts on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands (Geering *et al*., 2007).	Unlikely	No	~119 km (N) – 1982 (DBCA, 2017b)	No	Unlikely
Night Parrot *(Pezoporus occidentalis)*	EN	CR	The Night Parrot prefers sandy/stony plain habitat with old-growth spinifex (*Triodia*) for roosting and nesting in conjunction with native grasses and herbs for foraging (DPaW, 2017).	Possible	Yes	~55 km (NEE) – 1980 (DBCA, 2017b)	No	Unlikely
Australian Painted Snipe (*Rostratula australis)*	EN	EN	Generally, occupies shallow terrestrial freshwater wetlands (i.e. temporary and permanent lakes, swamps and claypans) with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire (Johnstone & Storr, 1998).	Unlikely	No	~150 km (S) – 2012 (Knuckey *et al.*, 2013)	No	Unlikely

Species	Conservation Status		Preferred Broad Habitats Within Region	Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Common Sandpiper (*Actitis hypoleucos*)	MI	MI	Estuaries and deltas of streams, as well as banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans (Johnstone & Storr, 1998).	Unlikely	Yes	~14 km (NNE) – 2005 (Birdlife Australia, 2017)	No	Unlikely
Grey Wagtail (*Motacilla cinerea*)	MI	MI	A rare vagrant to Western Australia where it has been recorded within various habitats with open waterbodies (Johnstone & Storr, 2004).	Unlikely	No	~539 km (NE) – 2013 (DBCA, 2017b)	No	Unlikely
Oriental Pratincole (*Glareola maldivarum*)	MI	MI	Prefers open plains, floodplains or short grasslands, often with extensive bare areas. They often occur near terrestrial wetlands (such as billabongs, lakes or creeks), and artificial wetlands (such as reservoirs, saltworks and sewage farms) (Johnstone & Storr, 1998).	Unlikely	No	~100 km (NNW) – 1980 (DBCA, 2017b)	No	Unlikely
Oriental Plover (*Charadrius veredus*)	MI	MI	A variety of habitats, including coastal habitats, such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches as well as open inland environments such as, semi-arid or arid grasslands, where the grass is short and sparse (Johnstone & Storr, 2004).	Unlikely	No	~14 km (NNE) – 2005 (Birdlife Australia, 2017; DBCA, 2017c)	No	Unlikely
Pectoral Sandpiper (*Calidris melanotos*)	MI	MI	Coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands (Johnstone & Storr, 2004; Johnstone *et al.*, 2013). It prefers wetlands with open fringing mudflats and low, emergent or fringing vegetation (Geering *et al.*, 2007).	Unlikely	No	~158 km (NW) – 1998 (DBCA, 2017b)	No	Unlikely

Species	Conservation Status		Preferred Broad Habitats Within Region	Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Yellow Wagtail (*Motacilla flava)*	MI	MI	An uncommon but regular visitor to the Pilbara region (Johnstone *et al.*, 2013). Occupies a range of damp or wet habitats with low vegetation although favours edges of fresh water, especially sewage ponds (Oakwood, 2000)	Unlikely	No	~19 km (NW) – 2010 (Birdlife Australia, 2017)	No	Unlikely
Osprey (*Pandion haliaetus)*	MI	MI	Occurs mainly in sheltered seas around islands, tidal creeks, estuaries and saltwork ponds, also large river pools (Johnstone *et al.*, 2013)	Possible	No	~104 km (SW) – 2013 (DBCA, 2017b)	No	Unlikely
Glossy Ibis *(Plegadis falcinellus)*	-	MI	Freshwater wetlands, irrigated areas, margins of dams, floodplains, brackish and saline wetlands, tidal mudflats, pastures, lawns and public gardens (Johnstone *et al.*, 2013).	Unlikely	Yes	~42 km (NNW) – 2008 (DBCA, 2017c)	No	Unlikely
Reptiles								
Pilbara Olive Python *(Liasis olivaceus barroni)*	VU	VU	Associated with drainage systems, including areas with localised drainage and watercourses (Pearson, 1993). In the inland Pilbara the species is most often encountered near permanent waterholes in rocky ranges or among riverine vegetation (Pearson, 1993).	Highly Likely	Yes	~20 km (NW) – date not provided (DBCA, 2017c)	No	Highly Likely
Black-lined Ctenotus *(Ctenotus nigrilineatus)*	-	P1	Little is known about the habitat preferences of the species. Previous records have however been collected from spinifex plains at the base of granite outcrops (How & Dell, 2004; How *et al.*, 1991b).	Possible	Yes	~57 km (E) – 2000 (DBCA, 2017b)	No	Possible

Confirmed within the Study Area

Northern Quoll (*Dasyurus hallucatus*)

The Northern Quoll is currently listed as Endangered under the EPBC act and the BC Act. The species, once widely distributed across northern Australia, is now restricted to three isolated populations; the Pilbara, the Kimberley and Northern Territory, and Queensland, in addition to a number of islands along the north coast (DoE, 2016). Such declines are primarily due to the western expansion of the Cane Toad (**Rhinella marina*), which is highly toxic to predators when consumed (Woinarski *et al.*, 2008). Other threats include predation from feral predators such as foxes and cats, inappropriate fire regimes, disease, habitat degradation through grazing as well as habitat destruction through mining and agriculture (Woinarski *et al.*, 2011). At present, Northern Quolls are relatively common in the northern Pilbara region (generally within 150 km of the coast) but are much less common in southern and south-eastern parts of the region (Cramer *et al.*, 2016). The Northern Quoll is both arboreal and terrestrial, inhabiting ironstone and sandstone ridges, scree slopes, granite boulders and outcrops, drainage lines and riverine habitats (Braithwaite & Griffiths, 1994; Oakwood, 2002). Rocky habitats tend to support higher densities, as they offer protection from predators and are generally more productive in terms of availability of resources (Braithwaite & Griffiths, 1994; Oakwood, 2000). Other microhabitat features important to the species include: rock cover; proximity to permanent water and time-since last fire (Woinarski *et al.*, 2008). Dens occur in a wide range of situations including rock overhangs, tree hollows, hollow logs, termite mounds, goanna burrows and human dwellings/infrastructure, where individuals usually den alone (Oakwood, 2002; Woinarski *et al.*, 2008).

The Northern Quoll was recorded during the current 2017 survey on five occasions from a total of two individuals. Each record was obtained via motion-sensor camera within Hillcrest/ Hillslope habitat in the north-western as well as the central to south-western portion of the Study Area (Appendix G). Further Northern Quoll records were made during targeted surveying conducted after the current survey, as described in Biologic (2019b, 2019c).

The nearest regional Northern Quoll records to the Study Area are from four locations; <28 km south-west during surveys conducted during 2014 at Corunna Downs and Roy Hill; <37 km south-east from surveys conducted from 2012 – 2014 (21 records); ~12 records, 28 - 48 km north of the Study Area, ranging in time from 1958 – 2016 from surveys conducted from Marble Bar, Muccan Station, and Yarrie Station (DBCA, 2017c). The species is moderately common through this area of the Pilbara (i.e. within 150 km of the coast) and therefore usually present where suitable rocky habitat is present. The Rocky Breakaway habitat of the Study Area provides high significance habitat in the form of denning and foraging habitat for the species. In light of the additional records from the following targeted survey (Biologic, 2019b, 2019c), it is likely that the species is resident to the Study Area, although a high turnover of males is expected due to the facultative die-off of Northern Quoll following the mating season. Additional denning habitat is also present within small instances of the Hillcrest/ Hillslope habitat and Rounded Hills (i.e. in small rocky breakaways). The Medium and Minor Drainage Line habitats also provide foraging and dispersal habitat for the species. The remainder of habitats are unlikely to provide significant habitat for the species.

Ghost Bat (*Macroderma gigas*)

This species is listed as Vulnerable under the EPBC Act and the BC Act. The Ghost Bat formerly occurred over a wide area of central, northern and southern Australia but has declined significantly in the southern parts of its' range in the last 200 years (Armstrong & Anstee, 2000). The species now occurs in only a few highly disjunct sites across northern Australia, confined to the Kimberley and Pilbara regions in Western Australia (van Dyck & Strahan, 2008). In the Pilbara region, the species roosts in deep, complex caves beneath bluffs of low rounded hills, often composed of Marra Mamba or banded iron formation, granite rock piles and abandoned mines (Armstrong & Anstee, 2000). They roost either individually or in colonies (Churchill, 2008) and move between a number of caves, both seasonally and as dictated by weather changes (van Dyck & Strahan, 2008).

A permanent maternity roost was confirmed at the disused Klondyke Queen workings, within the Study Area during the concurrent study (Biologic, 2017), with approximately 250 individuals confirmed in the area during this assessment period. Roosting habitat for the species appears confined to the plethora of disused mining adits and shafts scattered through the Study Area (see Biologic, 2017 for a detailed assessment of this). No additional natural caves were recorded within the Study Area and none are likely to occur based on the habitats and landforms present. Habitats including Hillcrest/ Hillslope, Rocky Breakaway, Medium and Minor Drainage Lines, and Stony Plains may provide suitable foraging habitat for the species, particularly the Medium Drainage Line habitats and the disused adit/shaft sites. Refer to Biologic (2019f) and Biologic (2019e in prep) for the results of studies investigating these preferred foraging areas of the Study Area and the impact of any development areas.

Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)

This species is listed as Vulnerable under the EPBC Act and the BC Act. The Pilbara Leaf-nosed Bat is restricted to the Pilbara region and is thought to have been separated from populations of the Orange Leaf-nosed Bat in the Kimberley, Northern Territory and western Queensland for at least 30,000 years (Churchill, 1991). The species is heavily reliant on warm (28-32 °C), humid (85 to 100 %) sites for roosting (Armstrong, 2001), which enable individuals to reduce water loss and energy expenditure (Baudinette *et al.*, 2000). The distribution of the species is therefore limited by the scarcity of caves that possess the required microclimates (Armstrong, 2001; Churchill, 1991).

Two roosts for the species were confirmed in the Study Area during the concurrent targeted bat survey, at the disused Klondyke Queen (> 3000 average calls/ night) and Bow Bells (> 4000 av calls/night) mines (Biologic, 2017). At the time of the current study (2017), the known both roosts potentially represent 'non-permanent breeding roosts', as defined by TSSC (2016).

The species was recorded at numerous other adits and shafts within the Study Area that potentially provide foraging and drinking sources for the species (Biologic, 2017). Foraging habitat for the Pilbara Leaf-nosed Bat is diverse. The species generally hunts with a manoeuvrable flight through riparian vegetation in gorges, and over hummock grassland and sparse tree and shrub savannah (Churchill, 1994). In the Pilbara, it has been observed in *Triodia* hummock grasslands covering low rolling hills and shallow gullies, with scattered *Eucalyptus camaldulensis* along the creeks (TSSC, 2016). It has also been recorded over small watercourses, amongst granite boulder terrain, over pools and low shrubs in

ironstone gorges, and above low shrubs and around pools in gravely watercourses with *Melaleuca leucadendron*, such as in Barlee Range Nature Reserve (Armstrong, 2001).

The Pilbara Leaf-nosed Bat will potentially forage over most habitats within the Study Area. The most productive foraging habitats within the Study Area are located at the intersection of Rocky Breakaways (classified as Priority 3 foraging habitat, TSSC, 2016) and Medium and Minor Drainage Line (classified as Priority 4 foraging habitat, TSSC, 2016). Additional foraging habitat is considered to include the Rounded Hills, Hillcrest/ Hillslope, Sandplain, and Stony Plain, classified as low significance, Priority 5 foraging habitat TSSC (2016). Refer to Biologic (2019f) and Biologic (2019e in prep) for the results of studies investigating these preferred foraging areas of the Study Area and the impact of any development areas.

Western Pebble-mound Mouse (*Pseudomys chapmani*)

This species is listed as Priority 4 under the BC Act. The Western Pebble-mound Mouse has experienced a significant decline in their range through the Gascoyne and Murchison and is now considered endemic to the Pilbara (Start *et al.*, 2000). This species almost exclusively occurs on the gentler slopes of rocky ranges where the ground is covered with a stony mantle and vegetated by hard spinifex, often with a sparse overstorey of eucalypts and scattered shrubs (Anstee & Armstrong, 2001).

Five mounds (one active, four inactive) have been opportunistically recorded in the Study Area to date following Biologic (2019c). These records are the first of the species within the Study Area. The nearest regional record of the Western Pebble-mound Mouse to the Study Area is approximately 16 km north-east from 1957 (DBCA, 2017b). The most recent records from the area include three records from 2014, one of which was ~22 km south-west and two of which were ~45 km south-east of the Study Area (DBCA, 2017c). There are a further 14 records within 45 km of the Study Area (DBCA, 2017c). Within the Study Area, suitable habitat is extensive, and includes the Hillcrest/ Hillslope and Stony Plain habitat.

Highly Likely to Occur

Pilbara Olive Python (*Liasis olivaceus barroni*)

The Pilbara Olive Python is listed as Vulnerable under the EPBC Act and the BC Act. It is moderately common through the ranges of the Pilbara and Mt Augustus, Western Australia, where it inhabits water courses and pools in rocky gorges and gullies. This species is primarily nocturnal and tends to shelter in small caves or under vegetation during the day, although it is occasionally active after sunrise, particularly in the warmer summer months (Pearson, 1993). The Pilbara Olive Python is known from a number of sites throughout the Pilbara and is associated with drainage systems, including areas with localised drainage and watercourses (Pearson, 1993).

The nearest regional record of Pilbara Olive Python is located approximately 20 km north-west of the Study Area (DBCA, 2017c). Habitat suitable for the species within the Study Area appears limited to the Rocky Breakaway intersected by Medium Drainage Line and Minor Drainage Line habitats (i.e.

small areas in the north-western, central and south-eastern portion of the drainage line). This species is considered highly likely to occur within the Study Area.

Likely to Occur

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed under the BC Act as "Other Specially Protected Fauna (OS)" and is considered rare over much of its range (Johnstone & Storr, 1998). In arid areas, it is most often encountered along cliffs above rivers, ranges and wooded watercourses where it hunts birds (Johnstone & Storr, 1998) . It typically nests on rocky ledges occurring on tall, vertical cliff faces between 25 m and 50 m high (Olsen & Olsen, 1989). It also appears to prefer nesting on large ledges a reasonable distance (average of 13 m) from the top of the cliff (Olsen & Olsen, 1989), possibly to avoid ground dwelling predators.

The Peregrine Falcon was recorded in 2001 approximately 10 km west of the Study Area (DBCA, 2017c). Potential nesting habitat may be present within Rocky Breakaway habitat, and the Medium Drainage Line is likely to provide suitable foraging habitat for the species. This species is considered likely to occur within the Study Area.

Greater Bilby (*Macrotis lagotis*)

The Greater Bilby is listed as Vulnerable under the EPBC Act, BC Act, and by the IUCN. Extant population of the Greater Bilby occur in a variety of habitats, usually on landforms with level to low slope topography and light to medium soils. Within the Pilbara region the species is recorded within spinifex sandplains associated with paleo-drainage lines and perched drainage lines where the substrate of sand, soil, sandy clay, or sandy gravel is suitable for burrowing (Dziminski & Carpenter, 2017). Within the Study Area, the Sandplain habitat type in the southern portion of the area displays habitat characteristics considered suitable to support Greater Bilby.

