

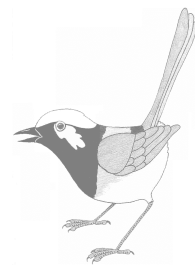
Mt Morgans Gold Project: Phoenix Ridge and Mt Marven

Level 1 Vertebrate Fauna Survey July 2019



Prepared for: Dacian Gold Limited

Prepared by: Western Wildlife
8 Ridgeway Pl
Mahogany Creek WA 6072
Ph: 0427 510 934



February 2020

Executive Summary

Introduction

Dacian Gold Limited (Dacian) is conducting exploration at Phoenix Ridge and Mt Maven (the 'study areas'), as components of the Mt Morgans Gold Project. Dacian commissioned Western Wildlife to carry out a Level 1 vertebrate fauna survey of the two areas. The objectives of the fauna survey were to:

- Identify the fauna habitats present in the study area.
- List the vertebrate fauna that were recorded in the study area and/or have the potential to occur in the study area.
- Identify species of conservation significance, or habitats of particular importance for fauna, that may occur in the study area.

This report details the findings of the fauna survey conducted in July 2019.

Methods

A Level 1 fauna survey was undertaken in accordance with Environmental Protection Authority (EPA) Statement of Environmental Principles, Factors and Objectives (EPA 2016a), Environmental Factor Guidelines – Terrestrial Fauna (EPA 2016b), Technical Guide – Terrestrial Fauna Surveys (EPA 2016c) and the Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA & DEC 2010). The field surveys were carried out by two zoologists between the 30th – 31st July 2019.

The field study included:

- Identification of fauna habitats
- Opportunistic records of vertebrate fauna
- Targeted searches for evidence of conservation significant fauna

Species of conservation significance were classified as: **Threatened** if listed as Extinct in the Wild, Critically Endangered, Endangered or Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or *Biodiversity Conservation Act 2016* (BC Act); **Migratory** if listed as Migratory under the EPBC Act and/or BC Act, excluding those species also listed as threatened; **Specially Protected** if listed as Other Specially Protected Species or Conservation Dependent Fauna under the BC Act; **Priority** if listed as Priority by DBCA and **Locally Significant** if considered by the author to potentially be of local significance.

Fauna Habitats

Seven fauna habitats were identified across the two study areas:

- Low rocky hills
- Banded Ironstone Formation (BIF) ridge
- Mulga woodlands
- Acacia shrubland on plains
- Creeklines
- Chenopod shrubland
- Samphire shrubland

Faunal Assemblage

The study areas have the potential to support up to ten frog, 85 reptile, 110 bird and 24 native mammal and nine introduced mammal species. The assemblage is likely to be relatively intact and typical of the region.

Conservation Significant Fauna

Ten conservation significant fauna have been recorded or potentially occur in the Study Area, as summarised in Table 5. The species have been grouped into their conservation significance categories and discussed below.

1. Threatened species

Four threatened species potentially occur in the study areas:

- Malleefowl (*Leipoa ocellata*) – EPBC Act (Vulnerable), BC Act (Vulnerable)
- Night Parrot (*Pezoporus occidentalis*) – EPBC Act (Endangered), BC Act (Critically Endangered)
- Princess Parrot (*Polytelis alexandrae*) – EPBC Act (Vulnerable), Priority 4
- Grey Falcon (*Falco hypoleucos*) – BC Act (Vulnerable)

The Malleefowl is unlikely to occur. Although known from many records in the region, the study areas lack the dense litter-forming shrublands that would provide breeding habitat for this species. The Night Parrot and Princess Parrot are unlikely to occur. While possible chenopod foraging habitat is present for the Night Parrot, there is no breeding habitat in the study areas. The Princess Parrot is a vagrant to the region and the study area is not likely to be important habitat. The Grey Falcon may occur as a foraging visitor, but no breeding habitat is present.

2. Migratory species

Two Migratory species potentially occur in the study areas, none of which have been recorded:

- Oriental Plover (*Charadrius veredus*) – EPBC Act (Migratory), BC Act (Migratory)
- Fork-tailed Swift (*Apus pacificus*) – EPBC Act (Migratory), BC Act (Migratory)

The Oriental Plover is likely to occur, but not in significant numbers. The Fork-tailed Swift is thought to be almost entirely aerial when visiting Australia, so the study area is not likely to provide important habitat for this species.

3. Specially Protected species

A single Specially Protected species potentially occurs in the study areas:

- Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is likely to occur as a foraging visitor but the rocky hills are too low to provide breeding habitat.

4. Priority species

Two Priority species potentially occur in the study areas:

- Striated Grasswren (*Amytornis striatus striatus*)
- Long-tailed Dunnart (*Sminthopsis longicaudata*)

The Striated Grasswren is unlikely to occur as the study areas lack its favoured spinifex grasslands. The Long-tailed Dunnart is likely to occur in the low rocky hills and BIF ridge.

5. Locally significant species

A single Locally Significant species potentially occurs in the study areas:

- Black-headed Worm Lizard (*Aprasia picturata*)

This species is known from very few records overall, but may occur in the low rocky hills and BIF Ridge.

Important Habitats

The habitats in the Study Area are common and widespread in the subregion. The Low Rocky Hills and BIF Ridge may be refugia for fauna on a local level, providing cracks and crevices as shelter from extreme conditions. As the study area is set within a largely uncleared landscape and the habitats present are broadly distributed, it is unlikely to have particular importance as a regional ecological linkage. Creekline habitats potentially provide ecological linkage on a local level. Of the habitats present in the study area, the Low Rocky Hills and BIF Ridge have some importance in supporting populations of the Long-tailed Dunnart. The presence of this species in the region is likely to be determined by the availability of these habitats, and the loss of these habitats may lead to the local loss of this species.

Table of Contents

Executive Summary	i
1. Introduction	1
1.1 Regional Location	1
1.2 Study Areas	1
1.3 Climate and Weather.....	4
2. Methods	4
2.1 Level of Survey	4
2.2 Personnel	5
2.3 Taxonomy and Nomenclature	5
2.4 Literature Review	5
2.5 Field Studies	7
2.6 Habitat Mapping	7
2.7 Likelihood of Occurrence	7
2.8 Assessing Conservation Significance of Fauna	8
2.8.1 Legislative Protection for Fauna	8
2.8.2 Levels of Conservation Significance in this report.....	10
2.9 Survey Limitations	11
3. Habitats of the Study Area	12
3.1 Low Rocky Hills.....	15
3.2 Low Banded Ironstone formation (BIF)	15
3.3 Mulga Woodland.....	16
3.4 Acacia Shrubland on Plains.....	16
3.5 Creeklines.....	16
3.6 Chenopod Shrubland	17
3.7 Samphire Shrubland	17
4. Vertebrate Fauna of the Study Area.....	18
4.1 Amphibians	18
4.1.1 Amphibians of Conservation Significance	18
4.2 Reptiles	20
4.2.1 Reptiles of Conservation Significance	20
4.3 Birds	21
4.3.1 Birds of Conservation Significance	21
4.4 Mammals	24
4.4.1 Mammals of Conservation Significance	25
5. Conclusions	28
5.1 Faunal Assemblage.....	28
5.2 Conservation Significant Fauna	28
5.3 Important Habitats	30
6. References.....	31
Appendices.	33
Appendix 1. Amphibians potentially occurring in the study area.	33
Appendix 2. Reptiles potentially occurring in the study area.	34
Appendix 3. Birds potentially occurring in the study areas.	37
Appendix 4. Mammals potentially occurring in the study area.	42
Appendix 5. EPBC Protected Matters Search Tool results.	44

Tables, Figures and Plates

Table 1. Databases used in the preparation of this report.	6
Table 2. Fauna survey limitations.....	11
Table 3. Fauna habitats in the study area.	12
Table 4. Summary of vertebrate fauna potentially occurring in the study area.	18
Table 5. Summary of conservation significant (CS) fauna in the study area.....	26
Figure 1. Mt Morgans Project: regional location.	2
Figure 2. Mt Morgans Project: Phoenix Ridge and Mt Marven study areas.	3
Figure 3. Climate statistics for Laverton (data after Bureau of Metereology 2019).	4
Figure 4. Mt Morgans Project – Phoenix Ridge fauna habitats.	13
Figure 5. Mt Morgans Project – Mt Marven fauna habitats.	14
Figure 6. Mt Morgans Project – DBCA records of conservation significant fauna.....	19
Plate 1. Rubbish (left) and drill track (right) in the study areas.....	12
Plate 2. Low Rocky Hills in the Mt Marven study area.	15
Plate 3. Banded Ironstone Formation in the Phoenix Ridge study area.....	15
Plate 4. Mulga Woodlands.	16
Plate 5. Creeklines.	17
Plate 6. Chenopod shrubland.	17

1. Introduction

Dacian Gold Limited (Dacian) is conducting exploration at Phoenix Ridge and Mt Marven (the 'study areas'), as components of the Mt Morgans Gold Project. Dacian commissioned Western Wildlife to carry out a Level 1 vertebrate fauna survey of the two areas. The objectives of the fauna survey were to:

- Identify the fauna habitats present in the study area.
- List the vertebrate fauna that were recorded in the study area and/or have the potential to occur in the study area.
- Identify species of conservation significance, or habitats of particular importance for fauna, that may occur in the study area.