Greater Bilbies are recorded as having low site fidelity and high mobility (Southgate *et al.*, 2007); males regularly move three to five kilometres between burrows on consecutive days; and have been recorded moving up to 15 km in a few weeks (Southgate & Possingham, 1995). As Greater Bilbies are often sparsely distributed across large areas, and populations can move across the landscape, and it is probable that a single survey may not detect bilby presence (DBCA, 2017a). Although there are numerous Greater Bilby records in the general area of the Study Area, there is a lack of contemporary records in the near vicinity. The nearest records are 15 km to the east of the Study Area boundary, recorded in 2004 from Meentheena Reserve, 12 km south of the Study Area from Corunna Station in 1984, and 15 km to the north of the Study Area from 1984 at Limestone Station, east of Marble Bar. It is considered that the species is likely to occur in the Study Area based on suitability of habitat (Sandplain) and the previous records in the vicinity.

Brush-tailed Mulgara (*Dasycercus blythi*)

The Brush-tailed Mulgara (DBCA Priority 4) is a small carnivorous marsupial occurring from southwestern Queensland across the Simpson, Tanami, and Great Sandy Deserts and central Western

Australia, including parts of the Pilbara (DSEWPaC, 2011). The Brush-tailed Mulgara occurs in Triodia sand plain and gibber plain habitats (Pavey *et al.*, 2012). Mulgara are renowned for using multiple burrow systems within a home-range and changing these frequently. A study in Kata Tjuta National Park found that on average burrows were used for only 3.2 days by one individual over a 55-day period, and numerous burrows were used by a single individual, indicating little burrow fidelity (Körtner *et al.*, 2007). Habitat within the Study Area considered most suitable to support the species is the Sandplain habitat in the southern portion of the Study Area.

The nearest record to the Study Area is approximately 15 km southwest, however it dates back to 1985 (DBCA, 2017c). Based on the availability of suitable habitat (Sandplain) in the Study Area, nearby records, and the location of the Study Area within the species distribution, Brush-tailed Mulgara are considered likely to occur.

Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*)

This species is currently listed as Priority 3 under the BC Act. The Spectacled Hare-wallaby is sparsely distributed and generally uncommon across northern Australia, distributed from northern Queensland in the east, to the Pilbara where the species is considered relatively rare (van Dyck & Strahan, 2008). The species shelters within grass tussocks and spinifex hummocks and low shrubs (Ingleby & Westoby, 1992).

The nearest record of this species is 1.1 km north-east of the Study Area from an unknown date (DBCA, 2017c). One further record has been documented 29 km south-west of the Study Area in 2014 (DBCA 2017b). The species is patchily distributed throughout the Pilbara region with few records of the species. The Sandplain and Stony Plain habitat which comprises expanses of *Triodia* hummock grasslands provides suitable habitat for the species. Based on the availability of suitable habitat in the Study Area, nearby records, and the location of the Study Area within the species distribution, Spectacled Hare-Wallaby are considered likely to occur.

May Possibly Occur

Northern Brushtail Possum (*Trichosurus vulpecula arnhemensis*)

The Northern Brushtail Possum is listed as Vulnerable under the BC Act. It occurs from the north-west Pilbara, through the Kimberley into the Northern Territory (van Dyck & Strahan, 2008). Little ecological information is known about the Pilbara population, although it is most often recorded from Medium drainage lines that contain large hollow-bearing Eucalypts (DBCA, 2017b). Within the Northern Territory, the species is omnivorous but often feeding on flowers and insects (Cruz *et al.*, 2012).

The nearest record of the species is located approximately ~26 km south-west of the Study Area from 2014 (DBCA, 2017b). The Medium Drainage Line habitat provides potential denning habitat for the Northern Brushtail Possum, although the species is somewhat patchily distributed through the region. It is considered possible that the species may occur in the Study Area.

Grey Falcon (*Falco hypoleucos*)

The Grey Falcon is currently listed as Vulnerable under the BC Act. This species appears to have a distribution centred on ephemeral or permanent creek lines (Garnett & Crowley, 2000), with numerous records from the Fortescue Marsh region (DBCA, 2017b). Grey Falcons prefer sparsely-treed, open plains and creek lines for hunting (Olsen & Olsen, 1986). They typically nest in the abandoned nest of a raptor or corvid (Olsen & Olsen, 1986) in trees or man-made structures, most notably repeater towers.

The nearest DBCA (2017c) record for this species is approximately 41 km south-east of the Study Area from 1994. The Rocky Breakaway and Medium Drainage Line habitat within the Study Area provides potentially nesting and foraging habitat for the species. The remaining habitats may be flown over, and opportunistically used for foraging, if individuals are resident within the local area. It is considered possible that the species may occur in the Study Area.

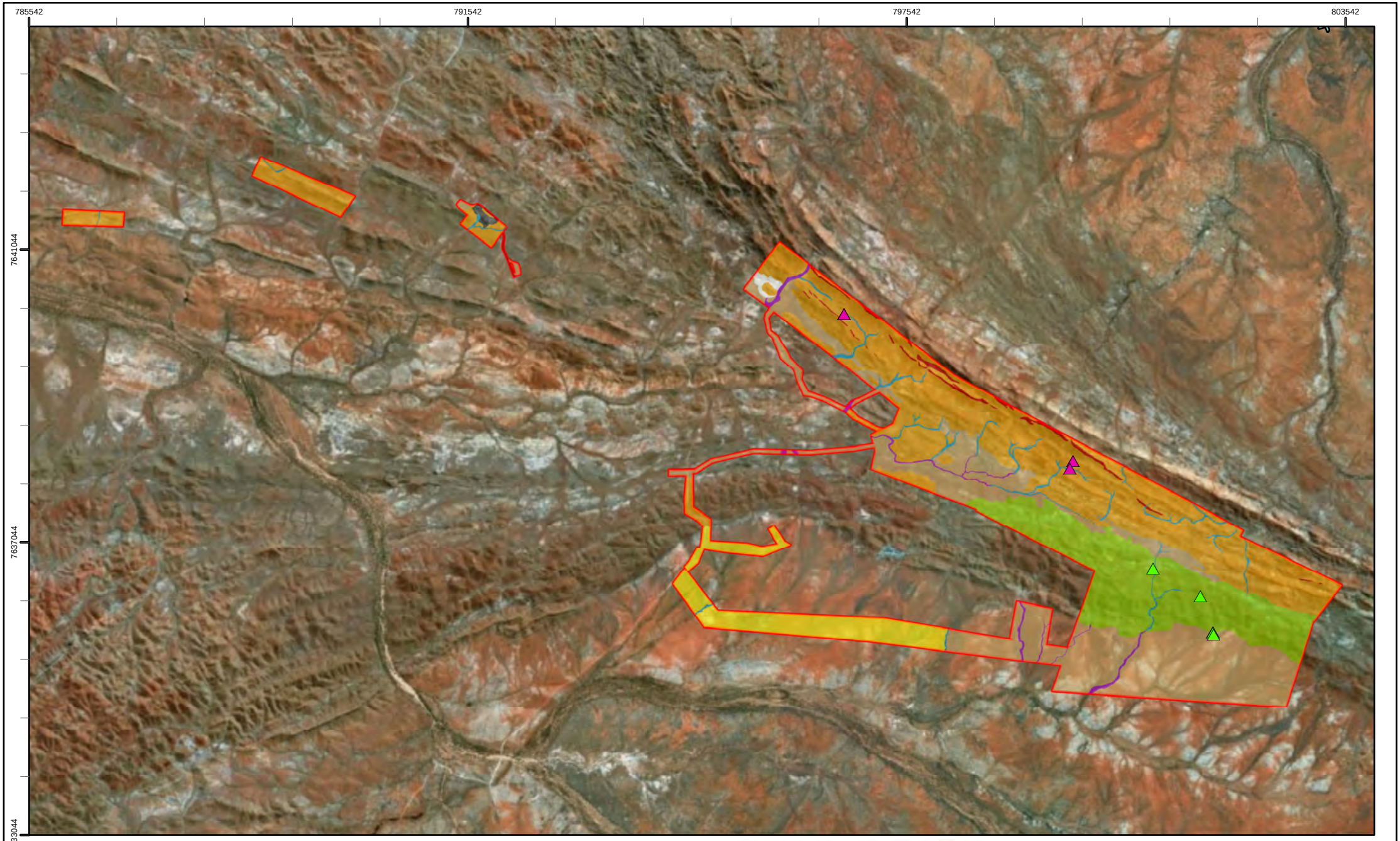
Black Lined Ctenotus (*Ctenotus nigrilineatus*)

This species is listed as Priority 1 by the DBCA. It shows a patchy distribution in spinifex at the base of granite outcrops around the Woodstock area in the Abydos Plain, Hamersley Range and Meethena, and is only known from few records (How & Dell, 2004; How *et al.*, 1991a; Storr *et al.*, 2002). The closest record of *Ctenotus nigrilineatus* is located ~57 km east of the Study Area from 2000 (DBCA, 2017b). Potential habitats within the Study Area may include the Stony Plain, Hillcrest/ Hillslope, and Rounded Hills. Given the variability in habitat preferences exhibited of the species, it is possible that the species may occur.

Long-tailed Dunnart (*Sminthopsis longicauda*)

This species is currently listed as Priority 4 under the BC Act. It is a nocturnal and agile species that is distributed through the Pilbara, north eastern goldfields and Gibson desert, south to the Nullarbor Plain, to central Northern Territory and western South Australia (van Dyck & Strahan, 2008). Its core habitat includes rocky scree slopes with hummock grass and shrubs, and tall open *Acacia* shrubland and woodlands (McKenzie *et al.*, 2008).

The nearest DBCA (2017c) record of this species is located approximately 17 km south-east of the Study Area from 2003. Owing to the occurrence of suitable habitats on Rocky Breakaway along the north-eastern border of the central portion of the Study Area, it is possible the species occurs within the Study Area.



Legend

- Study Area
- Claypan
- Disturbed
- Hillcrest/Hillslope
- Medium Drainage Line
- Minor Drainage Line
- Rocky Breakaway
- Rounded Hills
- Sandplain
- Stony Plain

Fauna Habitats

Species Recorded

- Northern Quoll
- Western Pebble-mound Mouse

biologic Environmental Survey

N

1:65,000

0 0.75 1.5 3 km

Calidus Resources - Warrawoona Gold Project

Level 1 Fauna Assessment

Figure 4.3: Species of conservation significance recorded in the Study Area

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

Size A4. Created 09/07/2019

4.2 Short-range Endemic Invertebrate Fauna

4.2.1 Desktop Assessment

The WAM database search identified 86 invertebrate records belonging to groups which are prone to short-range endemism within the vicinity of the Study Area (Appendix D), including the groups scorpions, pseudoscorpions, mygalomorph spiders, selenopid spiders, Diplopoda and Mollusca (Appendix D). Based on the occurrence of records within the vicinity of the Study Area it is likely that groups prone to short-range endemism (those listed above) do occur within the Study Area. Refer to Biologic (2019a in prep) for the faunal results of a two-phase SRE survey conducted within the Study Area after the completion of the current 2017 survey.

4.2.2 Habitat Mapping

Species considered SRE are often confined to specific microhabitats, and as such SRE habitat mapping is usually conducted at a finer scale to that for vertebrate fauna; however, vertebrate fauna habitat mapping can be used as a general indication of the potential suitability for SRE species. Details on the suitability of vertebrate fauna habitats for short-range endemism is detailed below in Table 4.5 and mapped in Figure 4.4). No habitats of high or very high significance were recorded.

Table 4.5: Suitability of vertebrate fauna habitats within the Study Area for SRE

Habitat	SRE Suitability	Hectares	Percentage
Sandplain	Low	137	7.51
Stony Plain	Low	548	30.07
Minor Drainage Line	Low/Moderate	31	1.69
Rounded Hills	Low/Moderate	339	18.61
Hillcrest/ Hillslope	Low/Moderate	718	39.42
Claypan	Moderate	6	0.33
Medium Drainage Line	Moderate	19	1.02
Rocky Breakaway	Moderate/High	19	1.03
Total		**1822**	**100**

Low Suitability

The Low Suitability habitat comprised of the Stony Plain (30.07%) and Sandplain (7.51 %). These habitats and the microhabitats contained within are common and widespread through the region. Due to the homogeneity and continuity of the habitats, it is less likely that species inhabiting this habitat type are restricted. There are however small and isolated microhabitat features present within these broader habitats, i.e. small boulder piles and outcrops, although these may be unlikely to be of sufficient size to promote endemism.

Low/Moderate Suitability

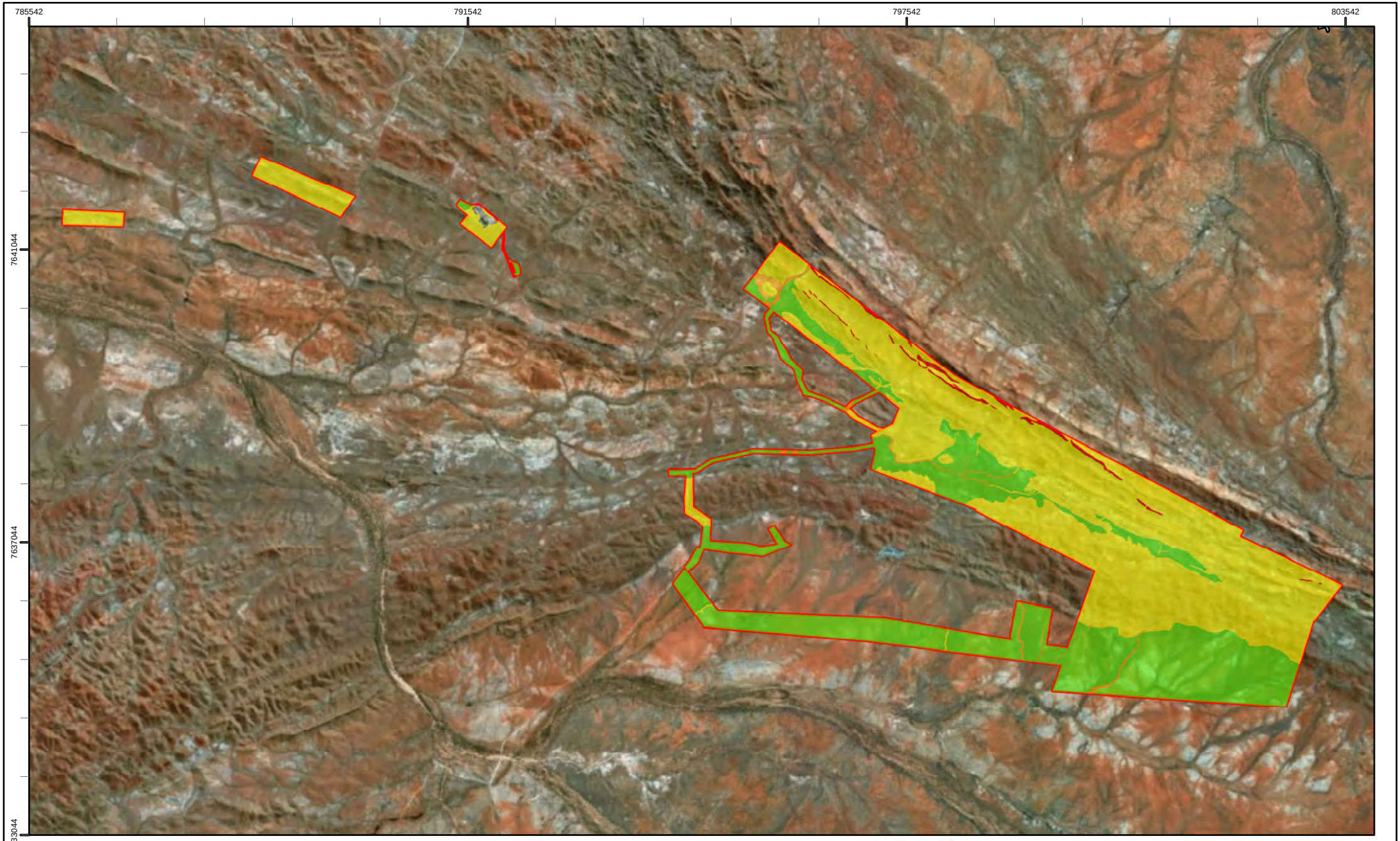
This comprises Minor Drainage Line (1.69%), Rounded Hills (18.61 %) and Hillcrest/ Hillslope (39.42%) habitats within the Study Area. While Minor Drainage Lines can be disturbed by the movement of water, it tends to be in lower volumes and at slower rates in comparison to Medium Drainage Lines. Therefore, there is likely to be less disturbance of the microhabitats present, which allows for the establishment of stable microhabitats over a longer period of time.

Moderate Suitability

This comprises Claypan (0.33 %) and Medium Drainage Line (1.02%) habitats within the Study Area. Medium Drainage Line can be disturbed more regularly (seasonally) in comparison to Minor Drainage Lines when water flows, and this makes them important dispersal pathways for SRE invertebrate fauna. Moreover, this habitat also incorporates some rocky microhabitats where it cuts through the range which may provide important microhabitat features SRE invertebrate fauna. The Claypan is a restricted habitat type and therefore may contain potentially endemic species; however, there are very few stable microhabitats suitable for SRE groups within this habitat.

Medium/High Suitability

This comprises Rocky Breakaways within the Study Area (1.03 %) associated with the higher slopes and crests of the hills and ranges. Such habitats often contain deep cracks and crevices which provide suitable habitat for many SRE groups. Furthermore, this habitat type is isolated within the landscape and therefore some species within this habitat type may have limited capacity to disperse to other suitable habitats.



Legend

- Study Area
- **Habitat Suitability for SRE**
  - Low
  - Low/Moderate
  - Moderate
  - Moderate/High

biologic Environmental Survey

N

1:65,000

0 0.75 1.5 3 km

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Level 1 Fauna Assessment

Figure 4.4: Suitable habitat for SRE species

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

Size A4. Created 09/07/2019

4.3 Subterranean Fauna

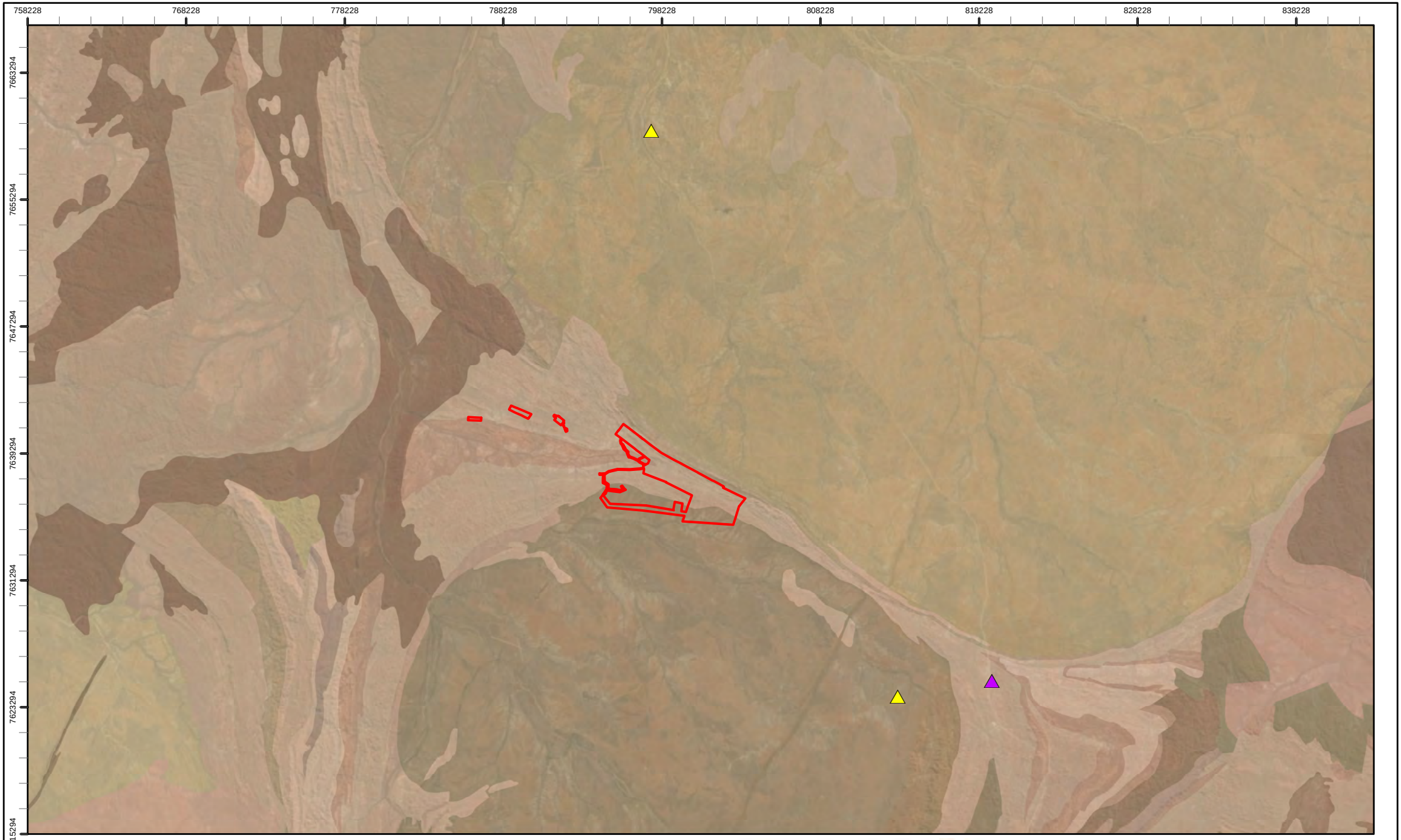
4.3.1 Desktop Assessment

Due to a lack of sampling conducted no records of subterranean fauna have been documented within the Study Area prior to the current 2017 survey. Three records have been documented within 20 km of the Study Area (Figure 4.5) one of which has been identified to species level; *Guineaxonopsis* `sp. S1`. A further 22 records of subterranean fauna have been made beyond 20 km from the Study area. A further 29 species may potentially occur within the Study Area or within 40 km of Study Area as identified in NatureMap (Appendix E).

4.3.2 Geology

At a scale of 1:500,000, there are four geology type mapped across the Study Area (Figure 4.5). The most dominant geological group is the Warrawoona Group which comprises 1262.1 ha (69.3 %) of the Study Area (Figure 4.5). The Warrawoona Group is defined as mafic, ultramafic, and felsic volcanic and intrusive rocks, and sedimentary rocks; metamorphosed. The Warrawoona Group, while not renowned for its ability to contain voids and pockets suitable for subterranean fauna, has the potential to contain suitable habitats due to its metamorphosed nature. The ability to support subterranean species is confirmed by the presence of a stygobitic mite, recorded from this geology approximately 15 km south of the Study Area (Figure 4.5). The Corunna Downs Granitic Complex is the next most common geology type of the Study Area, comprising approximately 487.1 ha and 26.7 % of the surface geology. It is described as undivided granitoid rocks, metamorphosed. The Duffer Formation is the next most common geology type of the Study Area, comprising approximately 33.5 ha and 1.83 % of the Study Area's surface geology. The Duffer formation is defined as felsic volcanic rock; local basalt, chert, and felsic schist; metamorphosed. The remaining geology, 39.6 ha (2.17 %) is comprised of the Wyman Formation, defined as felsic volcanic and volcaniclastic rocks; local clastic sedimentary rocks, chert and basalt; metamorphosed. Similarly, to the Warrawoona Group, these geological types are not typically renowned for their ability to support subterranean fauna although may potentially contain suitable habitat due to their metamorphosed nature.

Given the geologies present there is a moderate chance that subterranean fauna is present within the Study Area. None of the geological unit's present are known to hold diverse subterranean faunal assemblages and very few specimens have been collected from these geologies previously. However, the Pilbara region generally, is renowned at a hot-spot for subterranean fauna and therefore the likelihood of occurrence within most rocky landscapes is somewhat moderate (Eberhard *et al.*, 2005). Refer to Biologic (2019d in prep.) for the results of a two-phase subterranean fauna survey conducted in the Study Area after the completion of the current survey.



Legend

- Study Area
- WAM Arachnid Records
- WAM Crustacea Records

1:500,000 Geology

- A-CDl-st
- A-DG-s
- A-EMgo-gg
- A-FO-od
- A-FOh-xs-f-HAE
- A-FOh-xs-f-HAM
- A-FOk-b-HAE
- A-FOr-b-HAE
- A-FOr-b-HAM
- A-GC-xca-b
- A-GC-xci-s
- A-KEw-xf-s
- A-SR-g
- A-SRmo-gm
- A-WA-xb-f
- A-WAd-f
- A-WAp-f
- A-WAp-xf-cc
- A-g-PE
- A-g-PO
- A-g-PS

biologic Environmental Survey

N

1:300,000

0 3.5 7 14 km

Calidus Resources - Warrawoona Gold Project

Level 1 Fauna Assessment

Figure 4.5: Broad geology within the Study Area and WAM subterranean records

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

Size A4. Created 09/07/2019

5 CONCLUSION

A total of eight broad fauna habitat types (excluding disturbed areas) have been recorded and mapped across the Study Area. Two of these habitats, Rocky Breakaway and Sandplain are considered of high significance due to the ability to provide habitat for species of conservation significance. Rocky Breakaway provides potential denning and foraging habitat for the Northern Quoll and the Pilbara Olive Python. The Sandplain habitat provides potential habitat for Greater Bilby, Night Parrot, Spectacled Hare-Wallaby, and Brush-tailed Mulgara. Five habitats were considered of moderate significance, Medium Drainage Line, Minor Drainage Line, Hillcrest/ Hillslope, Rounded Hills, and Stony Plain, for the ability to provide supporting habitat for species of conservation of significance. Habitats of the Study Area are moderately common throughout the region. Ten surveys from the surrounding area were used in the literature review to provide contextual information on the species and habitat likely to occur; however, many others, although not all are publicly available, have been conducted. Given this, the vertebrate fauna assemblages occurring within the habitats present are relatively well-understood and documented.

The Northern Quoll was recorded during the survey on five occasions from two individuals during the survey. The Study Area represents 'habitat survival to the survival of the species' (as defined by DoE, 2016), as the Rocky Breakaway habitat of the Study Area provides suitable denning and foraging habitat for the species, and the Medium/Minor Drainage Line, Rounded Hills and Hillcrest/ Hillslope provides additional foraging habitat. As further Northern Quoll records were made in during targeted surveying conducted after the current 2017 survey, as described in Biologic (2019b, 2019c), the population present is likely to be permanent.

A permanent maternity roost of the Ghost Bat was confirmed at the disused Klondyke Queen mine during the concurrent targeted bat survey, with a population estimate of ~250 noted at the time of this current survey (Biologic, 2017). The presence of a significant population of Ghost Bat within the Study Area has lead to multiple surveys and studies of the species being conducted after the current 2017 survey. Much of the Study Area provides suitable foraging habitat for the species, particularly the Medium Drainage Line habitats and the disused adit/shaft sites. Refer to Biologic (2019f) and Biologic (2019e in prep) for the results of studies investigating these preferred foraging areas of the Study Area and the impact of any development areas.

Two significant roosts for the Pilbara Leaf-nosed Bat were confirmed in the Study Area during the concurrent targeted bat survey, at the disused Klondyke Queen and Bow Bells mines. The species is likely to forage over numerous habitats (TSSC, 2016) and therefore most habitat within the Study Area could be considered as foraging area. The Medium Drainage Line is likely to provide increased foraging and drinking resources, particularly when inundated, as well as providing a flyway for regional dispersal. As above, refer to Biologic (2019f) and Biologic (2019e in prep) for the results of studies investigating these preferred foraging areas of the Study Area and the impact of any development areas.

Using broad vertebrate fauna habitat mapping, there is a moderate/high to low suitability for SRE's within the Study Area, particular within the Rocky Breakaway habitats. The database searches identified

the occurrence of many groups prone to short-range endemism within the surrounding area, indicating some likelihood that these groups will occur within the Study Area. Refer to Biologic (2019a in prep) for the results of an SRE survey conducted within the Study Area, including the full extent of any habitats suitable for SRE invertebrate fauna.

The Pilbara is regarded as being a hotspot for subterranean species both in terms of species diversity and occurrence, and as such the potential for the occurrence of such species within most landscape is relatively high. Database searches did not show any subterranean fauna species as previously recorded within the Study Area; however, based on a review of the geologies within the Study Area, and their ability to support subterranean fauna outside the Study Area, there is a moderate potential for subterranean species to be present. Refer to Biologic (2019d in prep.) for the results of a two-phase subterranean fauna survey conducted in the Study Area.