This report details the findings of the fauna survey conducted in August 2019.

1.1 Regional Location

The Mt Morgans Gold Project is located approximately 30 km south west of Laverton, in the northern goldfields of Western Australia.

The study area falls within the Interim Biogeographic Regionalisation of Australia ('IBRA') Bioregion Murchison 1 – East Murchison Subregion (DoEE 2017, Cowan 2001). The Murchison Bioregion is characterised by an arid climate, primarily with a winter rainfall of about 200mm. The primary land-use is grazing on native pastures (over 85%), with smaller areas of unallocated Crown land, Crown reserves, mining and conservation (Cowan 2001). The East Murchison Subregion is large at 7,847,996ha and is characterised by red sandplains, broad plains of red-brown soils, breakaways and saltlake systems (Cowan 2001). The vegetation in the region is dominated by Mulga woodlands, hummock grasslands, saltbush shrublands and Teticornia shrublands (Cowan 2001).

1.2 Study Areas

The two study areas are Phoenix Ridge (416.8 ha) and Mt Marven (80.8 ha). They are adjacent areas that were surveyed in March 2016 and December 2017 (Figure 2). Though it does not include salt lake vegetation, the study areas are between 3 and 14 km north of the northern shore of Lake Carey, a large salt lake of about 75,000ha.

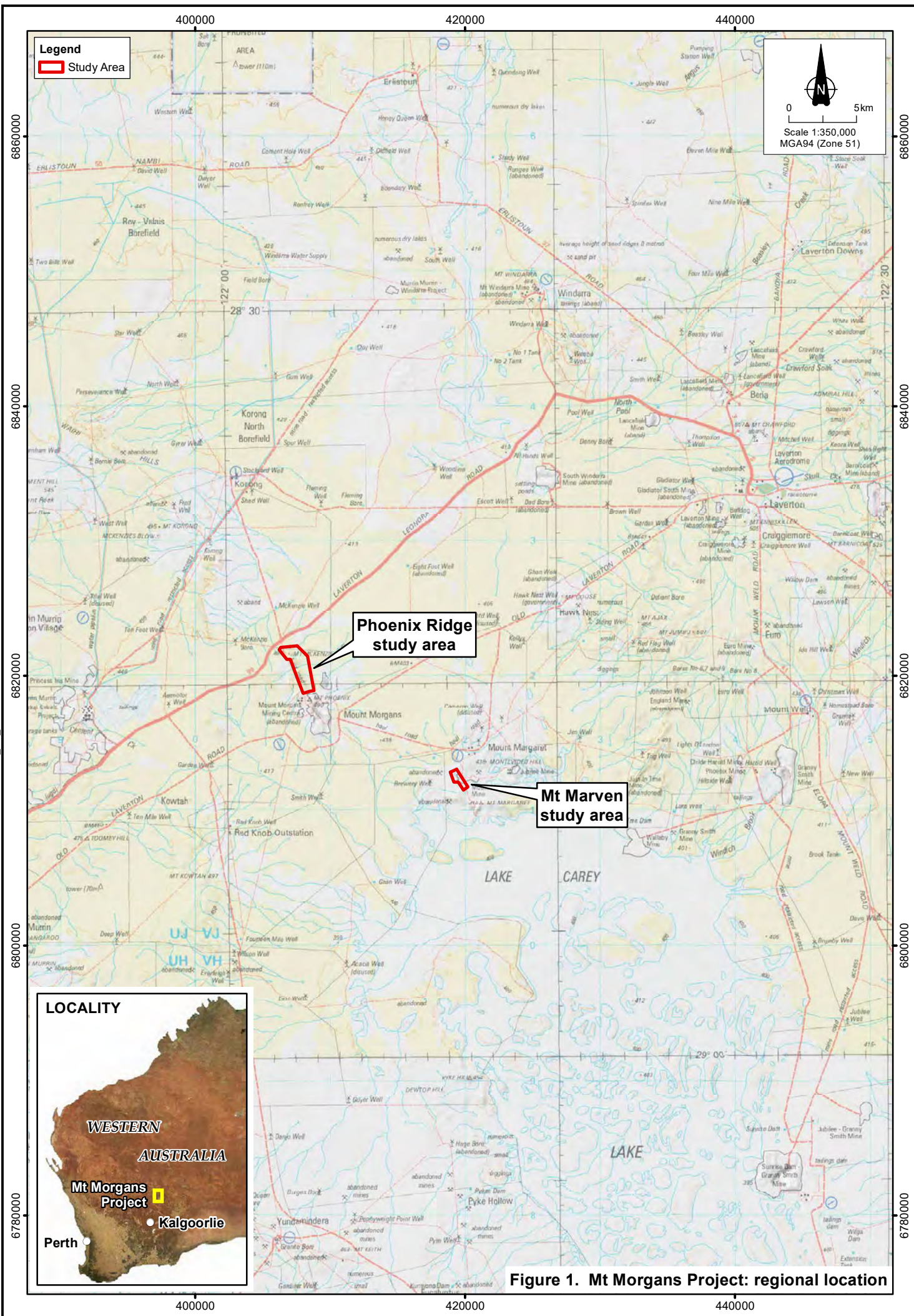


Figure 1. Mt Morgans Project: regional location

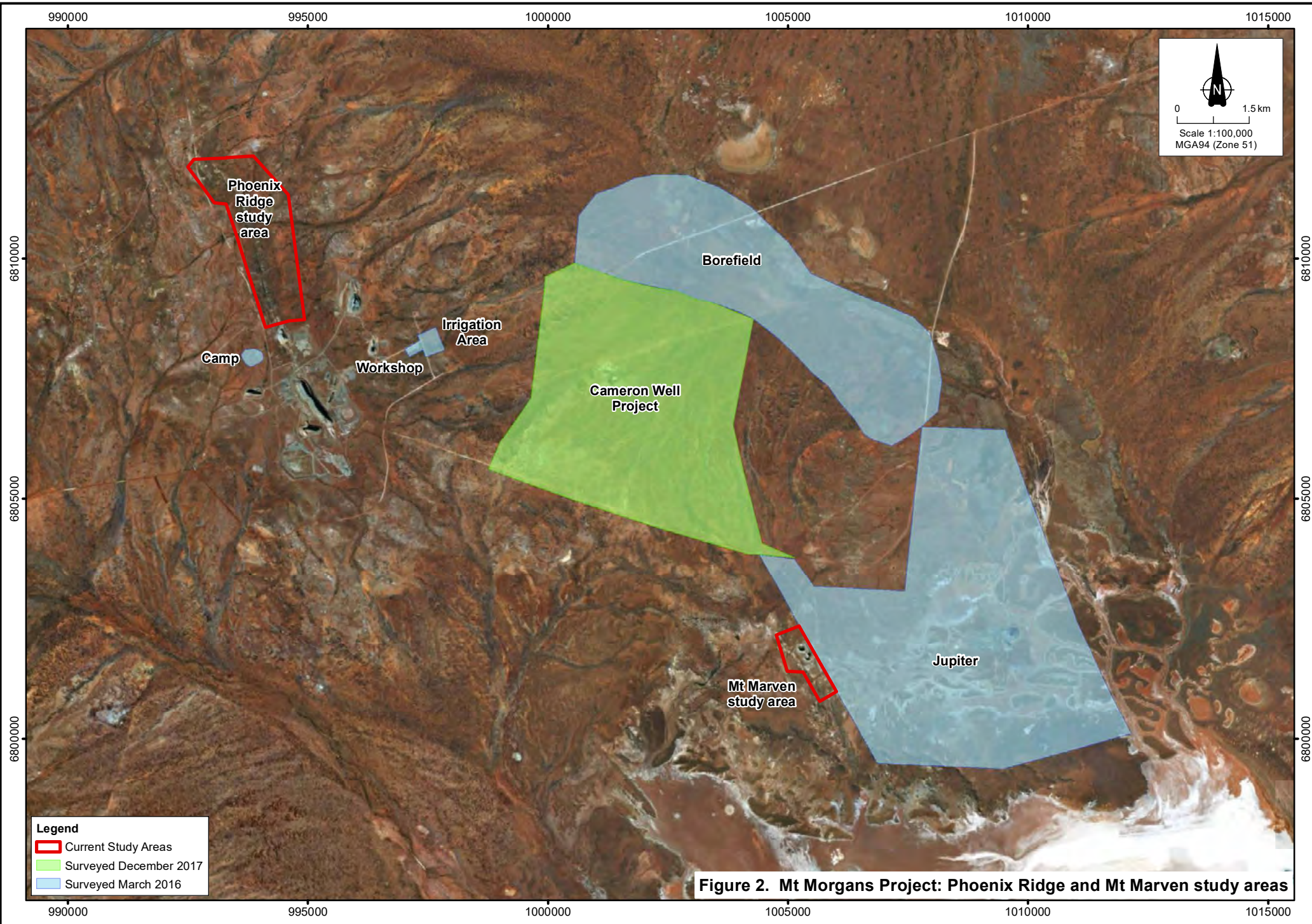


Figure 2. Mt Morgans Project: Phoenix Ridge and Mt Marven study areas

1.3 Climate and Weather

The study area is situated 30km southwest of the Laverton weather station (site 012045). The mean monthly temperatures show a summer maximum (Figure 3). The annual rainfall recorded at Laverton in 2018 was above average at 336.1mm, compared with the long-term average of 237.1mm collected between 1899 and 2019 (Bureau of Meteorology 2019). The beginning of 2019 also showed a lower than average rainfall in the months prior to the field survey in August 2019 (Figure 3).

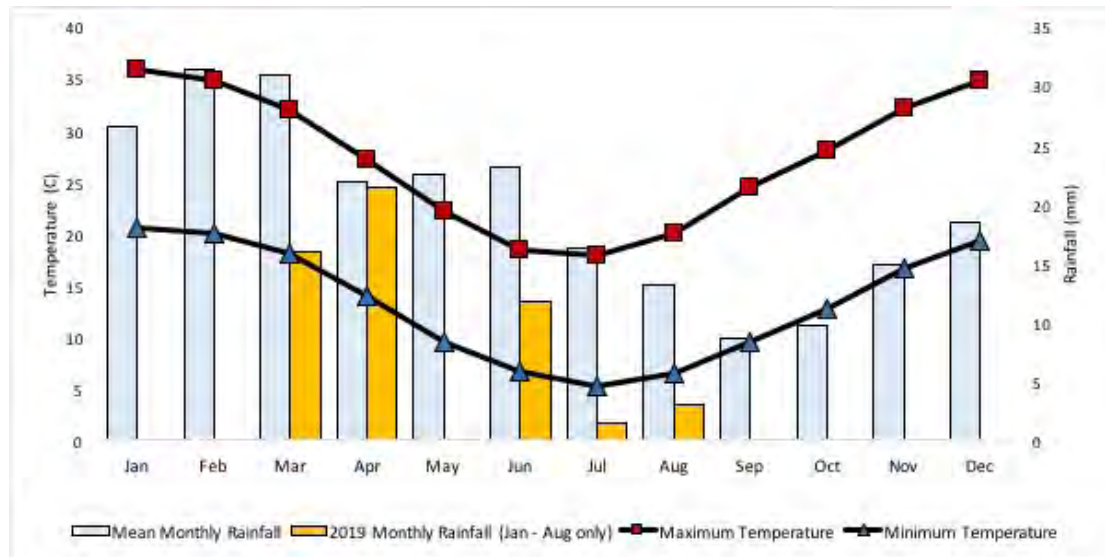


Figure 3. Climate statistics for Laverton (data after Bureau of Meteorology 2019).

The weather during the field survey was cool and dry, with the maximum temperature ranging from 19.3 – 35.3°C and the minimum temperature ranging from 7.3 – 4.1°C (Bureau of Meteorology 2019). No rain fell during or in the fortnight prior to the field survey.

2. Methods

2.1 Level of Survey

The survey was conducted as a Level 1 fauna survey in accordance with:

- Statement of environmental principles, factors and objectives (Environmental Protection Authority (EPA) 2016a)
- Environmental factor guideline – terrestrial fauna (EPA 2016b)
- Technical guidance – terrestrial fauna surveys (EPA 2016c)
- Technical Guide: terrestrial vertebrate fauna surveys for environmental impact assessment (EPA and DEC 2010)

The Level 1 fauna survey included a search of available literature and databases (a 'desktop' study), and a brief field survey of the study area. The field survey served to put the desktop study into context, as well as allowing for the identification of fauna habitats and likely fauna assemblages of the study area.

It was considered that a Level 1 fauna survey was sufficient to characterise the fauna habitats, vertebrate faunal assemblage and the likely conservation significant fauna using the study area. Although a Level 2 fauna survey involving trapping would be likely to add to the list of vertebrate fauna species known to occur in the study area, particularly of reptiles and small mammals, it is unlikely to provide extra information useful in managing potential impacts on fauna.

2.2 Personnel

The personnel involved in the fauna survey were Ms Jenny Wilcox (*BSc.Biol./Env.Sci., Hons.Biol.*) as the supervising zoologist and Mr Wes Bancroft (*BSc.Zool.,PhD.Zool.*) as the field zoologist. The zoologists have 19 and 21 years' experience in fauna consulting respectively. The report was prepared by Ms Jenny Wilcox.

2.3 Taxonomy and Nomenclature

Taxonomy and nomenclature for fauna species used in this report follow the Western Australian Museum checklists. These were last updated in 2019. In the text, common names are used where appropriate, and all scientific names are given in species lists. Where a species lacks a common name, they are referred to by their scientific name.

2.4 Literature Review

Lists of fauna expected to occur in the study area were produced using information from a number of sources. These included publications that provide information on general patterns of distribution of frogs (Tyler *et al.* 2000), reptiles (Wilson and Swan 2010, Storr *et al.* 1983, 1990, 1999 and 2002), birds (Barrett *et al.* 2003; Johnstone and Storr 1998 and 2004) and mammals (Churchill 1998, Menkhorst and Knight 2011; Van Dyck and Strahan 2008).

The databases listed in **Error! Reference source not found.** were searched for fauna records in and around the study area. In all cases the extent of the database search was larger than the extent of the study area, in order to pick up records of species in the wider area that may also occur in the study area. Some species may occur on database results that are not likely to be present in the study area, usually due to a lack of suitable habitat or the study area being outside the known range of the species as presented in the literature. These species are generally not included in lists of expected fauna unless some discussion is thought to be necessary.

Table 1. Databases used in the preparation of this report.

Database	Type of records held on database	Area searched
Western Australian Museum Specimen Database (DBCA 2007-)	Records of specimens held in the WA Museum. Includes historical data.	40km surrounding 28.76778 °S, 122.13722 °E.
Fauna Survey Returns Database (DBCA 2007-)	Records of fauna captured, observed or inferred from secondary evidence during fauna surveys.	40km surrounding 28.76778 °S, 122.13722 °E.
Birds Australia Atlas Database (DBCA 2007-)	Records of bird observations in Australia, 1998-2009.	40km surrounding 28.76778 °S, 122.13722 °E.
Birddata (DBCA 2007-)	Records of bird observations in Australia, 2010-current.	40km surrounding 28.76778 °S, 122.13722 °E.
DBCA's Threatened and Priority Fauna Database	Records of Threatened and Priority species in Western Australia, also drawing from the databases above.	200km surrounding 51J 413346 E, 6815777 N.
EPBC Act Protected Matters Search Tool	Records on matters protected under the EPBC Act, including threatened species.	20km surrounding 28.76778 °S, 122.13722 °E.

Recent fauna surveys were carried out for other developments in the Project area include:

- A Level 1 fauna survey of the Mt Morgans North Project, undertaken in November 2010 (RPS 2011). This survey was carried out over two days, with only ten fauna species observed opportunistically (six birds and four mammals). None of the observed species were of conservation significance.
- A desktop study of The Craic Project, with no additional records of fauna from the site (Outback Ecology Services 2009).
- A Level 1 fauna survey of the Mt Morgans Jupiter Project, with associated borefields, camp and workshop sites (Western Wildlife 2016). This survey was undertaken over five days in March 2016, with one frog, six reptiles 54 birds and five mammals recorded opportunistically. Conservation significant species recorded were migratory shorebirds on Lake Carey.
- A Level 1 fauna survey of the Mt Morgans Cameron Well Project (Western Wildlife 2018). This survey was undertaken over two days in December 2017, with two reptiles, 33 birds and two mammals recorded opportunistically. No conservation significant fauna were recorded.

These sources of information were used to create lists of species that potentially occur in the study area. As far as possible, expected species are those that are likely to utilise the study area. The lists exclude species that have been recorded in the general region as vagrants, or for which suitable habitat is absent within the study area.

2.5 Field Studies

The field study was carried out by two zoologists on the 30th and 31st July 2019. The field study component of a Level 1 fauna survey is primarily to identify the fauna habitats present in the study area. In addition, all fauna encountered during the field survey are recorded. The fauna species recorded are usually conspicuous species such as birds, large mammals and large reptiles. The presence of other species may be inferred from evidence such as tracks, burrows, scats or evidence of foraging. Particular attention was paid to searching for evidence of conservation significant species, such as Malleefowl mounds, or habitats likely to support conservation significant species.

2.6 Habitat Mapping

Habitat mapping was undertaken using vegetation mapping provided by Native Vegetation Solutions (2019), observations made by fauna personnel in the field and interpretation of aerial photography. CAD Resources produced the maps from information provided by Western Wildlife.