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7 APPENDICES

Appendix A: Conservation Status Codes

International Union for Conservation of Nature

Category	Definition
Extinct (Ex)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CE)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases, great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

Environment Protection and Biodiversity Conservation Act 1999

Category	Definition
Extinct (EX)	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (EW)	Taxa known to survive only in captivity.
Critically Endangered (CE)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (EN)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (VU)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Migratory (MG)	Consists of species listed under the following International Conventions: Japan-Australia Migratory Bird Agreement (JAMBA) China-Australia Migratory Bird Agreement (CAMBA) Convention on the Conservation of Migratory Species of Wild animals (Bonn Convention)

Wildlife Conservation Act 1950

Category	Definition
Critically Endangered (CR)	Rare or likely to become extinct, as *critically endangered* fauna.
Endangered (EN)	Rare or likely to become extinct, as *endangered* fauna.
Vulnerable (VU)	Rare or likely to become extinct, as *vulnerable* fauna.
Extinct (EX)	Being fauna that is presumed to be extinct.
Migratory (MI)	Birds that are subject to international agreements relating to the protection of migratory birds.
Conservation Dependent (CD)	Special conservation need being species dependent on ongoing conservation intervention.
Other Specially Protected (OS)	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines

Department of Biodiversity, Conservation, Biodiversity and Attractions (DBCA) codes

Category	Definition
Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
Priority 4 (P4)	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Appendix B: Vertebrate Fauna Species Identified During the Desktop Assessment

Mammals

Species	Common name	Conservation Status				Databases			Previous Survey									
		EPBC	BCA	DBCA	IUCN	Protected Matters Database (DoEE, 2017)	NatureMap (DBCA, 2017b)	Threatened and Protected Fauna (DBCA, 2017c)	Corunna Downs Project (MWH, 2016)	Panorama Project Area (Bamford Consulting Ecologists, 2001)	Mount Webber Iron Ore Project (ecologia Environment, 2010)	Panorama Project Mine Site and Haul Road Corridor (Biota, 2007)	Sulphur Springs, Pilbara (Molhar, 2007)	BC Iron Nullagine Iron Ore Project (Bamford Consulting Ecologists, 2009b)	Abydos DSO Project (Bamford Consulting Ecologists, 2009a)	Abydos DSO Project (Outback Ecology, 2011)	Abydos-Woodstock Reserve (How *et al.*, 1991b)	North Star Project (ecologia Environment, 2012)
TACHYGLOSSIDAE																		
Tachyglossus aculeatus	Short-beaked Echidna				LC		•		•	•	•				•	•	•	
DASYURIDAE																		
Dasycercus blythi	Brush-tailed Mulgara			P4	LC		•	•				•					•	
Dasykaluta rosamondae	Little Red Kaluta				LC		•		•					•			•	•
Dasyurus hallucatus	Northern Quoll	EN	EN		EN	•	•	•	•	•	•	•		•	•	•	•	•
Ningaui timealeyi	Pilbara Ningaui				LC		•		•	•		•					•	•
Planigale ingrami	Long-tailed Planigale				LC		•		•							•		
Planigale maculata	Common Planigale				LC					•	•			•			•	•
Pseudantechinus roryi	Rory's Pseudantechinus				LC		•			•	•				•			•
Pseudantechinus woolleyae	Woolley's Pseudantechinus				LC		•		•							•	•	•
Sminthopsis longicaudata	Long-tailed Dunnart			P4	LC		•	•										•
Sminthopsis macroura	Stripe-faced Dunnart				LC		•					•		•			•	
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart				LC		•										•	•
THYLACOMYIDAE																		
Macrotis lagotis	Bilby, Dalgyte	VU	VU		VU	Likely	•	•									•	
MACROPODIDAE																		
Lagorchestes conspicillatus subsp. *leichardti*	Spectacled Hare-Wallaby			P3			•.	•	•	•		•					•	
Osphranter robustus	Euro				LC		•		•	•	•	•		•	•	•	•	•
Osphranter rufus	Red Kangaroo, Marlu				LC		•		•					•			•	
Petrogale rothschildi	Rothschild's Rock-wallaby				LC		•		•	•	•				•	•	•	•
PHALANGERIDAE																		
Trichosurus vulpecula subsp. *arnhemensis*	Northern Brushtail Possum (Kimberley)		VU		LC		•		•									

Species	Common name	Conservation Status				Databases			Previous Survey									
		EPBC	BCA	DBCA	IUCN	Protected Matters Database (DoEE, 2017)	NatureMap (DBCA, 2017b)	Threatened and Protected Fauna (DBCA, 2017c)	Corunna Downs Project (MWH, 2016)	Panorama Project Area (Bamford Consulting Ecologists, 2001)	Mount Webber Iron Ore Project (ecologia Environment, 2010)	Panorama Project Mine Site and Haul Road Corridor (Biota, 2007)	Sulphur Springs, Pilbara (Molhar, 2007)	BC Iron Nullagine Iron Ore Project (Bamford Consulting Ecologists, 2009b)	Abydos DSO Project (Bamford Consulting Ecologists, 2009a)	Abydos DSO Project (Outback Ecology, 2011)	Abydos-Woodstock Reserve (How *et al.*, 1991b)	North Star Project (ecologia Environment, 2012)
PTEROPODIDAE																		
Pteropus alecto	Black Flying-fox				LC												•	
MEGADERMATIDAE																		
Macroderma gigas	Ghost Bat	VU	S3		VU	•	•	•	•	•		•	•		•	•	•	•
RHINONYCTERIDAE																		
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	VU	S3		LC	•	•	•	•	•	•	•	•		•	•		•
EMBALLONURIDAE																		
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat				LC		•		•		•				?	•		
Taphozous georgianus	Common Sheathtail-bat				LC		•		•	•	•				•	•	•	•
MOLOSSIDAE																		
Chaerephon jobensis	Greater Northern Freetail-bat				LC		•		•		•			•	?			
Ozimops lumsdenae	Northern Free-tailed Bat								•		•							
Austronomus australis	White-striped Freetail-bat				LC					•					•			
VESPERTILIONIDAE																		
Chalinolobus gouldii	Gould's Wattled Bat				LC		•		•		•			•		•		•
Nyctophilus geoffroyi	Lesser Long-eared Bat				LC		•		•									•
Scotorepens greyii	Little Broad-nosed Bat				LC		•		•		•	•			•	•	•	•
Vespadelus finlaysoni	Finlayson's Cave Bat				LC		•		•	•	•			•	•	•	•	•
MURIDAE																		
**Mus musculus*	House Mouse				LC	Likely	•		•	•	•	•		•			•	
Notomys alexis	Spinifex Hopping-mouse				LC		•											
Pseudomys chapmani	Western Pebble-mound Mouse			P4	LC		•	•	•	•	•	•		•	•		•	•
Pseudomys delicatulus	Delicate Mouse				LC		•		•	•							•	•
Pseudomys desertor	Desert Mouse				LC		•		•	•	•	•		•				•

Species	Common name	Conservation Status				Databases			Previous Survey									
		EPBC	BCA	DBCA	IUCN	Protected Matters Database (DoEE, 2017)	NatureMap (DBCA, 2017b)	Threatened and Protected Fauna (DBCA, 2017c)	Corunna Downs Project (MWH, 2016)	Panorama Project Area (Bamford Consulting Ecologists, 2001)	Mount Webber Iron Ore Project (ecologia Environment, 2010)	Panorama Project Mine Site and Haul Road Corridor (Biota, 2007)	Sulphur Springs, Pilbara (Molhar, 2007)	BC Iron Nullagine Iron Ore Project (Bamford Consulting Ecologists, 2009b)	Abydos DSO Project (Bamford Consulting Ecologists, 2009a)	Abydos DSO Project (Outback Ecology, 2011)	Abydos-Woodstock Reserve (How *et al.*, 1991b)	North Star Project (ecologia Environment, 2012)
Pseudomys hermannsburgensis	Sandy Inland Mouse				LC		•		•			•				•	•	•
Zyzomys argurus	Common Rock-rat				LC		•		•	•	•	•		•	•	•	•	•
BOVIDAE																		
**Bos taurus*	European Cattle						•		•		•	•			•	•	•	•
SUIDAE																		
**Sus scrofa*	Pig					Likely												
CAMELIDAE																		
**Camelus dromedarius*	Camel					Likely	•		•	•					•		•	•
CANIDAE																		
Canis dingo	Dingo					Likely	•		•	•					•	•	•	
**Vulpes vulpes*	Red Fox					Likely											•	
FELIDAE																		
**Felis catus*	Cat					Likely	•		•	•				•	•	•	•	•
EQUIDAE																		
**Equus asinus*	Donkey					Likely				•							•	
*Equus caballus	Horse					Likely												
LEPORIDAE																		
**Oryctolagus cuniculus*	Rabbit					Likely												

Birds

Species	Common name	Conservation Status				Databases				Previous Survey								
		EPBC	BCA	DBCA	IUCN	Protected Matters Database (DoEE, 2017)	NatureMap (DBCA, 2017b)	Threatened and Protected Fauna (DBCA, 2017c)	Birdata Database (Birdlife Australia, 2017)	Corunna Downs Project (MWH, 2016)	Panorama Project Area (Bamford Consulting Ecologists, 2001)	Mount Webber Iron Ore Project (ecologia Environment, 2010)	Panorama Project Mine Site and Haul Road Corridor (Biota, 2007)	BC Iron Nullagine Iron Ore Project (Bamford Consulting Ecologists, 2009b)	Abydos DSO Project (Bamford Consulting Ecologists, 2009a)	Abydos DSO Project (Outback Ecology, 2011)	Abydos-Woodstock Reserve (How *et al.*, 1991b)	North Star Project (ecologia Environment, 2012)
ACANTHIZIDAE																		
Gerygone fusca	Western Gerygone				LC						•						•	
Smicrornis brevirostris	Weebill				LC		•		•	•	•	•		•		•	•	•
ACCIPITRIDAE																		
Accipiter cirrocephalus	Collared Sparrowhawk				LC		•		•	•	•						•	•
Accipiter fasciatus	Brown Goshawk				LC		•		•	•	•	•	•		•	•	•	
Aquila audax	Wedge-tailed Eagle				LC		•			•	•	•	•	•	•	•	•	•
Circus approximans	Swamp Harrier				LC		•											
Circus assimilis	Spotted Harrier				LC		•			•	•	•		•	•		•	
Elanus axillaris	Black-shouldered Kite				LC					•	•						•	
Haliaeetus leucogaster	White-bellied Sea-Eagle				LC	•	•											
Haliastur sphenurus	Whistling Kite				LC		•		•	•	•			•	•			•
Hamirostra melanosternon	Black-breasted Buzzard				LC										•			
Hieraaetus morphnoides	Little Eagle				LC		•		•		•			•			•	
Lophoictinia isura	Square-tailed Kite				LC													•
Milvus migrans	Black Kite				LC		•		•	•					•		•	•
ACROCEPHALIDAE																		
Acrocephalus australis	Australian Reed-Warbler				LC		•		•					•			•	
AEGOTHELIDAE																		
Aegotheles cristatus	Australian Owlet-nightjar				LC		•			•	•			•	•		•	•
ALAUDIDAE																		
Mirafra javanica	Horsfield's Bushlark				LC		•		•					•				•
ALCEDINIDAE																		

Species	Common name	Conservation Status				Databases				Previous Survey								
		EPBC	BCA	DBCA	IUCN	Protected Matters Database (DoEE, 2017)	NatureMap (DBCA, 2017b)	Threatened and Protected Fauna (DBCA, 2017c)	Birdata Database (Birdlife Australia, 2017)	Corunna Downs Project (MWH, 2016)	Panorama Project Area (Bamford Consulting Ecologists, 2001)	Mount Webber Iron Ore Project (ecologia Environment, 2010)	Panorama Project Mine Site and Haul Road Corridor (Biota, 2007)	BC Iron Nullagine Iron Ore Project (Bamford Consulting Ecologists, 2009b)	Abydos DSO Project (Bamford Consulting Ecologists, 2009a)	Abydos DSO Project (Outback Ecology, 2011)	Abydos-Woodstock Reserve (How *et al.*, 1991b)	North Star Project (ecologia Environment, 2012)
Dacelo leachii	Blue-winged Kookaburra						●		●	●	●	●	●	●	●	●	●	●
Todiramphus pyrrhopygius	Red-backed Kingfisher				LC		●		●	●	●		●	●	●	●	●	●
Todiramphus sanctus	Sacred Kingfisher				LC		●		●		●			●	●	●	●	●
ANATIDAE																		
Anas gracilis	Grey Teal				LC		●		●						●		●	●
Anas superciliosa	Pacific Black Duck				LC		●		●		●				●		●	●
Aythya australis	Hardhead				LC		●		●									
Cygnus atratus	Black Swan				LC		●		●					●				●
Dendrocygna eytoni	Plumed Whistling-duck				LC										●			
Malacorhynchus membranaceus	Pink-eared Duck				LC		●		●									
ANHINGIDAE																		
Anhinga novaehollandiae	Australasian Darter				LC		●		●		●						●	●
APODIDAE																		
Apus pacificus	Fork-tailed Swift	MI	MI		LC	●											●	●
ARDEIDAE																		
Ardea alba	Great Egret				LC	●	●	●	●		●						●	
Ardea intermedia	Intermediate Egret				LC		●		●									
Ardea pacifica	White-necked Heron				LC		●		●		●				●		●	
Bubulcus ibis	Cattle Egret				LC	●												
Egretta garzetta	Little Egret				LC		●		●									
Egretta novaehollandiae	White-faced Heron				LC		●		●		●		●	●	●		●	●
Nycticorax caledonicus	Nankeen Night-Heron				LC		●		●		●		●				●	
ARTAMIDAE																		
Artamus cinereus	Black-faced Woodswallow				LC		●		●	●	●	●	●	●	●	●	●	●

Species	Common name	Conservation Status				Databases				Previous Survey								
		EPBC	BCA	DBCA	IUCN	Protected Matters Database (DoEE, 2017)	NatureMap (DBCA, 2017b)	Threatened and Protected Fauna (DBCA, 2017c)	Birdata Database (Birdlife Australia, 2017)	Corunna Downs Project (MWH, 2016)	Panorama Project Area (Bamford Consulting Ecologists, 2001)	Mount Webber Iron Ore Project (ecologia Environment, 2010)	Panorama Project Mine Site and Haul Road Corridor (Biota, 2007)	BC Iron Nullagine Iron Ore Project (Bamford Consulting Ecologists, 2009b)	Abydos DSO Project (Bamford Consulting Ecologists, 2009a)	Abydos DSO Project (Outback Ecology, 2011)	Abydos-Woodstock Reserve (How *et al.*, 1991b)	North Star Project (ecologia Environment, 2012)
Artamus minor	Little Woodswallow				LC		•		•	•	•	•	•		•		•	•
Artamus personatus	Masked Woodswallow				LC		•						•		•		•	•
Cracticus nigrogularis	Pied Butcherbird				LC		•		•	•	•	•	•	•	•	•	•	•
Cracticus torquatus	Grey Butcherbird				LC		•		•									•
Gymnorhina tibicen	Australian Magpie				LC		•		•	•	•	•	•	•	•		•	•
BURHINIDAE																		
Burhinus grallarius	Bush Stone-curlew				LC		•		•	•	•		•	•	•		•	•
CACATUIDAE																		
Cacatua sanguinea	Little Corella				LC		•		•	•	•	•		•	•	•	•	•
Eolophus roseicapilla	Galah				LC		•		•	•	•	•	•	•	•	•	•	•
Nymphicus hollandicus	Cockatiel				LC		•			•	•		•	•	•	•	•	•
CAMPEPHAGIDAE																		
Coracina maxima	Ground Cuckoo-shrike				LC							•					•	
Coracina novaehollandiae	Black-faced Cuckoo-shrike				LC		•		•	•	•	•	•	•	•	•	•	•
Lalage tricolor	White-winged Triller				LC		•		•	•	•		•		•		•	•
CASUARIIDAE																		
Dromaius novaehollandiae	Emu				LC									•			•	
CHARADRIIDAE																		
Charadrius ruficapillus	Red-capped Plover				LC		•		•									
Charadrius veredus	Oriental Plover	MI	MI		LC		•	•	•								•	
Elseyornis melanops	Black-fronted Dotterel				LC		•		•	•	•			•	•		•	•
Erythrogonys cinctus	Red-kneed Dotterel				LC		•		•									
Vanellus miles	Masked Lapwing				LC		•		•									
CICONIIDAE																		

Species	Common name	Conservation Status				Databases				Previous Survey								
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Ephippiorhynchus asiaticus	Black-necked Stork				NT		•		•		•				•			
CLIMACTERIDAE																		
Climacteris melanurus	Black-tailed Treecreeper				LC				•	•								
COLUMBIDAE																		
Geopelia cuneata	Diamond Dove				LC		•		•	•	•		•	•	•		•	•
Geopelia placida	Peaceful Dove				LC		•		•	•	•			•	•	•	•	•
Geophaps plumifera	Spinifex Pigeon				LC		•		•	•	•	•	•	•	•	•	•	•
Ocyphaps lophotes	Crested Pigeon				LC		•		•	•	•		•	•	•		•	•
Phaps chalcoptera	Common Bronzewing				LC		•		•	•	•	•	•	•	•	•	•	•
CORVIDAE																		
Corvus bennetti	Little Crow				LC		•		•	•				•			•	
Corvus orru	Torresian Crow				LC		•		•	•	•	•	•	•	•	•	•	•
CUCULIDAE																		
Centropus phasianinus	Pheasant Coucal				LC		•		•		•		•		•		•	•
Chalcites basalis	Horsfield's Bronze-Cuckoo				LC		•		•	•	•		•		•			•
Chalcites osculans	Black-eared Cuckoo				LC									•			•	
Heteroscenes pallidus	Pallid Cuckoo				LC		•		•	•	•		•	•	•		•	•
DICAEIDAE																		
Dicaeum hirundinaceum	Mistletoebird				LC		•		•	•	•				•		•	
ESTRILDIDAE																		
Emblema pictum	Painted Finch				LC		•		•	•	•	•	•	•	•	•	•	•
Neochmia ruficauda	Star Finch				LC		•		•					•			•	•
Taeniopygia guttata	Zebra Finch				LC		•		•	•	•	•	•	•	•	•	•	•
EUROSTOPODIDAE																		