2.7 Likelihood of Occurrence

Fauna of conservation significance were assessed and ranked for their likelihood of occurrence in the study area, according to the following criteria:

- **Very Low:** The study area is outside the current known distribution of the species as presented in the literature; no suitable habitat was identified as being present during the field survey; for some species, individuals may occur occasionally as vagrants, especially if suitable habitat is located nearby, but the study area itself would not support the species; includes species generally accepted as being locally extinct.
- **Low:** The study area is within or just outside the current known distribution of the species, as presented in the literature; any habitat present is either limited in extent or of marginal quality at best; no recent or nearby records of the species on databases; the species is generally known to be less common in the vicinity of the study area (e.g. for inland sites, where the species usually occurs on the coast).
- **Moderate:** The study area is within the current known distribution of the species, as presented in the literature; habitat of reasonable quality was identified as being present during the field survey; some recent and/or nearby records of the species of databases;
- **High:** The study area is well within the current known distribution of the species, as presented in the literature; habitat of good quality was identified as being present during the field survey; many recent and nearby records of the species on databases.
- **Known to Occur:** The species was positively identified in the study area during this field survey, or recorded as occurring in the study area on previous recent field surveys. Note that for a species 'known to occur', the habitat may still be marginal and therefore the population may be small or the species may visit the site irregularly.

2.8 Assessing Conservation Significance of Fauna

2.8.1 Legislative Protection for Fauna

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the Commonwealth Government's primary piece of environmental legislation. Listed under Part 3 of the EPBC Act are 'Matters of National Environmental Significance' (MNES); these include threatened species, threatened ecological communities and migratory species. Threatened fauna species are assessed against categories based on International Union for Conservation of Nature (IUCN) criteria.

The migratory species listed under the EPBC Act are those recognised under international agreements. These agreements are the China-Australia Migratory Bird Agreement (CAMBA), the Japan-Australia Migratory Bird Agreement (JAMBA), the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), or species listed under the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) for which Australia is a range state.

Matters of National Environmental Significance (MNES) include the following categories:

- **Extinct in the wild (EW):** Taxa known to survive only in captivity.
- **Critically Endangered (Cr):** 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 very high risk of extinction in the wild in the medium-term future.
- **Migratory (Mi):** Taxa listed under international agreements to which Australia is a party.

Reports on the conservation status of most vertebrate fauna species have been produced by the federal Department of Environment and Energy (DoEE) in the form of Action Plans. An Action Plan is a review of the conservation status of a taxonomic group against IUCN categories. Action Plans have been prepared for amphibians (Tyler 1998), reptiles (Cogger *et al.* 1993), birds (Garnett *et al.* 2011) and mammals (Woinarski *et al.* 2014). These publications also use categories similar to those used by the EPBC Act. The information presented in some of the earlier Action Plans may be out of date due to changes since publication.

The *Biodiversity Conservation Act 2016* (BC Act) is State legislation that aims to conserve and protect biodiversity and biodiversity components in Western Australia, including threatened fauna. It is administered by the Department of Biodiversity, Conservation and Attractions (DBCA). In addition to threatened fauna, the BC Act has scope to protect threatened ecological communities and important habitats.

Fauna species are listed under the BC Act as threatened species using IUCN categories, or as specially protected species, as described below.

Threatened Species:

- **Extinct in the wild (EW):** Taxa known to survive only in captivity.
- **Critically Endangered (Cr):** 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 very high risk of extinction in the wild in the medium-term future.

Specially Protected Species:

- **Migratory (Mi):** A subset of the migratory fauna that are known to visit Western Australia that are protected under the international agreements or treaties, excluding species that are listed as Threatened species.
- **Conservation dependent fauna (CD):** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened
- **Other specially protected species (OS):** fauna in need of special protection to ensure their conservation.

The BC Act supersedes the *Western Australian Wildlife Conservation Act 1950* (WC Act).

Priority species are not listed under State or Commonwealth Acts. In Western Australia, DBCA maintains a list of Priority Fauna made up of species that are possibly Threatened but do not meet adequacy of survey requirements or are otherwise data deficient. There are four levels of Priority as defined by DBCA, as listed below.

- **Priority 1:** Poorly known species (on threatened lands)
- **Priority 2:** Poorly known species in few locations (some on conservation lands)
- **Priority 3:** Poorly known species in several locations (some on conservation lands)
- **Priority 4:** Rare, near threatened and other species in need of monitoring

2.8.2 Levels of Conservation Significance in this report

Five levels of conservation significance are used within this report to indicate the level of significance of fauna species, according to the following criteria:

- **Threatened (T):** Taxa listed as Extinct in the Wild, Critically Endangered, Endangered or Vulnerable under the EPBC Act and/or BC Act. These species are grouped as they are all species considered to be at risk of extinction, are often rare and are likely to be subject to on-going threatening processes.
- **Migratory (Mi):** Taxa listed as Migratory under the EPBC Act and/or BC Act, excluding those species also listed as threatened. These species are grouped as they are not necessarily rare, but may be dependent on specific habitats for a portion of their life-cycle. For these species, loss of important foraging, breeding or stop-over sites may have a disproportionately large impact on populations.
- **Specially Protected (SP):** Taxa listed as Other Specially Protected Species or Conservation Dependent Fauna under the BC Act. These species are not necessarily rare, but may be dependent on on-going conservation to ensure their protection.
- **Priority (P):** Taxa listed as Priority by DBCA. These species are grouped as they are either conservation dependent or data deficient and in need of further survey.
- **Locally Significant (LS):** Locally significant taxa are not listed under State or Commonwealth Acts or in publications on threatened fauna or as Priority species by DBCA, but are considered by the author to potentially be of local significance because they are at the limit of their distribution in the area, they have a very restricted range or they occur in breeding colonies (e.g. some waterbirds). This level of significance has no legislative recognition and is based on interpretation of information on the species patterns of distribution. For example, the Government of Western Australia (2000) used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of Bush Forever. Recognition of such species is consistent with the aim of preserving regional biodiversity.

2.9 Survey Limitations

Various factors can limit the effectiveness of a fauna survey. Pursuant to EPA Technical Guidance (EPA 2016c), these factors have been identified and their potential to impact on the effectiveness of the surveys has been assessed in Table 2 below. All fauna surveys have limitations, and not all fauna species present on the site are likely to be sampled during a survey. Fauna may not be recorded because they are rare, they are difficult to trap or observe, or because they are only present on the site for part of the year.

Table 2. Fauna survey limitations.

Potential Limitation	Extent of limitation for the fauna survey	
Competency /experience of the team carrying out the survey	Not limiting	Supervising zoologist has 19 years' experience with fauna surveys in Western Australia. Field zoologist has more than 20 years' experience.
Proportion of fauna identified, recorded and/or collected.	Not limiting	Although only a small proportion of the fauna were recorded, a complete inventory is not the purpose of a Level 1 survey.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data	Minor limitation	There is a moderate amount of data available on databases for this region, but other than for birds, few records of fauna species from the Mt Morgans Gold Project.
Timing/weather/season/cycle	Not limiting	The weather was warm and dry, and conducive to recording fauna including signs of the Malleefowl
Disturbances (e.g. fire, flood, accidental human intervention etc.), which affected results of survey	Not limiting	Although disturbances such as tracks were noted, these are unlikely to have affected the outcome of the survey. Malleefowl mounds persist in the landscape for many years, and the key purpose of the Level 1 survey was habitat assessment.
Intensity (in retrospect, was the intensity adequate)	Not limiting	Sufficient time was allowed to survey all habitats.
Completeness (e.g. was relevant area fully surveyed)	Not limiting	A representative proportion of all habitats were able to be accessed and surveyed.
Resources (e.g. degree of expertise available in animal identification to taxon level)	Not limiting	No taxonomic issues were encountered.
Remoteness and/or access problems	Not limiting	Entire Study Area accessible by vehicle or on foot.
Availability of contextual (e.g. biogeographic) information on the region	Minor limitation	There is some contextual information available for this region and many of the fauna that occur have widespread distributions across the semi-arid zone, however, the current status of some conservation significant species is not well understood.

3. Habitats of the Study Area

Seven fauna habitats were identified in the study areas (Table 3, Figures 4 and 5). All the habitats present in the study areas are widely represented in the region. Other habitats in the region, such as Spinifex sandplains, claypans or salt lakes, are absent from the study area, though some of these occur nearby. There is some disturbance to habitats, from drilling access tracks, roads, rubbish dumps and an open pit at Mt Marven (Plate 1).

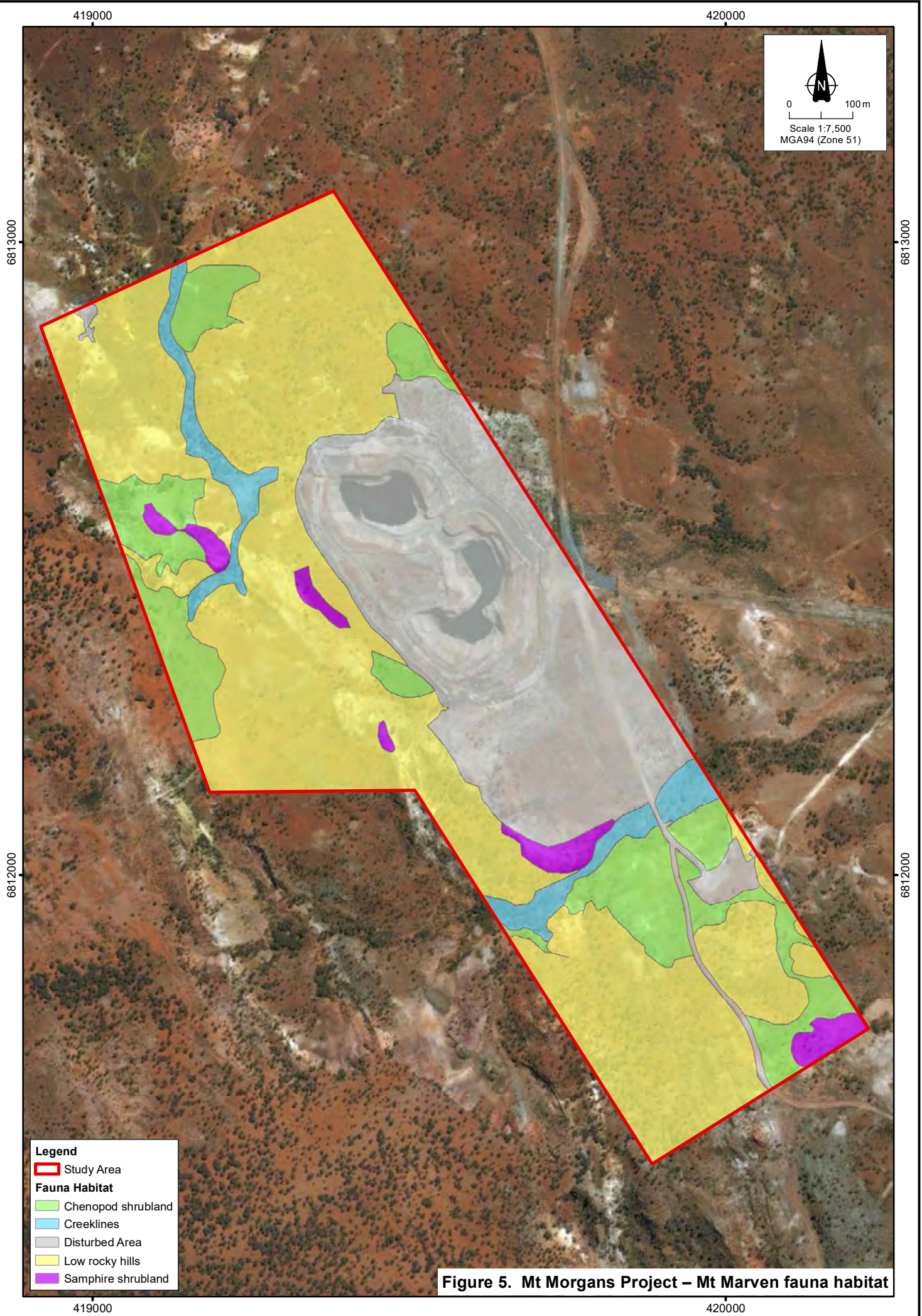
Table 3. Fauna habitats in the study area.

Fauna Habitat	Key Habitat Elements	Phoenix Ridge - Area (ha)	Mt Marven - Area (ha)
Low Rocky Hills	Cracks and crevices in the rocks provide shelter for reptiles and small mammals.	4.1	41.1
Low Banded Ironstone Formation (BIF) Ridge	Cracks and crevices in the rocks provide shelter for reptiles and small mammals.	27.7	-
Mulga Woodland	Seeding mulga and flowering <i>Eremophila</i> spp. provides a foraging resource for birds.	352.7	-
Acacia Shrubland on Plains	Seeding mulga and flowering <i>Eremophila</i> spp. provides a foraging resource for birds.	1.1	-
Creeklines	- Dense vegetation provides shelter and breeding habitat for birds. - May provide ecological linkage on a local level.	25.8	3.2
Chenopod Shrubland	Chenopods provide a seed resource for foraging birds.	-	10.4
Samphire Shrubland	Nil	-	1.9
Disturbed Areas	Nil	5.5	24.2
		416.8	80.8



Plate 1. Rubbish (left) and drill track (right) in the study areas.





3.1 Low Rocky Hills

Low rocky hills occur mainly in the Mt Marven study area (Figure 5). These hills are generally low and have a stony or rocky surface with some cracks and crevices (Plate 2). Conservation significant species that may be present in this habitat include the Long-tailed Dunnart (*Sminthopsis longicaudata*) and Peregrine Falcon (*Falco peregrinus*).



Plate 2. Low Rocky Hills in the Mt Marven study area.

3.2 Low Banded Ironstone formation (BIF)

A low BIF ridge runs north-south in the Phoenix Ridge study area. There are small overhangs and breakaways present in areas with greater relief (Plate 3). Rocky areas provide shelter for a range of reptile and small mammal species. Overhangs and ledges may provide nesting habitat for some birds and shelter for kangaroo species. Conservation significant species that may be present in this habitat include the Long-tailed Dunnart (*Sminthopsis longicaudata*) and Peregrine Falcon (*Falco peregrinus*).



Plate 3. Banded Ironstone Formation in the Phoenix Ridge study area.

3.3 Mulga Woodland

Broad floodplains are dominated by Mulga (*Acacia aneura*) woodland (Plate 4), typically with denser vegetation than the surrounding Acacia shrublands. The floodplains are unlikely to hold water, but the dense vegetation provides shelter and breeding sites for fauna. As a common habitat in the region, Mulga woodland is likely to support a large range of vertebrate species. Small insectivorous birds forage and nest among Mulga trees. Where *Eremophila* shrubs are present and flowering, nectar-feeding birds are likely to be present. Some reptile species, such as geckos, shelter under logs or in crevices on Mulga trees. Although conservation significant fauna such as the Malleefowl (*Leipoa ocellata*) occur in this habitat, the Mulga woodlands in the study area are likely to be too sparse to support this species.



Plate 4. Mulga Woodlands.

3.4 Acacia Shrubland on Plains

Acacia shrubland on plains is a very common habitat in the region, but only comprise a small part of the Phoenix Ridge study area (Figure 4). The shrublands are generally dominated by Mulga (*Acacia aneura*) and other species of *Acacia*, with scattered *Eremophila* over tussock grass on clay-loam or stony soils. The shrubland is often relatively sparse, and although conservation significant fauna such as the Malleefowl (*Leipoa ocellata*) occur in this habitat, the *Acacia* shrublands in the study area are likely to be too sparse to support this species.

3.5 Creeklines

Minor creeklines occur in both study areas, and typically have denser vegetation than the surrounding Acacia shrublands or Mulga woodlands (Plate 5). The creeks in the study area are unlikely to hold water for long periods of time, though they may retain small waterholes after rain. The dense vegetation around creeks provide shelter and breeding sites for birds and other fauna.



Plate 5. Creeklines.

3.6 Chenopod Shrubland

Chenopod shrubland occurred in a small portion of the Mt Marven study area (Figure 5), and typically consisted of *Acacia* over sparse low shrubs of *Maireana*, *Sclerolaena*, *Tecticornia* and *Atriplex* species (Plate 6). As this habitat is sparsely vegetated it is likely to support a lower diversity of fauna than some of the surrounding habitats. However, conservation significant species that may be present include the Oriental Plover (*Charadrius veredus*).



Plate 6. Chenopod shrubland.

3.7 Samphire Shrubland

The shrublands are dominated by samphires (*Tecticornia spp.*) and Bluebushes (*Maireana spp.*) on saline soils, and is generally sparse. Samphire shrublands comprise a small part of the Mt Marven study area and are likely to support only a few vertebrate fauna species.

4. Vertebrate Fauna of the Study Area

The results of the literature review and field survey were combined to create lists of the vertebrate fauna likely to occur in the study area. The number of vertebrate species potentially occurring in the study area are summarised in Table 4. The amphibians, reptiles, birds and mammals that have the potential to occur in the study area are listed in Appendices 1 to 4.

Table 4. Summary of vertebrate fauna potentially occurring in the study area.

Taxon	Total species	Introduced species	Recorded on this survey	Conservation significant species				
				T	Mi	OS	P	LS
Amphibians	10	-	-	-	-	-	-	-
Reptiles	85	-	1	-	-	-	-	1
Birds	110	-	20	5	2	1	1	-
Mammals	33	9	5	-	-	-	1	-
Totals:	238	9	26	5	2	1	2	1

The study areas are likely to support a relatively intact faunal assemblage, with only regionally extinct species likely to be missing. The predicted faunal assemblages and fauna of conservation significance are discussed in the sections below and summarised in Table 5. The results of the EPBC Act Protected Matters search are given in Appendix 5. Records of conservation significant fauna within 200km of the study area on DBCA's Threatened and Priority Fauna Database search are shown on Figure 6.