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Eurostopodus argus	Spotted Nightjar				LC		•		•	•	•	•		•	•	•	•	•
FALCONIDAE																		
Falco berigora	Brown Falcon				LC		•		•	•	•	•	•	•	•	•	•	•
Falco cenchroides	Nankeen Kestrel				LC		•		•	•	•	•		•	•	•	•	•
Falco hypoleucos	Grey Falcon		VU		VU			•										•
Falco longipennis	Australian Hobby				LC		•										•	
Falco peregrinus	Peregrine Falcon		OS		LC		•	•		•							•	
Falco subniger	Black Falcon				LC		•		•									
GLAREOLIDAE																		
Glareola maldivarum	Oriental Pratincole	MI	MI		LC	may												
Stiltia isabella	Australian Pratincole				LC		•										•	
HIRUNDINIDAE																		
Hirundo neoxena	Welcome Swallow				LC		•		•									
Hirundo rustica	Barn Swallow	MI	MI		LC	May												
Petrochelidon ariel	Fairy Martin				LC		•		•	•		•			•		•	•
Petrochelidon nigricans	Tree Martin				LC		•		•	•	•	•		•			•	•
LARIDAE																		
Chlidonias hybrida	Whiskered Tern				LC												•	•
LOCUSTELLIDAE																		
Cincloramphus cruralis	Brown Songlark				LC						•						•	•
Cincloramphus mathewsi	Rufous Songlark				LC				•	•	•							•
Poodytes carteri	Spinifexbird				LC		•		•	•	•	•		•	•	•	•	•
Poodytes gramineus	Little Grassbird				LC		•		•									
MALURIDAE																		

Species	Common name	Conservation Status				Databases				Previous Survey									
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Amytornis striatus	Striated Grasswren				LC		●		●	●	●	●		●	●	●	●	●
Malurus lamberti	Variegated Fairy-wren				LC		●			●	●	●	●	●	●	●	●	●
Malurus leucopterus	White-winged Fairy-wren				LC		●					●			●		●	●
Stipiturus ruficeps	Rufous-crowned Emu-wren				LC		●				●						●	
MELIPHAGIDAE																		
Acanthagenys rufogularis	Spiny-cheeked Honeyeater				LC		●		●					●			●	●
Certhionyx variegatus	Pied Honeyeater				LC		●				●			●		●	●	
Conopophila whitei	Grey Honeyeater				LC											●		
Epthianura tricolor	Crimson Chat				LC		●			●	●						●	●
Gavicalis virescens	Singing Honeyeater				LC		●		●	●	●		●	●	●	●	●	●
Lichmera indistincta	Brown Honeyeater				LC		●		●	●	●	●	●	●	●	●	●	●
Manorina flavigula	Yellow-throated Miner				LC		●		●	●	●	●	●	●	●	●	●	●
Melithreptus gularis	Black-chinned Honeyeater				LC		●		●	●	●		●		●			●
Ptilotula keartlandi	Grey-headed Honeyeater				LC		●		●	●	●	●	●	●	●	●	●	●
Ptilotula penicillata	White-plumed Honeyeater				LC				●	●	●	●	●	●	●	●	●	●
Ptilotula plumulus	Grey-fronted Honeyeater				LC					●								
Purnella albifrons	White-fronted Honeyeater				LC												●	
Sugomel niger	Black Honeyeater				LC									●			●	
MEROPIDAE																		
Merops ornatus	Rainbow Bee-eater				LC		●	●	●	●	●	●	●	●	●	●	●	●
MONARCHIDAE																		
Grallina cyanoleuca	Magpie Lark				LC		●		●	●	●		●	●	●	●	●	●
MOTACILLIDAE																		
Anthus novaeseelandiae	Australasian Pipit						●		●	●				●	●		●	●

Species	Common name	Conservation Status				Databases				Previous Survey								
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Motacilla cinerea	Grey Wagtail	MI	MI		LC													
Motacilla flava	Yellow Wagtail	MI	MI		LC				•									
OREOICIDAE																		
Oreoica gutturalis	Crested Bellbird				LC		•		•	•	•			•	•	•	•	•
OTIDIDAE																		
Ardeotis australis	Australian Bustard				LC		•			•	•		•	•	•		•	•
PACHYCEPHALIDAE																		
Colluricincla harmonica	Grey Shrike-thrush				LC		•		•	•	•	•	•	•	•	•	•	•
Pachycephala rufiventris	Rufous Whistler				LC		•		•	•	•	•		•				•
PANDIONIDAE																		
Pandion haliaetus	Osprey	MI	MI		LC	•												
PARDALOTIDAE																		
Pardalotus rubricatus	Red-browed Pardalote				LC		•		•	•	•		•	•	•		•	•
Pardalotus striatus	Striated Pardalote				LC		•		•		•	•			•			
PELECANIDAE																		
Pelecanus conspicillatus	Australian Pelican				LC		•		•		•						•	
PETROICIDAE																		
Melanodryas cucullata	Hooded Robin				LC		•		•	•								
Petroica goodenovii	Red-capped Robin				LC												•	
PHALACROCORACIDAE																		
Microcarbo melanoleucos	Little Pied Cormorant				LC		•		•		•						•	
Phalacrocorax sulcirostris	Little Black Cormorant				LC		•		•		•						•	
PHASIANIDAE																		
Coturnix pectoralis	Stubble Quail				LC												•	

Species	Common name	Conservation Status				Databases				Previous Survey								
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Synoicous ypsilophora	Brown Quail				LC		•		•		•				•			•
PODARGIDAE																		
Podargus strigoides	Tawny Frogmouth				LC						•		•		•	•	•	•
PODICIPEDIDAE																		
Poliocephalus poliocephalus	Hoary-headed Grebe				LC		•		•									
Tachybaptus novaehollandiae	Australasian Grebe				LC		•		•								•	
POMATOSTOMIDAE																		
Pomatostomus temporalis	Grey-crowned Babbler				LC		•		•	•				•	•			•
PSITTACIDAE																		
Barnardius zonarius	Australian Ringneck				LC		•			•	•	•		•	•	•	•	•
Melopsittacus undulatus	Budgerigar				LC		•		•	•	•		•		•		•	•
Neopsephotus bourkii	Bourke's Parrot				LC		•		•									
Pezoporus occidentalis	Night Parrot	EN	CR		EN	•												
PTILINORHYNCHIDAE																		
Ptilonorhynchus guttatus	Western Bowerbird				LC		•		•	•	•		•		•	•	•	•
RALLIDAE																		
Fulica atra	Eurasian coot				LC		•		•								•	
Hypotaenidia philippensis	Buff-banded Rail				LC		•		•									•
Porphyrio porphyrio	Purple Swamphen				LC		•		•									
Tribonyx ventralis	Black-tailed Native-hen				LC				•									
Zapornia tabuensis	Spotless Crake				LC		•		•									
RECURVIROSTRIDAE																		
Himantopus himantopus	Black-winged Stilt				LC		•		•								•	
RHIPIDURIDAE																		

Species	Common name	Conservation Status				Databases				Previous Survey								
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Rhipidura leucophrys	Willie Wagtail				LC		•		•	•	•	•	•	•	•	•	•	•
Rhipidura albiscapa	Grey Fantail				LC					•								
ROSTRATULIDAE																		
Rostratula. australis	Australian Painted Snipe	EN	EN		EN	•												
SCOLOPACIDAE																		
Actitis hypoleucos	Common Sandpiper	MI	MI		LC	•	•		•								•	
Calidris acuminata	Sharp-tailed Sandpiper	MI	MI		LC	•	•	•	•									
Calidris ferruginea	Curlew Sandpiper	CR/ MI	VU/ MI		NT	•												
Calidris melanotos	Pectoral Sandpiper	MI	MI		LC	•												
Tringa glareola	Wood Sandpiper	MI	MI		LC		•	•	•								•	
Tringa nebularia	Common Greenshank	MI	MI		LC		•	•	•								•	
STRIGIDAE																		
Ninox boobook	Southern Boobook				LC		•	•		•	•	•		•	•		•	•
Ninox connivens	Barking Owl				LC		•								•		•	
THRESKIORNITHIDAE																		
Plegadis falcinellus	Glossy Ibis		MI		LC			•										
Threskiornis moluccus	Australian White Ibis				LC				•									
Threskiornis spinicollis	Straw-necked Ibis				LC		•		•		•						•	
TURNICIDAE																		
Turnix velox	Little Button-quail				LC		•		•	•	•				•		•	•
TYTONIDAE																		
Tyto alba	Barn Owl						•			•							•	

Reptiles

Species	Common name	Conservation Status				Database Searches			Previous Survey								
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AGAMIDAE																	
Ctenophorus caudicinctus	Ring-tailed Dragon						•		•	•	•	•	•	•	•	•	•
Ctenophorus isolepis	Military Dragon or Crested Dragon						•		•					•		•	•
Ctenophorus nuchalis	Central Netted Dragon				LC		•		•							•	•
Ctenophorus reticulatus	Western Netted Dragon				LC						•		•				
Ctenophorus scutulatus	Dragon				LC						•						
Diporiphora valens	Southern Pilbara Tree Dragon				LC											•	•
Gowidon longirostris	Long-nosed Dragon						•		•	•	•		•	•	•	•	•
Lophognathus gilberti	Ta-Ta or Gilbert's Dragon				LC		•						•				
Pogona minor	Dwarf Bearded Dragon												•			•	•
CARPHODACTYLIDAE																	
Nephrurus levis	Knob-tailed Gecko															•	•
Nephrurus wheeleri	Banded Knob-tailed Gecko				LC		•										
CHELONIIDAE																	
Chelodina steindachneri	Flat-shelled Turtle						•		•							•	•
DIPLODACTYLIDAE																	
Crenadactylus ocellatus	Clawless Gecko						•			•							•
Diplodactylus conspicillatus	Fat-tailed Gecko				LC		•		•		•					•	•
Diplodactylus galaxias	Northern Pilbara Beak-faced Gecko																•
Diplodactylus savagei	Southern Pilbara Beak-faced Gecko				LC		•		•	•	•	•	•	•	•		•
Lucasium squarrosum	Gecko				LC						•						
Lucasium stenodactylum	Pale-snouted Ground Gecko				LC		•		•		•	•	•	•	•	•	•
Lucasium wombeyi	Gecko				LC		•		•		•	•	•	•	•		•

Species	Common name	Conservation Status				Database Searches			Previous Survey								
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Oedura fimbria	Western Marbled Velvet Gecko				LC		•		•					•	•	•	•
Rhynchoedura ornata	Western Beaked Gecko				LC		•		•							•	•
Strophurus elderi	Jewelled Gecko				LC		•		•	•	•	•	•			•	•
Strophurus jeanae	Gecko				LC											•	
Strophurus wellingtonae	Gecko				LC								•				
ELAPIDAE																	
Acanthophis pyrrhus	Desert Death Adder						•		•							•	
Acanthophis wellsi	Pilbara Death Adder				LC		•		•				•	•			•
Brachyurophis approximans	North-western Shovel-nosed Snake				LC		•		•							•	•
Demansia psammophis	Yellow-faced Whipsnake						•		•							•	•
Demansia rufescens	Rufous Whipsnake				LC		•		•	•					•		•
Furina ornata	Moon Snake						•		•		•		•			•	•
Parasuta monachus	Inland Hooded Snake				LC				•								•
Pseudechis australis	Mulga Snake				LC		•		•							•	•
Pseudonaja mengdeni	Western Brown Snake				LC		•				•		•			•	•
Pseudonaja modesta	Ringed Brown Snake				LC		•		•					•		•	•
Suta fasciata	Rosen's Snake				LC		•		•								•
Suta punctata	Little Spotted Snake				LC											•	
Vermicella snelli	Pilbara Bandy Bandy				LC		•		•			•			•		
GEKKONIDAE																	
Gehyra pilbara	Pilbara Dtella				LC		•			?			•		•	•	
Gehyra punctata	Spotted Rock Dtella				LC		•		•	•	•			•	•	•	•
Gehyra variegata	Tree Dtella				LC		•		•	•	•	•	•	•	•	•	•
Heteronotia binoei	Bynoe's Gecko				LC		•		•	•	•		•	•	•	•	•

Species	Common name	Conservation Status				Database Searches			Previous Survey								
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Heteronotia spelea	Desert Cave Gecko				LC		•		•		•				•		•
PYGOPODIDAE																	
Delma butleri	Legless Lizard				LC		•		•		•		•				
Delma elegans	Legless Lizard				LC		•		•	•	•				•		•
Delma fraseri					LC												•
Delma nasuta	Long-nosed Delma				LC		•		•	•			•	•	•	•	•
Delma pax	Legless Lizard				LC		•		•	•	•	•	•		•	•	•
Delma tincta	Legless Lizard				LC		•		•						•	•	•
Lialis burtonis	Burton's legless lizard				LC		•		•	•			•			•	•
Pygopus nigriceps	Hooded Scaly foot				LC		•		•								•
PYTHONIDAE																	
Antaresia perthensis	Pygmy Python				LC		•		•	•	•					•	•
Antaresia stimsoni	Stimson's Python				LC		•							•	•	•	•
Aspidites melanocephalus	Black-headed Python				LC									•		•	
Liasis olivaceus subsp. barroni	Pilbara Olive Python	VU	VU			Likely	•	•	•				•	•	•	•	•
SCINCIDAE																	
Carlia munda	Shaded-litter Rainbow Skink				LC		•		•	•		•	•	•	•	•	•
Carlia triacantha	Desert Rainbow Skink				LC		•		•								•
Cryptoblepharus buchananii	Buchanan's Snake-eyed Skink				LC					•						•	•
Cryptoblepharus ustulatus	Russet Snake-eyed Skink				LC		•		•					•	•		•
Ctenotus duricola	Skink				LC		•		•		•	•			•	•	•
Ctenotus grandis	Grand Ctenotus						•		•		•				•	•	•
Ctenotus hanloni	Skink				LC		•										
Ctenotus helenae	Skink				LC		•									•	•