4.1 Amphibians

There are ten species of frog that have the potential to occur in the study area (Appendix 1). No frogs were observed opportunistically during the site visit, though the Desert Tree Frog (*Litoria rubella*), was common around the exploration camp at the Mt Morgans townsite in 2016 (Western Wildlife 2016). Frogs are likely to occur throughout the study area, potentially breeding anywhere that holds relatively fresh water after rainfall, including man-made depressions. Many species develop from tadpoles into frogs very quickly, and can make use of ephemeral pools in minor creeks or on claypans. During the dry season most species aestivate underground.

The frog species that occur in the study area are common and widely distributed in the semi-arid zone.

4.1.1 Amphibians of Conservation Significance

No frogs of conservation significance are likely to be present in the study area.

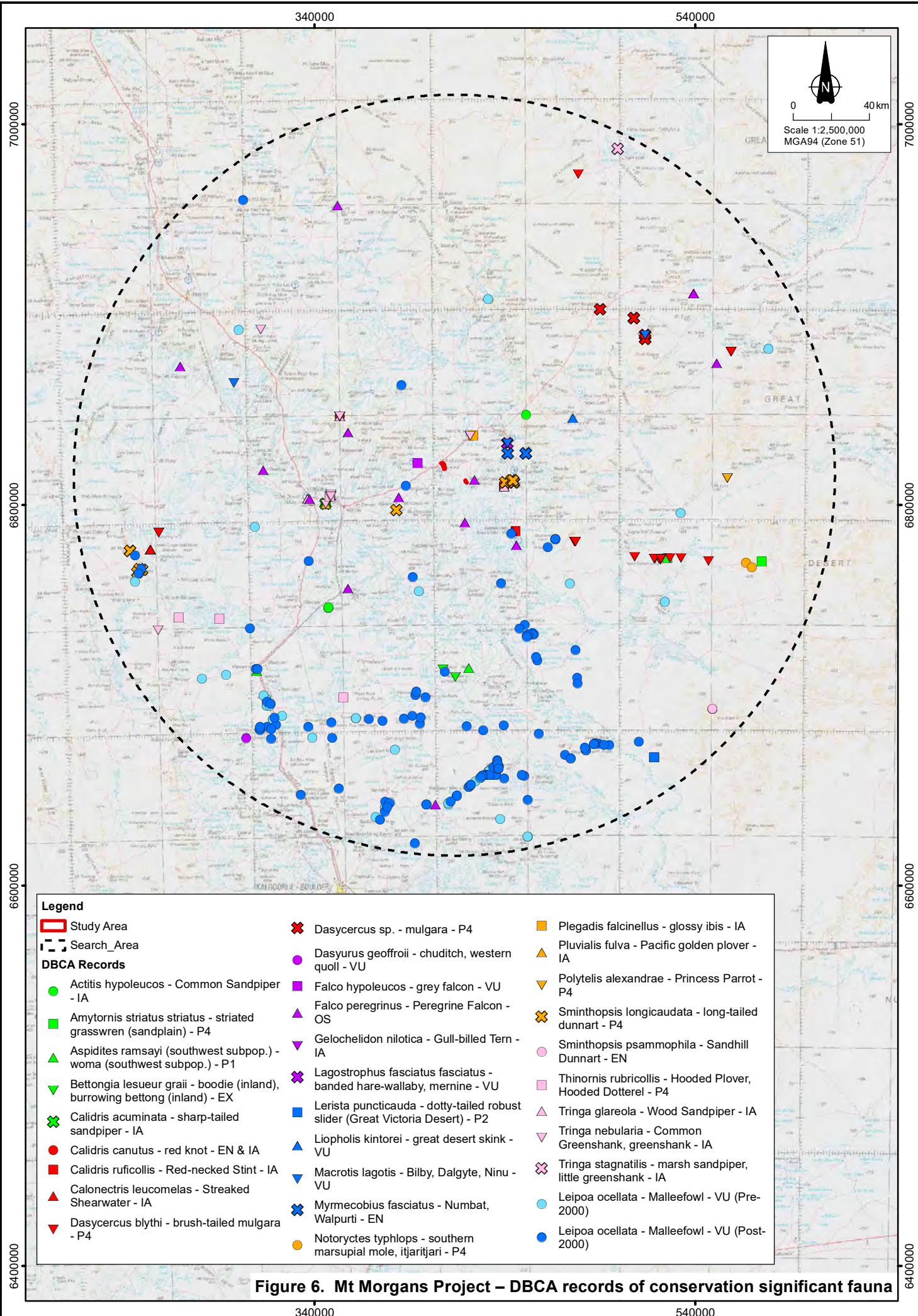


Figure 6. Mt Morgans Project – DBCA records of conservation significant fauna

4.2 Reptiles

There are 85 species of reptile that have the potential to occur in the study areas, of which one species was recorded opportunistically during the survey. A further four species were recorded in nearby surveys at Mt Morgans Gold Project (Appendix 2). The species recorded are all common in the region. The study area is likely to support an intact reptile assemblage. However, as each study area is relatively small, it is unlikely that all the potentially occurring species occur.

Most of the reptile species listed in Appendix 2 are common and widespread in the semi-arid region of Western Australia. Many species have broad habitat preferences, or are associated with *Acacia* shrublands and woodlands, a very common habitat type in the region. Several of the species listed favour Spinifex sandplains, such as the Beaded Gecko (*Lucasium damaeum*), Jewelled Gecko (*Strophurus elderi*) and the Pygmy Desert Monitor (*Varanus eremius*). These species are likely to be absent from the study area, though they would occur nearby.

4.2.1 Reptiles of Conservation Significance

There are three reptiles listed on DBCA's Threatened and Priority Fauna Database (Figure 6) that would not occur in the study areas. The Great Desert Skink (*Liopholis kintorei*) and Woma (*Aspidites ramsayi*) occur only on spinifex sandplains, a habitat that is absent from the study areas. The Dotty-tailed Robust Slider (*Lerista puncticauda*) is known only from Queen Victoria Spring, about 200km south of the study areas. These species are not included in the list of potentially occurring species and are excluded from the discussion below.

There is one reptile of conservation significance that may occur in vicinity of the study area, as listed and discussed below.

Locally Significant Fauna

Black-headed Worm-lizard

Aprasia picturata

There is a record of the **Black-headed Worm-lizard** within 40 km of the study area on the WA Museum database (Appendix 2). This species is known from a record in rocky ridges vegetated with low *Acacia* and *Eremophila* near Leonora (Wilson and Swan 2010). As this species is known only from a few individuals, it is uncertain as to whether it may occur in other habitats, as other species of *Aprasia* inhabit loose soils rather than ridges. However, based on the habitat of the specimens collected near Leonora, this species potentially occurs on the low rocky hills or BIF ridge in the study areas.

4.3 Birds

There are 110 species of bird that have the potential to occur in the study area, of which 20 were recorded during the survey (Appendix 3). The study area is likely to support a bird assemblage typical of the Mulga shrublands and woodlands in the region. A total of 54 bird species were recorded nearby during the 2016 site visit (Western Wildlife 2016), though some of these were waterbirds and are thus unlikely to occur in the study area, and 33 species were recorded nearby at Camerons Well (Western Wildlife 2018). Waterbirds have been excluded from the list in Appendix 3, as the study area lacks wetland habitats.

Many of the terrestrial bird species listed are widespread and abundant in semi-arid shrublands and woodlands of the region. When understorey shrubs (*Eremophila spp.*) are flowering, they are likely to provide a seasonal food resource for nectar-feeding species such as honeyeaters. Seeding *Acacia* shrubs and trees provide a food resource for seed-eating birds such as parrots and pigeons. The Mulga woodlands in the broad floodplains are more densely vegetated than the surrounding shrublands and are likely to provide shelter and breeding sites for birds. The study area lacks the large eucalypt-lined watercourses that are significant breeding habitat for some species.

4.3.1 Birds of Conservation Significance

Several migratory shorebirds, seabirds and wetland birds are listed on databases for the region (Figure 6, Appendix 5), but have been excluded from the discussion below as the study area lacks suitable wetland habitats to support them. This includes the Common Sandpiper (*Actitis hypoleucos*), Sharp-tailed Sandpiper (*Calidris acuminata*), Red-necked Stint (*Calidris ruficollis*), Red Knot (*Calidris canutus*), Hooded Plover (*Thinornis rubricollis*), Wood Sandpiper (*Tringa glareola*), Common Greenshank (*Tringa nebularia*), Marsh Sandpiper (*Tringa stagnatilis*), Pectoral Sandpiper (*Calidris melanotos*), Pacific Golden Plover (*Pluvialis fulva*), Glossy Ibis (*Plegadis falcinellus*), Streaked Shearwater (*Calonectris leucomelas*), Gull-billed Tern (*Geochelidon nilotica*), Grey Wagtail (*Motacilla cinerea*) and Yellow Wagtail (*Motacilla fulva*). These species may occur on nearby Lake Carey, but are not likely to use the study areas.