Species	Common name	Conservation Status				Database Searches			Previous Survey								
		EPBC	BCA	DBCA	IUCN	Protected Matters Database (DoEE, 2017)	NatureMap (DBCA, 2017b)	Threatened and Protected Fauna (DBCA, 2017c)	Corunna Downs Project (MWH, 2016)	Panorama Project Area (Bamford Consulting Ecologists, 2001)	Mount Webber Iron Ore Project (ecologia Environment, 2010)	Panorama Project Mine Site and Haul Road Corridor (Biota, 2007)	BC Iron Nullagine Iron Ore Project (Bamford Consulting Ecologists, 2009b)	Abydos DSO Project (Bamford Consulting Ecologists, 2009a)	Abydos DSO Project (Outback Ecology, 2011)	Abydos-Woodstock Reserve (How *et al.*, 1991b)	North Star Project (ecologia Environment, 2012)
Ctenotus inornatus	Stony-soil Ctenotus				LC				•								
Ctenotus leonhardii	Skink				LC		•		•								
Ctenotus nigrilineatus	Black-lined Ctenotus		P1		LC											•	
Ctenotus pantherinus	Leopard Ctenotus						•		•		•		•	•	•	•	•
Ctenotus piankai	Coarse Sand Ctenotus				LC		•						•				•
Ctenotus rubicundus	Ruddy Ctenotus				LC		•		•	•	•			•	•		•
Ctenotus rutilans	Pilbara Rusty Ctenotus				LC		•		•								
Ctenotus saxatilis	Rock Ctenotus				LC		•			•	•	•	•	•	•	•	•
Ctenotus schomburgkii	Barred Wedge-tailed Ctenotus				LC		•									•	•
Ctenotus serventyi	North-western Sandy-loam Ctenotus				LC											•	
Cyclodomorphus melanops	Slender Blue-tongue						•		•	•		•	•		•	•	•
Egernia ebsisolus	Eastern Pilbara Spiny-tailed Skink				LC		•		•		•					•	•
Egernia formosa	Goldfields Crevice-skink				LC		•		•	•		•		•	•	•	•
Eremiascincus richardsonii	Broad-banded Sand Swimmer				LC								•			•	
Lerista bipes	Two-toed Skink				LC		•		•		•			•	•	•	•
Lerista clara	Skink				LC										•		
Lerista flammicauda	Pilbara Flame-tailed Slider				LC		•										
Lerista jacksoni	Jackson's Three-toed Slider				LC		•		•						•		•
Lerista muelleri	Skink				LC		•		•	•	•	•	•	•		•	•
Lerista verhmens	Powerful Lerista				LC		•										•
Liopholis striata	Nocturnal Desert Skink				LC											•	
Menetia greyii	Dwarf Skink				LC		•		•						•	•	•
Menetia surda	Skink						•			•							
Morethia ruficauda	Fire-tailed Skink						•		•	•	•	•	•	•	•	•	•

Species	Common name	Conservation Status				Database Searches			Previous Survey								
		EPBC	BCA	DBCA	IUCN	Protected Matters Database (DoEE, 2017)	NatureMap (DBCA, 2017b)	Threatened and Protected Fauna (DBCA, 2017c)	Corunna Downs Project (MWH, 2016)	Panorama Project Area (Bamford Consulting Ecologists, 2001)	Mount Webber Iron Ore Project (ecologia Environment, 2010)	Panorama Project Mine Site and Haul Road Corridor (Biota, 2007)	BC Iron Nullagine Iron Ore Project (Bamford Consulting Ecologists, 2009b)	Abydos DSO Project (Bamford Consulting Ecologists, 2009a)	Abydos DSO Project (Outback Ecology, 2011)	Abydos-Woodstock Reserve (How *et al.*, 1991b)	North Star Project (ecologia Environment, 2012)
Notoscincus ornatus	Ornate Soil-crevice Skink				LC		•		•	•		•			•	•	•
Proablepharus reginae	Skink				LC		•			•					•	•	•
Tiliqua multifasciata	Central Blue-tongue Lizard				LC		•		•				•			•	•
Tiliqua occipitalis	Western Blue-tongue				LC		•										
TYPHLOPIDAE																	
Anilios ammodytes	Blind Snake				LC				•		•			•	•		•
Anilios diversus	Northern Blind snake				LC											•	
Anilios grypus	Blind Snake				LC				•		•		•		•	•	•
Anilios hamatus	Blind Snake				LC				•							•	
VARANIDAE																	
Varanus acanthurus	Spiny-tailed Monitor						•		•	•	•		•	•	•	•	•
Varanus brevicauda	Short-tailed Pygmy Monitor						•		•							•	•
Varanus caudolineatus							•									•	
Varanus eremius	Pygmy Desert Monitor						•		•		•	•				•	•
Varanus giganteus	Perentie						•		•	•	•		•	•	•	•	•
Varanus gouldii	Sand Monitor or Bungarra						•							•		•	•
Varanus panoptes	Yellow Spotted Monitor						•		•				•	•		•	•
Varanus pilbarensis	Northern Pilbara Rock Monitor						•		•						•	•	•
Varanus tristis	Racehorse Monitor						•		•			•	•	•	•	•	•

Amphibians

Species	Common name	Conservation Status				Databases			Previous Surveys								
		EPBC	BCA	DBCA	IUCN	Protected Matters Database (DoEE, 2017)	NatureMap (DBCA, 2017b)	Threatened and Protected Fauna (DBCA, 2017c)	Birdata Database (Birdlife Australia, 2017)	Corunna Downs Project (MWH, 2016)	Panorama Project Area (Bamford Consulting Ecologists, 2001)	Mount Webber Iron Ore Project (ecologia Environment, 2010)	Panorama Project Mine Site and Haul Road Corridor (Biota, 2007)	BC Iron Nullagine Iron Ore Project (Bamford Consulting Ecologists, 2009b)	Abydos DSO Project (Bamford Consulting Ecologists, 2009a)	Abydos DSO Project (Outback Ecology, 2011)	Abydos-Woodstock Reserve (How *et al.*, 1991b)
HYLIDAE																	
Cyclorana australis	Giant Frog				LC										•		•
Cyclorana maini	Sheep Frog				LC		•		•		•		•			•	•
Litoria rubella	Little Red Tree Frog				LC		•		•	•	•	•		•	•	•	•
LIMNODYNASTIDAE																	
Neobatrachus aquilonius	Northern Burrowing Frog				LC								•				
Notaden nichollsi	Desert Spadefoot				LC		•										•
Platyplectrum spenceri	Centralian Burrowing Frog				LC		•		•		•			•		•	•
MYOBATRACHIDAE																	
Pseudophryne douglasi	Gorge Toadlet				LC		•										
Uperoleia russelli	Northwest Toadlet				LC		•			•	•	•		•	•	•	
Uperoleia glandulosa	Glandular Toadlet				LC		•						•	•		•	•
Uperoleia saxatilis	Pilbara Toadlet						•		•								•

Fish

Species	Common name	Conservation Status				Databases			Previous Surveys								
		EPBC	BCA	DBCA	IUCN	DoEE	NatureMap	DBCA Threatened and Protected Fauna	Corunna Downs Project (MWH, 2016)	Panorama Project Area (Bamford Consulting Ecologists 2001)	Mount Webber Iron Ore Project (ecologia 2010)	Panorama Project Mine Site and Haul Road Corridor (Biota 2007)	BC Iron Nullagine Iron Ore Project (Bamford Consulting Ecologists 2009b)	Abydos DSO Project (Bamford Consulting Ecologists 2009a)	Abydos DSO Project (Outback Ecology 2011)	Abydos-Woodstock Reserve (How *et al.* 1991)	North Star Project (ecologia 2012)
Leiopotherapon unicolour	Spangled Perch						•			•				•	•		
Melanotaenia australis	Western Rainbowfish						•			•			•	•	•		
Neosilurus hyrtlii	Hyrtl's Catfish						•			•					•		
Nematalosa erebi	Bony Bream				LC		•			•							

Appendix C: Motion Camera Sampling Locations from the current survey

Site name	Date Deployed	Date Retrieved	Trapping Nights	Latitude	Longitude	Habitat	Notes
WAR_MC01	21/09/2017	24/09/2017	3	-21.3418	119.9012	Hillcrest/ Hillslope	Aligns with site WAR_NQ03 (Biologic, 2019c)
WAR_MC02	22/09/2017	23/09/2017	2	-21.3361	119.8879	Hillcrest/ Hillslope	Aligns with site WAR_NQ05 (Biologic, 2019c)
WAR_MC03	22/09/2017	24/09/2017	2	-21.3353	119.8883	Minor Drainage Line	Aligns with site WAR_NQ05 (Biologic, 2019c)
WAR_MC04	22/09/2017	24/09/2017	2	-21.3348	119.8894	Minor Drainage Line	Aligns with site WAR_NQ05 (Biologic, 2019c)
WAR_MC05	21/09/2017	24/09/2017	3	-21.3347	119.8900	Minor Drainage Line	Aligns with site WAR_NQ05 (Biologic, 2019c)
WAR_MC06	22/09/2017	24/09/2017	2	-21.3346	119.889	Minor Drainage Line	Aligns with site WAR_NQ05 (Biologic, 2019c)
WAR_MC07	22/09/2017	24/09/2017	2	-21.3343	119.8901	Minor Drainage Line	Aligns with site WAR_NQ05 (Biologic, 2019c)
WAR_MC08	22/09/2017	24/09/2017	2	-21.3338	119.8904	Hillcrest/ Hillslope	Aligns with site WAR_NQ05 (Biologic, 2019c)
WAR_MC09	22/09/2017	24/09/2017	2	-21.3336	119.8908	Hillcrest/ Hillslope	Aligns with site WAR_NQ05 (Biologic, 2019c)
WAR_MC10	21/09/2017	24/09/2017	3	-21.3196	119.8628	Minor Drainage Line	Aligns with site WAR_NQ01 (Biologic, 2019c)
WAR_MC11	21/09/2017	24/09/2017	3	-21.3162	119.8599	Hillcrest/ Hillslope	Aligns with site WAR_NQ01 (Biologic, 2019c)
WAR_MC12	21/09/2017	24/09/2017	3	-21.3148	119.8581	Hillcrest/ Hillslope	Aligns with site WAR_NQ01 (Biologic, 2019c)
WAR_MC13	21/09/2017	24/09/2017	3	-21.3103	119.855	Medium Drainage Line	Aligns with site WAR_NQ02 (Biologic, 2019c)

Appendix D: Records of fauna from SRE target groups around the Study Area

ORDER	INFRAORDER	FAMILY	GENUS	SPECIES	LATITUDE	LONGITUDE	COLLECTION METHOD	YEAR
Araneae	Araneomorphae	Selenopidae		`indet. (moulted skin)`	-21.3754	119.688	searching	2016
Araneae	Mygalomorphae	Nemesiidae	*Aname*		-21.2794	119.4119	wet pitfall	2010
Araneae	Mygalomorphae	Nemesiidae	*Aname*	`MYG001 group`	-21.6785	120.0884	ethylene glycol pits	2010
Araneae	Mygalomorphae	Nemesiidae	*Aname*	`MYG099`	-21.4076	120.0713	ethylene glycol pits	2010
Araneae	Mygalomorphae	Nemesiidae	*Aname*	`sp. indet. (female)`	-21.6158	120.0822	hand collected	2012
Araneae	Mygalomorphae	Nemesiidae	*Aname*	`sp. indet. (juvenile)`	-21.3881	119.6522	Wet Pitfall Trap	2015
Araneae	Mygalomorphae	Nemesiidae	*Aname*	mellosa	-21.6616	119.9756	targeted searching	2014
Araneae	Mygalomorphae	Barychelidae	*Aurecocrypta*	`sp. indet.`	-21.4726	119.6352	Dry Pitfall Trap	2015
Araneae	Mygalomorphae	Barychelidae			-21.4992	120.1092	wet pit (eth. glycol	2012
Araneae	Mygalomorphae	Barychelidae	*Idiommata*	`MYG111`	-21.5939	120.0939	dry pitfall	2012
Araneae	Mygalomorphae	Idiopidae			-21.4684	120.0065	wet pit (eth. glycol	2012
Araneae	Araneomorphae	Sparassidae	*Isopedella*	`gibsandi?`	-21.1722	119.7892	by hand	2016
Araneae	Araneomorphae	Selenopidae	*Karaops*	`indet. (juv.)`	-21.4726	119.6352	pitfall trap	2016
Araneae	Araneomorphae	Selenopidae	*Karaops*	`sp. indet. (juvenile)`	-21.4799	120.0908	wet pit, ethy. glyc.	2011
Araneae	Araneomorphae	Selenopidae	*Karaops*	nyangumarta	-21.4528	119.6543	Wet Pitfall Trap	2015
Araneae	Mygalomorphae	Actinopodidae	*Missulena*	melissae	-21.4077	120.0713	wet pit (eth.gyl)	2010
Araneae	Mygalomorphae	Actinopodidae	*Missulena*	rutraspina	-21.4619	120.0136	wet pit (eth.gyl)	2010
Araneae	Mygalomorphae	Nemesiidae			-21.6785	120.0884	wet pit (eth. glycol	2012
Araneae	Araneomorphae	Sparassidae	*Neosparassus*	`sp. A4a`	-21.3358	119.8875		2004
Araneae	Araneomorphae	Selenopidae			-21.4675	119.6708	wet pitfall trap	2015
Araneae	Mygalomorphae	Barychelidae	*Synothele*	`MYG114`	-21.6785	120.0884	ethylene glycol pits	2009
Araneae	Araneomorphae	Sparassidae	*Typostola*	pilbara	-21.1666	119.75	by hand	1970
Polydesmida		Paradoxosomatidae	*Antichiropus*	`DIP011 ?`	-20.8956	119.6025	ethylene glycol pitf	2006
Polydesmida		Paradoxosomatidae	*Antichiropus*	`DIP026`	-21.7703	120.0919		2006
Polydesmida		Paradoxosomatidae	*Antichiropus*	`DIP034`	-21.1726	119.7453	hand collected	2012
Polydesmida		Paradoxosomatidae	*Antichiropus*	`DIP038`	-21.4264	119.5531	ethylene glycol pitf	2006
Polydesmida		Paradoxosomatidae	*Antichiropus*	`sp. check (male)`	-21.3923	120.0709		2006
Polydesmida		Paradoxosomatidae	*Antichiropus*	`sp. indet. (damaged)`	-21.6158	120.0822	wet pitfall	2012
Polydesmida		Paradoxosomatidae	*Antichiropus*	`sp. Indet. (female)`	-21.4683	120.0064		2006
Polydesmida		Paradoxosomatidae	*Antichiropus*	`sp. indet. (female/juvenile)`	-21.5786	120.1194	wet pitfall	2012
Polydesmida		Paradoxosomatidae	*Antichiropus*	`sp. indet. (juvenile)`	-21.4683	120.0064	wet pitfall traps	2004
Polydesmida		Paradoxosomatidae			-21.3887	119.6185	Targeted Searching	2015
Pseudoscorpiones	Panctenata	Olpiidae	*`Genus 7/4`*		-21.6014	120.0978	wet pitfall	2012
Pseudoscorpiones	Panctenata	Olpiidae	*`Genus indet.`*	`sp. indet. (damaged)`	-21.58	120.15	wet pitfall	2012
Pseudoscorpiones	Panctenata	Olpiidae	*`Genus?`*		-20.8841	120.1042		2008
Pseudoscorpiones	Panctenata	Sternophoridae	*Afrosternophorus*		-21.6909	119.6736	Targeted searching	2014
Pseudoscorpiones	Panctenata	Olpiidae	*Austrohorus*		-20.8841	120.1042		2008
Pseudoscorpiones		Olpiidae	*Austrohorus*	`sp. indet.`	-21.4232	119.6217	Targeted Searching	2014
Pseudoscorpiones		Olpiidae	*Beierolpium*	`8/3`	-21.4945	119.6364	Wet Pitfall Trap	2015
Pseudoscorpiones	Panctenata	Olpiidae	*Beierolpium*	`sp. 8/4 lge`	-21.58	120.15	wet pitfall	2012
Pseudoscorpiones		Olpiidae	*Beierolpium*	`sp. indet. (juvenile)`	-21.3881	119.6522	Targeted Searching	2014
Pseudoscorpiones	Panctenata	Olpiidae	*Euryolpium*		-20.8841	120.1042		2008
Pseudoscorpiones		Feaellidae	*Feaella*	*tealei*	-21.3887	119.6185	Targeted Searching	2014
Pseudoscorpiones	Panctenata	Chernetidae	*Haplochernes*	*`sp.`*	-20.9306	119.8542	by hand	2012

ORDER	INFRAORDER	FAMILY	GENUS	SPECIES	LATITUDE	LONGITUDE	COLLECTION METHOD	YEAR
Pseudoscorpiones		Olpiidae	*Indolpium*		-21.155	119.8356	wet pitfall	2010
Pseudoscorpiones		Olpiidae	*Indolpium*	*`sp. indet. (juvenile)`*	-21.4945	119.6364	Targeted Searching	2014
Pseudoscorpiones		Olpiidae	*Indolpium*	*`sp. indet.`*	-21.4903	119.6678	Targeted Searching	2014
Pseudoscorpiones	Panctenata	Olpiidae			-21.3923	120.0709	wet pitfall	2006
Pseudoscorpiones	Panctenata				-21.1675	119.7628	by hand	2014
Pseudoscorpiones	Panctenata	Garypidae	*Synsphyronus*	*`8/3 pilbara`*	-21.3887	119.6185	Wet Pitfall Trap	2014
Pseudoscorpiones	Panctenata	Garypidae	*Synsphyronus*	*`paradoxus complex`*	-21.6939	119.6786	dry pitfall	2014
Pseudoscorpiones	Panctenata	Garypidae	*Synsphyronus*	*`PSE091, 7/3 short`*	-21.6785	119.6538	dry pitfall	2014
Pseudoscorpiones	Panctenata	Garypidae	*Synsphyronus*	*`PSE093, 8/1 Pilbara`*	-21.1408	119.8889		2006
Pseudoscorpiones	Panctenata	Garypidae	*Synsphyronus*	*`sp. nov. Spinifex Ridge`*	-20.8837	120.1158		2008
Pseudoscorpiones	Panctenata	Olpiidae	*Xenolpium*	*`PSE063`*	-21.5706	120.1311	hand collected	2012
Pseudoscorpiones		Olpiidae	*Xenolpium*	*`sp. indet. (juvenile)`*	-21.4667	119.648	Targeted Searching	2014
Pseudoscorpiones		Olpiidae	*Xenolpium*	*`sp. indet.`*	-21.4675	119.6708	wet pitfall trap	2014
Scorpiones		Bothriuridae	*Cercophonius*	*granulosus*	-20.888	120.1158		2005
Scorpiones		Buthidae	*Lychas*	*`bituberculatus (?, juvenile)`*	-20.8848	120.1206		2008
Scorpiones		Buthidae	*Lychas*	*`bituberculatus complex`*	-21.4874	119.6689	wet pitfall trap	2014
Scorpiones		Buthidae	*Lychas*	*`gracilimanus`*	-21.698	119.6909	Targeted searching	2014
Scorpiones		Buthidae	*Lychas*	*`hairy tail complex`*	-21.4185	119.6817	wet pitfall trap	2014
Scorpiones		Buthidae	*Lychas*	*`hairy tail group`*	-20.8869	120.0795		2008
Scorpiones		Buthidae	*Lychas*	*`hairy tail grp`*	-21.6033	120.0783	wet pitfall	2012
Scorpiones		Buthidae	*Lychas*	*`harveyi`*	-21.6805	119.6867	Targeted searching	2014
Scorpiones		Buthidae	*Lychas*	*`sp. 1`*	-20.8983	119.5906	Ethylene Glycol Pit	2007
Scorpiones		Buthidae	*Lychas*	*`sp. 2`*	-21.6772	120.1554	Ethylene Glycol Pit	2007
Scorpiones		Buthidae	*Lychas*	*`sp. 3`*	-21.6772	120.1554	Ethylene Glycol Pit	2007
Scorpiones		Buthidae	*Lychas*	*`sp. 4`*	-21.4684	120.0065	Ethylene Glycol Pit	0
Scorpiones		Buthidae	*Lychas*	*`sp. 6`*	-21.7703	120.0919	Ethylene Glycol Pit	2007
Scorpiones		Buthidae	*Lychas*	*`sp.`*	-21.5847	120.1414	wet pitfall	2012
Scorpiones		Buthidae	*Lychas*	*annulatus*	-21.4991	120.1091	wet pitfall (ethylen	0
Scorpiones		Buthidae	*Lychas*	*bituberculatus*	-21.698	119.6909	Targeted searching	2014
Scorpiones		Urodacidae	*Urodacus*		-21.6212	120.1028	dry pitfall	2012
Scorpiones		Urodacidae	*Urodacus*	*`Pilbara 16`*	-21.4685	119.6363	dry pitfall trap	2014
Scorpiones		Urodacidae	*Urodacus*	*`pilbara 4`*	-21.4685	119.6363	dry pitfall trap	2014
Scorpiones		Urodacidae	*Urodacus*	*`pilbara 5`*	-21.6939	119.6786	dry pitfall	2014
Scorpiones		Urodacidae	*Urodacus*	*`Pilbara sp. 5`*	-21.6772	120.1554	Ethylene Glycol Pit	0
Scorpiones		Urodacidae	*Urodacus*	*`sp. 2`*	-21.4076	120.0713	Ethylene Glycol Pit	0
Scorpiones		Urodacidae	*Urodacus*	*`sp. 4`*	-21.7703	120.0919	Ethylene Glycol Pit	0
Scorpiones		Urodacidae	*Urodacus*	*`sp. 5`*	-20.9352	119.8581	Ethylene Glycol Pit	0
Scorpiones		Urodacidae	*Urodacus*	*`sp. indet.`*	-21.6616	119.9762	dry pitfall	2014
Scorpiones		Urodacidae	*Urodacus*	*`sp. Pilbara 8`*	-21.218	119.4019	Ethylene Glycol Pit	0
Scorpiones		Urodacidae	*Urodacus*	*`sp.`*	-20.9108	119.6497	wet pitfall (ethylen	0
Scorpiones		Urodacidae	*Urodacus*	*butleri*	-21.6939	119.6786	dry pitfall	2014
Scorpiones		Urodacidae	*Urodacus*	*yaschenkoi*	-20.8666	119.7833	by hand	1938
Potential SRE Fauna Identified In NatureMap								
Stylommatophora		Camaenidae	*Rhagada*	*convicta*				

Appendix E: Records of subterranean fauna around the Study Area

CLASS	ORDER	INFRAORDER	FAMILY	GENUS	SPECIES	LATITUDE	LONGITUDE	COLLECTION METHOD	YEAR
Arachnida	Acari					-21.3308	120.3756		
Arachnida	Acari		Hydryphantidae	*Wandesia*		-21.3308	120.3756		2008
Arachnida	Acari		Mideopsidae	*Guineaxonopsis*	*`sp. S1`*	-21.4497	120.0781		
Arachnida	Acari		Unionicolidae	*Recifella*	*`sp. 1`*	-20.9378	119.9601		2008
Arachnida	Araneae	Araneomorphae	Oonopidae	*Prethopalpus*		-21.59083	120.0956	trog net scrape	2015
Malacostraca	Bathynellacea		Parabathynellidae	*nr Atopobathynella*	*sp. B16*	-21.0136	120.004	Net, 11 metres	2013
Malacostraca	Isopoda		Microcerberidae			-21.1402	119.865	Bore hole net	
Malacostraca	Isopoda		Microcerberidae			-21.4595	120.021	Bore hole net	
Malacostraca	Isopoda		Microcerberidae			-20.9377	119.96	Bore hole net	
Malacostraca	Isopoda		Microcerberidae			-20.9377	119.96	Bore hole net	
Malacostraca	Isopoda		Microcerberidae			-21.1032	119.408	Bore hole net	
Maxillopoda	Cyclopoida		Cyclopidae	*Diacyclops*	*sobeprolatus*	-21.0136	120.003	Net, 5 metres	2012
Maxillopoda	Cyclopoida		Cyclopidae	*Microcyclops*	*varicans*	-21.0136	120.003	Net, 5 metres	2013
Maxillopoda	Cyclopoida		Cyclopidae	*Orbuscyclops*	*westaustraliensis*	-21.0136	120.004	Net, 9 metres	2013
Maxillopoda	Harpacticoida		Ameiridae	*Megastygonitocrella*	*unispinosa*	-21.0136	120.004	Net, 23 metres	2012
Maxillopoda	Harpacticoida		Parastenocarididae	*Parastenocaris*	*sp. B23*	-21.0136	120.004	Net, 9 metres	2012
Ostracoda	Podocopida		Candonidae	*Amphitritecandona*	*secunda*	-20.9352	119.851		2006
Ostracoda	Podocopida		Candonidae	*Kencandona*	*harleyi*	-20.9377	119.96		2006
Ostracoda	Podocopida		Candonidae	*Kencandona*	*harleyi*	-20.9377	119.96		2006
Ostracoda	Podocopida		Candonidae	*Kencandona*	*harleyi*	-20.9377	119.96		2006
Ostracoda	Podocopida		Candonidae	*Leicacandona*	*lite*	-21.1033	119.408		2006
Ostracoda	Podocopida		Candonidae	*Leicacandona*	*lite*	-21.1033	119.408		2006
Ostracoda	Podocopida		Candonidae	*Leicacandona*	*makra*	-20.9377	119.96		2006
Ostracoda	Podocopida		Candonidae	*Leicacandona*	*makra*	-20.9377	119.96		2006
Ostracoda	Podocopida		Candonidae	*Leicacandona*	*makra*	-20.9377	119.96		2006
Subterranean Fauna Identified In NatureMap									
Malacostraca	Amphipoda		Paramelitidae		*sp.*				
Malacostraca	Amphipoda		Paramelitidae		*sp. 6 (PSS)*				

CLASS	ORDER	INFRAORDER	FAMILY	GENUS	SPECIES	LATITUDE	LONGITUDE	COLLECTION METHOD	YEAR
Malacostraca	Amphipoda		Paramelitidae		*sp.*				
Malacostraca	Bathynellacea		Bathynellidae	*Bathynella*	*sp.*	-	-	-	-
Maxillopoda	Cyclopoida		Cyclopidae	*Australoeucyclops*	*karaytugi (ex Paracyclops sp. 7)*				
Maxillopoda	Cyclopoida		Cyclopidae	*Diacyclops*	*cockingi*				
Maxillopoda	Cyclopoida		Cyclopidae	*Diacyclops*	*humphreysi humphreysi*				
Maxillopoda	Cyclopoida		Cyclopidae	*Diacyclops*	*scanloni*				
Maxillopoda	Cyclopoida		Cyclopidae	*Diacyclops*	*sp.*				
Maxillopoda	Cyclopoida		Cyclopidae	*Mesocyclops*	*darwini*				
Maxillopoda	Cyclopoida		Cyclopidae	*Mesocyclops*	*notius*				
Maxillopoda	Cyclopoida		Cyclopidae	*Tropocyclops*	*confinis (ex Paracyclops sp. 6)*				
Maxillopoda	Harpacticoida		Ameiridae	*Stygonitocrella*	*bispinosa*	-	-	-	-
Maxillopoda	Harpacticoida		Ameiridae	*Stygonitocrella*	*trispinosa*	-	-	-	-
Maxillopoda	Harpacticoida		Ameiridae	*Stygonitocrella*	*unispinosa*	-	-	-	-
Maxillopoda	Harpacticoida		Canthocamptidae	*Elaphoidella*	*humphreysi*				
Maxillopoda	Harpacticoida		Parastenocarididae		*sp.*				
Maxillopoda	Harpacticoida		Parastenocarididae	*Parastenocaris*	*sp.*				
Maxillopoda	Harpacticoida		Parastenocarididae	*Parastenocaris*	*sp. 3*				
Oligochaeta					*sp.*				
Oligochaeta	Tubificida		Phreodrilidae		*Phreodrilid with similar ventral chaetae*				
Oligochaeta	Tubificida		Phreodrilidae		*Phreodrilid with dissimilar ventral chaetae*				
Oligochaeta	Tubificida		Phreodrilidae	*Insulodrilus*	*lacustris s.l. Pilbara type 2/3 = WA35 (PSS)*				
Oligochaeta	Tubificida		Phreodrilidae	*Phreodrilus*	*peniculus*				
Ostracoda					*sp.*				
Ostracoda	Podocopida		Candonidae	*Candonopsis*	*tenuis*	-	-	-	-
Ostracoda	Podocopida		Candonidae	*Humphreyscandona*	*'capillus' (PSS)*	-	-	-	-
Ostracoda	Podocopida		Candonidae	*Notacandona*	*Cf. ‘carinata (PSS)*	-	-	-	-
Ostracoda	Podocopida		Limnocytheridae	*Gomphodella*	*'hirsuta' (PSS)*	-	-	-	-