There are eight birds of conservation significance that may potentially occur in the study areas, as listed and discussed below.

Threatened Fauna**Malleefowl***Leipoa ocellata*

This species is listed as Vulnerable under the EPBC Act and BC Act.

Grey Falcon*Falco hypoleucos*

This species is listed as Vulnerable under the BC Act.

Peregrine Falcon*Falco peregrinus*

This falcon is listed as Other specially protected fauna under the BC Act.

Princess Parrot*Polytelis alexandrae*

This species is listed as Vulnerable under the EPBC Act and as Priority 4 by DBCA.

Night Parrot*Pezoporus occidentalis*

This species is listed as Endangered under the EPBC Act and as Critically Endangered under the BC Act.

The **Malleefowl** is at the north-eastern limit of its range in the study area. This large ground-dwelling bird inhabits mallee and *Acacia* thickets that have a dense layer of leaf litter (Johnstone and Storr 1998). There are many records of this species from the surrounding area on DBCA's Threatened and Priority Fauna Database (Figure 6). The habitats present in the study area appear unsuitable for this species as they lack leaf litter and are generally sparsely vegetated. Searching during the site visit failed to record any evidence of historic Malleefowl mounds in the study area. Although the Malleefowl can be locally common in other parts of its range, it is unlikely to occur in the study areas, except as an occasional dispersing visitor.

The **Grey Falcon** generally occurs further north and east than the study area. There is a single record within 200km of the study area on DBCA's Threatened and Priority Fauna Database (Figure 6). The Grey Falcon forages over timbered plains, including *Acacia* shrublands, with its distribution centred on inland drainages. The Grey Falcon nests in tall trees on watercourses (Garnett *et al.* 2011) and occasionally on man-made structures such as transmission line towers (pers. obs.). The study area lacks suitable breeding habitat for this species. Although the Grey Falcon may occur in the study area on occasion, it is unlikely to provide significant habitat for this species.

The **Peregrine Falcon** is a widespread bird of prey that globally has a very large range and a very large population that appears to be secure (BirdLife International 2019). In Western Australia the population is secure, though this species may experience reductions at a local level due to human disturbance at nesting sites (Debus 1998). The Peregrine Falcon nests mainly on ledges on cliffs or rocky outcrops, and it may also use tall trees (Johnstone and Storr 1998). This species often takes advantage of man-made structures such as abandoned open pits or quarries. The Peregrine Falcon may occur and forage in the study area. Potential breeding habitat is present nearby, but the rocky hills in the study area are likely to be too low to provide breeding sites for this species.

The range of the **Princess Parrot** is generally further north and east of the study area (Garnett *et al.* 2011, Johnstone and Storr 1998) and database records in the local area are likely to be of vagrant birds. This species inhabits lightly wooded desert areas, foraging in the swales between sand dunes and nesting in eucalypt or desert oak (*Allocasuarina decaisneana*) hollows (Garnett *et al.* 2011, Johnstone and Storr 1998). There two records of this species on the DBCA Threatened and Priority Fauna Database (Figure 6), from Laverton (an undated historical record) and Mt Luck, 150km to the east, in 1984. The study area is outside the core range of the Princess Parrot and the habitats present are unlikely to support this species.

Historically, the **Night Parrot** was recorded across a large range in the arid and semi-arid interior of Australia (Garnett *et al.* 2011). In recent times however, there are very few verified records of the species, though it may still occur across its range at low densities (Garnett *et al.* 2011). Reliable records in recent times are from two main areas, one in western Queensland and one in the Pilbara region of Western Australia (TSSC 2016). The key habitats for the Night Parrot are thought to be chenopod shrublands and Spinifex grasslands, with the chenopod shrublands a refuge during dry conditions (Garnett *et al.* 2011). With the reasons for its decline unknown, potential threats to the species remain unconfirmed (TSSC 2016). Possible threats include predation by feral cats or foxes, human-induced fire and degradation of soil around watering points (TSSC 2016). The Mt Marven study area contains a small area of chenopod shrubland habitat, but the likelihood of the Night Parrot occurring in the study area is very low. This species is very rarely recorded anywhere, has not been recorded within 200km of the study area on DBCA's Threatened and Priority Fauna Database and the study areas lack Spinifex grasslands. If present in the region, the Night Parrot may potentially forage in the study area, but the study area does not include the Spinifex grasslands currently understood to be breeding habitat.

Migratory Fauna

Oriental Plover

This species is listed as migratory under the EPBC Act and BC Act.

Charadrius veredus

Fork-tailed Swift

This species is listed as migratory under the EPBC Act and BC Act.

Apus pacificus

The **Oriental Plover** is a migratory shorebird that occurs on sparsely vegetated plains, as well as beaches and tidal flats (Johnstone and Storr 1998). This species is a non-breeding visitor to Australia between August and April and is more common in the north (Geering 2011, Johnstone and Storr 1998). The study area would need to support 1% of the population (700 birds) in order to be a significant site for the species (Bamford *et al.* 2008). Although the Oriental Plover may occur in the study areas on occasion, it is only likely to be represented by a small number of individuals.

The **Fork-tailed Swift** is a non-breeding visitor to Australia between September and April (Boehm 1962). While it can be scarce in southwest Australia this species is generally more common in the north (Johnstone and Storr 1998). The bird is primarily observed foraging for insects in proximity to cyclonic weather (Boehm 1962). Although a migratory species, the Fork-tailed Swift has a large range and a large population that appears to be stable (BirdLife International 2019). Although there are no nearby records of this species (Figure 6), it is likely to occur in the region from time to time. The Fork-tailed Swift is largely an aerial species and is unlikely to be affected by changes to the study areas.

Priority Fauna

Striated Grasswren

This species is listed as Priority 4 by DBCA.

Amytornis striatus striatus

The subspecies of **Striated Grasswren** *Amytornis striatus striatus* occurs mainly in the eastern desert region in Western Australia, with an apparently isolated population between Meekatharra and Wiluna (Johnstone and Storr 2004). It inhabits Spinifex, Spinifex with low shrubs or *Acacia* shrubland over Spinifex on sandy or loamy plains (Johnstone and Storr 2004). There is a record of Striated Grasswren from Sunrise Dam, on the eastern side of Lake Carey (Kingfisher Environmental Consulting 2014), and this record has been captured in the DBCA Threatened and Priority Fauna Database, so is also shown on Figure 6. Although it is possible that this species occurs in Spinifex habitats that surround nearby Lake Carey, the Striated Grasswren is not likely to occur in the study areas due to lack of suitable habitat.

4.4 Mammals

There are 33 species of mammal that have the potential to occur in the study area, of which 24 are native and nine introduced (Appendix 4). Five species of mammal were recorded opportunistically during the site visit, two native species and three introduced (Appendix 4). The native species observed were the Red Kangaroo (*Osphranter robustus*), which is likely to be common in the study area, favouring plains and open habitats, and the Euro (*Osphranter robustus*), a common species of hilly areas. Most of the mammals listed in Appendix 4 have wide distributions in the semi-arid region, occurring in a variety of habitats. A few species, such as the Wongai Ningaui (*Ningaui ridei*), Hairy-footed Dunnart (*Sminthopsis hirtipes*) and Spinifex Hopping Mouse (*Notomys alexis*) favour sandplains, and may be absent from the study area, though they are likely to occur nearby.

Several species of dunnart and other dasyurid marsupials may occur. Dunnarts are nocturnal foragers, and by day they shelter in a nest constructed under fallen timber or in a hollow log (Van Dyck and Strahan 2008). Almost a third of the mammals listed in Appendix 4 are insectivorous bats. These species are likely to forage over the study area at night. Some species, such as Hill's Sheath-tail Bat (*Taphozous hilli*), roost in caves or mine shafts, while others, such as the White-striped Freetail Bat (*Ozimops australis*), roost in tree hollows (Churchill 1998). The study areas do not appear to contain caves, but cave-roosting species are likely to roost in crevices in the low rocky hills.

4.4.1 Mammals of Conservation Significance

Many native mammals in the region are locally extinct, including the Chuditch (*Dasyurus geoffroii*), Bilby (*Macrotis lagotis*), Numbat (*Myrmecobius fasciatus*), Banded Hare-wallaby (*Lagostrophus fasciatus*) and Boodie (*Bettongia lesueur*). These species may occur on databases as historical records, but are no longer considered to be present in the area. Other species, such as the Brush-tailed Mulgara (*Dasyurus blythi*), Southern Marsupial Mole (*Notoryctes typhlops*) and Sandhill Dunnart (*Sminthopsis psammophila*) are known from the region, but only occur in sandy habitats such as spinifex sandplains and sand dunes.

There is one mammal of conservation significance that may occur in the study areas, as listed and discussed below.