Appendix F: Habitat Assessments

Survey	Site ID	Latitude	Longitude	Landform	Aspect	Slope	Soil Type and Availability	Outcropping Amount and Type	Ground Cover				Microhabitats					Condition		
									Rock Type	Vegetation Litter	Dominant Vegetation Type	Woody Debris	Rocky Cracks/ Crevices	Burrowing Suitability	Hollows (<10 cm)	Hollows (>10 cm)	Water	Habitat Condition	Disturb	Fire Ages
Biologic (2019b)	WAR_HA01	-21.3575	119.9036	Stony Plain	Flat	Flat	Sand, Many Small Patches	Limited Outcropping	Boulders (>61cm)	Scarce	Triodia Grassland	Scarce	Granite	Low	None	Low 5-20%	None	Not noted	None Discernible	Old (6+yr)
Biologic (2019b)	WAR_HA02	-21.3570	119.8974	Stony Plain	Flat	Flat	Sand, Many Small Patches	Limited Outcropping	Boulders (>61cm)	Scarce	Triodia Grassland	Scarce	Granite	Low	None	Low 5-20%	None	Not noted	None Discernible	Old (6+yr)
Biologic (2019b)	WAR_HA03	-21.3492	119.8999	Rounded Hills	South	Moderate	Clay Loam, Scarce	Minor Outcropping	Large Rocks (21-60cm)	Scarce	Triodia Grassland	Scarce	Other	Nil	None	Negligible <5%	None	Not noted	Mining Exploration, ,Road/ Access Track	Old (6+yr)
Biologic (2019b)	WAR_HA04	-21.3379	119.8837	Medium Drainage Line	South	Low	Sand, Many Small Patches	Minor Outcropping	Pebbles (5-10cm)	Many Small Patches	Eucalyptus/ Corymbia Woodland	Few Small Patches	Conglom	Low	None	Low 5-20%	None	Not noted	None Discernible	Old (6+yr)
Biologic (2019a)	WAR_HA05	-21.3419	119.9018	Hillcrest/ Hillslope	East	Moderate	Clay Loam	Few Small Patches	Moderate Outcropping	Pebbles (5-10cm)	Few Small Patches	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Mining Exploration	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA06	-21.3281	119.8604	Medium Drainage Line	South	Flat	Sand	Many Small Patches	Negligible	Negligible	Few Small Patches	Eucalyptus/ Corymbia Woodland	Not noted	Nil	None	None	None	Not noted	Road/ Access Track	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA07	-21.3262	119.8550	Hillcrest/ Hillslope	Flat	Flat	Clay Loam	Scarce	Limited Outcropping	Gravel (1-4cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Road/ Access Track	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA08	-21.3224	119.8529	Hillcrest/ Hillslope	South	Low	Light Clay	Scarce	Limited Outcropping	Gravel (1-4cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Road/ Access Track	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA09	-21.3323	119.8696	Hillcrest/ Hillslope	North	Moderate	Clay Loam	Scarce	Moderate Outcropping	Large Rocks (21-60cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Mining Exploration	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA10	-21.3354	119.8740	Medium Drainage Line	East	Flat	Sand	Many Large Patches	Negligible	Large Rocks (21-60cm)	Many Small Patches	Eucalyptus/ Corymbia Woodland	Not noted	Low	None	None	None	Not noted	Weed Invasion	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA11	-21.3358	119.8737	Hillcrest/ Hillslope	North	Moderate	Clay Loam	Scarce	Major Outcropping	Small Rocks (11-20cm)	Few Small Patches	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Cattle Grazing	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA12	-21.3352	119.8805	Hillcrest/ Hillslope	South	Low	Clay Loam	Scarce	Negligible	Negligible	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Road/ Access Track	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA13	-21.3413	119.8868	Hillcrest/ Hillslope	North	Low	Clay Loam	Scarce	Limited Outcropping	Small Rocks (11-20cm)	None Discernible	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Mining Exploration	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA14	-21.3363	119.8393	Stony Plain	Flat	Flat	Clay Loam	Few Small Patches	Negligible	Gravel (1-4cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA15	-21.3412	119.8405	Hillcrest/ Hillslope	North	Moderate	Clay Loam	Scarce	Limited Outcropping	Small Rocks (11-20cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA16	-21.3475	119.8435	Sand Plain	Flat	Flat	Clay Loam	Evenly Spread	Limited Outcropping	Negligible	Few Small Patches	Triodia Grassland	Not noted	High	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA17	-21.3462	119.8428	Sand Plain	Flat	Flat	Clay Loam	Evenly Spread	Limited Outcropping	Negligible	Few Small Patches	Triodia Grassland	Not noted	High	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA18	-21.3447	119.8524	Sand Plain	Flat	Flat	Clay Loam	Evenly Spread	Limited Outcropping	Negligible	Few Small Patches	Triodia Grassland	Not noted	High	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA19	-21.3061	119.7642	Hillcrest/ Hillslope	South/ East	Moderate	Clay Loam	Scarce	Major Outcropping	Large Rocks (21-60cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Road/ Access Track	Old (6+ yr)
Biologic (2019a)	WAR_HA20	-21.3067	119.7620	Hillcrest/ Hillslope	North/ East	Moderate	Sandy Clay Loam	Scarce	Moderate Outcropping	Large Rocks (21-60cm)	Few Small Patches	Open Eucalyptus/ Corymbia	Not noted	Nil	None	None	None	Not noted	Mining Exploration	Old (6+ yr)
Biologic (2019a)	WAR_HA21	-21.2997	119.7744	Hillcrest/ Hillslope	South	Low	Clay Loam	Scarce	Minor Outcropping	Large Rocks (21-60cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA22	-21.2998	119.7834	Hillcrest/ Hillslope	South	Moderate	Clay Loam	Few Small Patches	Moderate Outcropping	Boulders (>61cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Mining Exploration	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA23	-21.3032	119.7890	Hillcrest/ Hillslope	South	Moderate	Clay Loam	Few Small Patches	Minor Outcropping	Boulders (>61cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Mining Exploration	Moderate (3 to 5 yr)

Survey	Site ID	Latitude	Longitude	Landform	Aspect	Slope	Soil Type and Availability	Outcropping Amount and Type	Ground Cover				Microhabitats					Condition		
									Rock Type	Vegetation Litter	Dominant Vegetation Type	Woody Debris	Rocky Cracks/ Crevices	Burrowing Suitability	Hollows (<10 cm)	Hollows (>10 cm)	Water	Habitat Condition	Disturb	Fire Ages
Biologic (2019a)	WAR_HA24	-21.3053	119.8112	Hillcrest/ Hillslope	South	Moderate	Clay Loam	Scarce	Minor Outcropping	Small Rocks (11-20cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Mining Exploration	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA25	-21.3063	119.8119	Medium Drainage Line	Flat	Flat	Sandy Loam	Many Large Patches	Negligible	Negligible	Few Small Patches	Eucalyptus/ Corymbia Woodland	Not noted	Low	None	None	None	Not noted	Mining Exploration	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA26	-21.3668	119.9099	Stony Plain	Flat	Flat	Sandy Clay Loam	Few Large Patches	Negligible	Gravel (1-4cm)	Few Small Patches	Triodia Grassland	Not noted	Low	None	None	None	Not noted	Road/ Access Track	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA27	-21.3551	119.9215	Hillcrest/ Hillslope	South	Moderate	Clay Loam	Scarce	Moderate Outcropping	Small Rocks (11-20cm)	Scarce	Triodia Grassland	Not noted		None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA28	-21.3542	119.9228	Hillcrest/ Hillslope	South	Moderate	Clay Loam	Scarce	Moderate Outcropping	Small Rocks (11-20cm)	Scarce	Triodia Grassland	Not noted		None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA29	-21.3546	119.9005	Medium Drainage Line	South	Low	Sand	Few Large Patches	Negligible	Pebbles (5-10cm)	Few Small Patches	Open Eucalyptus/ Corymbia	Not noted		None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA30	-21.3507	119.9009	Hillcrest/ Hillslope	South	Moderate	Clay Loam	Scarce	Moderate Outcropping	Small Rocks (11-20cm)	Scarce	Triodia Grassland	Not noted		None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA31	-21.3580	119.9051	Rounded Hills	Flat	Flat	Sandy Clay Loam	Few Large Patches	Negligible	Gravel (1-4cm)	Few Small Patches	Triodia Grassland	Not noted	Low	None	None	None	Not noted	Road/ Access Track	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA32	-21.3491	119.9055	Minor Drainage Line	Flat	Flat	Sandy Clay Loam	Few Small Patches	Limited Outcropping	Small Rocks (11-20cm)	Many Small Patches	Open Eucalyptus/ Corymbia	Not noted		None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA33	-21.3299	119.8810	Hillcrest/ Hillslope	South	Moderate	Clay Loam	Scarce	Major Outcropping	Large Rocks (21-60cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Mining Exploration, Road/ Access Track	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA34	-21.3280	119.8766	Hillcrest/ Hillslope	South	Moderate	Clay Loam	Scarce	Major Outcropping	Large Rocks (21-60cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Mining Exploration, Road/ Access Track	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA35	-21.3251	119.8723	Minor Drainage Line	Flat	Flat	Sandy Loam	Few Small Patches	Limited Outcropping	Gravel (1-4cm)	Scarce	Other Acacia Thicket	Not noted	Low	None	None	None	Not noted	Road/ Access Track	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA36	-21.3201	119.8642	Hillcrest/ Hillslope	South	Moderate	Clay Loam	Scarce	Major Outcropping	Boulders (>61cm)	Scarce	Triodia Grassland	Not noted	Nil	None	None	None	Not noted	Mining Exploration, Road/ Access Track	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA37	-21.3151	119.8573	Rocky Breakaway	South	Steep	Clay Loam	Many Small Patches	Major Outcropping	Large Rocks (21-60cm)	Many Small Patches	Ficus Tree/ Shrub	Not noted	Nil	None	None	None	Not noted	None Discernible	Old (6+ yr)
Biologic (2019a)	WAR_HA38	-21.3457	119.8499	Sand Plain	Flat	Flat	Clay Loam	Evenly Spread	Limited Outcropping	Negligible	Few Small Patches	Triodia Grassland	Not noted	High	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA39	-21.3528	119.8464	Sand Plain	Flat	Flat	Sand	Evenly Spread	Limited Outcropping	Negligible	Few Small Patches	Triodia Grassland	Not noted	High	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA40	-21.3577	119.8492	Sand Plain	Flat	Flat	Sand	Evenly Spread	Limited Outcropping	Negligible	Few Small Patches	Triodia Grassland	Not noted	High	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA41	-21.3591	119.8500	Sandplain	Flat	Flat	Sandy Clay Loam	Few Small Patches	Negligible	Gravel (1-4cm)	Few Small Patches	Triodia Grassland	Not noted	High	None	None	None	Not noted	Road/ Access Track	Old (6+ yr)
Biologic (2019a)	WAR_HA42	-21.3558	119.8611	Sand Plain	Flat	Flat	Sand	Evenly Spread	Limited Outcropping	Negligible	Few Small Patches	Triodia Grassland	Not noted	High	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA43	-21.3547	119.8724	Sandy/ Stony Plain	Flat	Flat	Sand	Evenly Spread	Negligible	Negligible	Few Small Patches	Triodia Grassland	Not noted	Low	None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Biologic (2019a)	WAR_HA44	-21.3575	119.8831	Hillcrest/ Hillslope	South	Low	Clay Loam	Scarce	Negligible	Gravel (1-4cm)	Few Small Patches	Open Eucalyptus/ Corymbia	Not noted		None	None	None	Not noted	None Discernible	Moderate (3 to 5 yr)
Current survey	WAR_HA45	-21.3437	119.9079	Hillcrest/Upper Hillslope	North	Moderate	Clay Loam, Scarce	Minor Outcropping, Other	Pebbles (5-10cm)	Scarce	Spinifex Hummock Grassland	Scarce	Low	Nil	None	None	None	Pristine	Mining Exploration	Old (6+yr)
Current survey	WAR_HA46	-21.3367	119.8967	Hillcrest/Upper Hillslope	North	Moderate	Clay Loam, Scarce	Minor Outcropping, Other	Pebbles (5-10cm)	Scarce	Spinifex Hummock Grassland	Scarce	Low	Nil	None	None	None	Pristine	Mining Exploration	Old (6+yr)

Survey	Site ID	Latitude	Longitude	Landform	Aspect	Slope	Soil Type and Availability	Outcropping Amount and Type	Ground Cover				Microhabitats					Condition		
									Rock Type	Vegetation Litter	Dominant Vegetation Type	Woody Debris	Rocky Cracks/ Crevices	Burrowing Suitability	Hollows (<10 cm)	Hollows (>10 cm)	Water	Habitat Condition	Disturb	Fire Ages
Current survey	WAR_HA47	-21.3418	119.9012	Hillcrest/Upper Hillslope	North	Moderate	Clay Loam, Scarce	Minor Outcropping, Other	Pebbles (5-10cm)	Scarce	Spinifex Hummock Grassland	Scarce	Low	Nil	None	None	None	Pristine	Mining Exploration	Old (6+yr)
Current survey	WAR_HA48	-21.3121	119.8527	Medium Drainage Line	North	Flat	Silty Loam, Few Large Patches	Negligible	Small Rocks (11-20cm)	Few Small Patches	Scattered Eucalypts	Few Small Patches	Low	Nil	Scarce	Scarce	None	Pristine	Cattle Grazing, Mining Exploration	Moderate (3-5yr)
Current survey	WAR_HA49	-21.3352	119.8864	Hillcrest/Upper Hillslope	South	Steep	Clay Loam, Scarce	Major Outcropping, Other	Boulders (>61cm)	Few Small Patches	Spinifex Hummock Grassland	Scarce	High	Low	None	None	None	Excellent	Mining Exploration	Old (6+yr)
Current survey	WAR_HA50	-21.3304	119.8815	Footslope	East	Moderate	Clay Loam, Scarce	Moderate Outcropping, Other	Gravel (1-4cm)	Few Small Patches	Spinifex Hummock Grassland	Scarce	Moderate	Nil	None	None	None	Pristine	Cattle Grazing, Road/ Access Track	Moderate (3-5yr)
Current survey	WAR_HA51	-21.3266	119.8744	Gully	North	Low	Sandy Loam, Many Small Patches	Limited Outcropping, Other	Pebbles (5-10cm)	Few Small Patches	Eucalypt Woodland	Few Small Patches	Nil	Nil	Scarce	None	None	Pristine	Mining Exploration, Road/ Access Track	Recent (0-2 years)
Current survey	WAR_HA52	-21.3124	119.8511	Claypan	N/A	Flat	Light Clay, Evenly Spread	Negligible	Gravel (1-4cm)	Few Small Patches	Sparse Low Shrubs	Scarce	Nil	Nil	None	None	None	Excellent	Cattle Grazing, Mining Exploration, Road/ Access Track	Old (6+yr)
Current survey	WAR_MC05	-21.3275	119.8756	Hillcrest/Upper Hillslope	South	Moderate	Clay Loam, Scarce	Moderate Outcropping, Other	Pebbles (5-10cm)	Few Small Patches	Spinifex Hummock Grassland	Scarce	Moderate	Nil	None	None	None	Pristine	Cattle Grazing, Mining Exploration	Old (6+yr)
Current survey	WAR_MC10	-21.3196	119.8624	Medium Drainage Line	Flat	Flat	Clay Loam, Scarce	Moderate Outcropping, other	Pebbles (5-10cm)	Many Small Patches	Spinifex Hummock Grassland	Few Small Patches	Moderate	Low	None	None	None	Pristine	Cattle Grazing, Mining Exploration	Old (6+yr)
Current survey	WAR_MC11	-21.3162	119.8599	Hillslope	East	Moderate	Clay Loam, Scarce	Moderate Outcropping, Other	Gravel (1-4cm)	Scarce	Spinifex Hummock Grassland	Scarce	Moderate	Nil	None	None	None	Pristine	Road/ Access Track	Old (6+yr)
Current survey	WAR_MC13	-21.3103	119.8547	Breakaway	South	Steep	Silty Loam, Few Small Patches	Major Outcropping, Other	Large Rocks (21-60cm)	Many Small Patches	Spinifex Hummock Grassland	Few Small Patches	Moderate	Nil	Scarce	Scarce	None	Pristine	Cattle Grazing, Mining Exploration	Old (6+yr)

Appendix G: Records for Species of Conservation Significance Recorded During the Current Survey

Common Name	Species	No. of Indivs	Record Type	Latitude	Longitude	Habitat Type
Mammals						
Northern Quoll	*Dasyurus hallucatus*	1	Motion Camera	-21.3162	119.8599	Hillcrest/ Hillslope
Northern Quoll	*Dasyurus hallucatus*	1	Motion Camera	-21.3162	119.8599	Hillcrest/ Hillslope
Northern Quoll	*Dasyurus hallucatus*	1	Motion Camera	-21.3338	119.8904	Hillcrest/ Hillslope
Northern Quoll	*Dasyurus hallucatus*	1	Motion Camera	-21.3338	119.8904	Hillcrest/ Hillslope
Northern Quoll	*Dasyurus hallucatus*	1	Motion Camera	-21.3347	119.8900	Minor Drainage Line
Western Pebble Mound Mouse	*Pseudomys chapmani*	1	Opportunistic during the 2018 targeted survey	-21.3545	119.9092	Hillcrest/ Hillslope
Western Pebble Mound Mouse	*Pseudomys chapmani*	1	Opportunistic during the 2018 targeted survey	-21.3547	119.9092	Hillcrest/ Hillslope
Western Pebble Mound Mouse	*Pseudomys chapmani*	1	Opportunistic during the 2018 targeted survey	-21.3501	119.9075	Hillcrest/ Hillslope
Western Pebble Mound Mouse	*Pseudomys chapmani*	1	Opportunistic during the 2018 targeted survey	-21.3469	119.9012	Hillcrest/ Hillslope
Western Pebble Mound Mouse	*Pseudomys chapmani*	1	Opportunistic during the 2018 targeted survey	-21.3549	119.9093	Hillcrest/ Hillslope