Priority Fauna	
Long-tailed Dunnart This species is listed as Priority 4 by DBCA.	<i>Sminthopsis longicaudata</i>

The **Long-tailed Dunnart** is associated with breakaways and scree slopes, but also occurs on gravel or stony plains (Van Dyck and Strahan 2008). There are several records of this species on DBCA's Threatened and Priority Fauna Database (Figure 6). This species is likely to occur on the low rocky hills and BIF ridge in the study areas, and may range onto the adjacent stony plains. Low rocky hills and the BIF ridge, such as the ones in the study areas, are likely to be important habitat for maintaining this species in the local area.

Table 5. Summary of conservation significant (CS) fauna in the study area.**Key to Status:** Cr = Critically Endangered, En = Endangered, Vu = Vulnerable, OS = Other Specially Protected Fauna, Mi = Migratory, P1 – P4 = Priority 1 – Priority 4.

Species	Status				DBCA records within 200km (see Figure 6)	Likelihood of occurrence in the study area	Habitat preferences	Potential habitat use in the study area						
	EPBC Act	BC Act	DBCA Priority	Locally Significant				Low rocky hills	BIF Ridge	Acacia shrubland on plains	Mulga woodlands	Creeklines	Chenopod shrublands	Samphire shrublands
<i>Pezoporus occidentalis</i> Night Parrot	En	Cr			-	Very low	Chenopod shrublands, Spinifex plains.						✓	
<i>Leipoa ocellata</i> Malleefowl	Vu	Vu			Many records, including the Black Swan Mine Site, Kurnalpi (2009, 2010), Murrin Murrin, Leonora (2011), Tropicana Gold Mine (2014), Laverton (2009 & 2014), Leonora (2016), Goongarrie National Park (2017).	Very low	Acacia thickets, mallee woodlands with leaf litter.			✓	✓	✓		
<i>Polytelis alexandrae</i> Princess Parrot	Vu		P4		Within 40km (DBCA 2007-)	Very low	Lightly timbered deserts, tree-lined watercourses							
<i>Falco hypoleucos</i> Grey Falcon		Vu			One record from Murrin Murrin (1996)	Low	Timbered plains, tree-lined watercourses.	✓	✓	✓	✓	✓	✓	✓
<i>Falco peregrinus</i> Peregrine Falcon		OS			Several records, including Laverton (2012 & 2004) and Murrin Murrin, Leonora (2012)	Moderate	Variety of habitats, nests in tall trees, cliffs, open pits.	✓	✓	✓	✓	✓	✓	✓

Table 5. (cont.).

Species	Status				DBCA records within 200km (see Figure 6)	Likelihood of occurrence in the study area	Habitat preferences	Potential habitat use in the study area						
	EPBC Act	BC Act	DBCA Priority	Locally Significant				Low rocky hills	BIF Ridge	Acacia shrubland on plains	Mulga woodlands	Creeklines	Chenopod shrublands	Samphire shrublands
<i>Charadrius veredus</i> Oriental Plover	Mi	Mi			-	Low	Sparsely vegetation plains, beaches, tidal flats.			✓	✓		✓	✓
<i>Apus pacificus</i> Fork-tailed Swift	Mi	Mi			-	Low	Overfly any habitat.	✓	✓	✓	✓	✓	✓	✓
<i>Amytornis striatus striatus</i> Striated Grasswren			P4		Two records, both from Tropicana Gold Mine (2014).	Very low	Spinifex plains, Acacia shrublands over Spinifex on sands or loams.							
<i>Sminthopsis longicaudata</i> Long-tailed Dunnart			P4		Several records, including from Laverton (2011), Granny Deeps Mine (2011), Mt Ida (2011 & 2012), Mt Mason (2012) and Murrin Murrin, Leonora (2011).	High	Rocky areas, scree slopes, breakaways, stony plains.	✓	✓					
<i>Aprasia picturata</i> Black-headed Worm-lizard				LS	Near Leonora (Wilson and Swan 2017)	Low	Rocky ridges with <i>Acacia</i> and <i>Eremophila</i> .	✓	✓					

5. Conclusions

5.1 Faunal Assemblage

The faunal assemblage of the study areas is likely to be typical of the region, with many of the species widely distributed through semi-arid Western Australia. Species that use wetlands or inhabit spinifex sandplains are likely to be absent as these habitats do not occur in the study areas.

The predicted faunal assemblage includes up to 10 frogs, 85 reptiles, 110 birds and 24 native mammals and nine introduced mammals. The observed assemblage for the study areas includes no frogs, 1 reptiles, 20 birds, two native mammals and three introduced mammals. The observed assemblage for the Mt Morgans Gold Project as a whole now stands at one frog, eight reptile, 52 bird, two native mammals and four introduced mammals.

5.2 Conservation Significant Fauna

Ten conservation significant fauna have been recorded or potentially occur in the Study Area, as summarised in Table 5. The species have been grouped into their conservation significance categories and discussed below.

1. Threatened species

Four threatened species potentially occur in the study areas:

- Malleefowl (*Leipoa ocellata*)
- Night Parrot (*Pezoporus occidentalis*)
- Princess Parrot (*Polytelis alexandrae*)
- Grey Falcon (*Falco hypoleucos*)

Threatened species are those that are considered in danger of extinction as their populations have declined and/or are still declining, and their total population size is small and/or fragmented or geographically restricted. Sites that support these species may be important for their long-term conservation, particularly if the site supports a resident breeding population.

The Malleefowl is unlikely to occur. Although known from many records in the region, the study areas lack the dense litter-forming shrublands that would provide breeding habitat for this species. Although it may occur on occasion, the study areas are unlikely to provide important habitat for the Malleefowl.

The Night Parrot and Princess Parrot are unlikely to occur. The Night Parrot is a very rare bird that nests in large Spinifex hummocks. While possible chenopod foraging habitat is present, there is no breeding habitat in the study areas. The Princess Parrot is a vagrant to the region and the study area is not likely to be important habitat. The Grey Falcon may occur as a foraging visitor, but no breeding habitat is present.

2. Migratory species

Two Migratory species potentially occur in the study areas, none of which have been recorded:

- Oriental Plover (*Charadrius veredus*)
- Fork-tailed Swift (*Apus pacificus*)

Migratory species are not always present at a site, but a particular site may have significance as a seasonal or ephemeral foraging, breeding or shelter area. Impacts to these sites may then impact the population both within the site and further afield.

The Oriental Plover is likely to occur, but not in significant numbers. The Fork-tailed Swift is thought to be almost entirely aerial when visiting Australia, so the study area is not likely to provide important habitat for this species.

3. Specially Protected species

A single Specially Protected species potentially occurs in the study areas:

- Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is likely to occur as a foraging visitor. The study areas are unlikely to be important for this species as its population is large and secure, and the rocky hills are too low to provide breeding habitat.

4. Priority species

Two Priority species potentially occur in the study areas:

- Striated Grasswren (*Amytornis striatus striatus*)
- Long-tailed Dunnart (*Sminthopsis longicaudata*)

The Striated Grasswren is unlikely to occur as the study areas lack its favoured spinifex grasslands. The Long-tailed Dunnart is likely to occur in the low rocky hills and BIF ridge.

5. Locally significant species

A single Locally Significant species potentially occurs in the study areas:

- Black-headed Worm Lizard (*Aprasia picturata*)

This species is known from very few records overall, but may occur in the low rocky hills and BIF Ridge.

5.3 Important Habitats

All habitats have some importance in that they support native fauna, however, habitats may be of particular importance if they:

- support very diverse or unique faunal assemblages
- are restricted or rare in the region (and thus the faunal assemblages are restricted or rare)
- are refugia (e.g. from drought or fire)
- provide ecological linkage
- support conservation significant fauna

The habitats in the Study Area are common and widespread in the subregion and are likely to support a faunal assemblage typical of the region. The Low Rocky Hills and BIF Ridge may be refugia for fauna on a local level, providing cracks and crevices as shelter from extreme conditions. As the study area is set within a largely uncleared landscape and the habitats present are broadly distributed, it is unlikely to have particular importance as a regional ecological linkage. Creekline habitats potentially provide ecological linkage on a local level.

Of the habitats present in the study area, the Low Rocky Hills and BIF Ridge have some importance in supporting populations of the Long-tailed Dunnart. The presence of this species in the region is likely to be determined by the availability of these habitats, and the loss of these habitats may lead to the local loss of this species.

6. References

- Bamford, M., Watkins, D., Bancroft, W., Tischler, G. and Wahl, J. (2008). *Migratory Shorebirds of the East Asian – Australian Flyway: Population Estimates and Internationally Important Sites*. Wetlands International – Oceania, Canberra, Australia.
- Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). *The New Atlas of Australian Birds*. Royal Australasian Ornithologists Union, Victoria.
- BirdLife International (2019) IUCN Red List for birds. URL: <http://www.birdlife.org>
- Boehm, E.F. (1962). Some habits of the Fork-tailed Swift. *Emu* 61(4) 281-282.
- Bureau of Meteorology (2019). URL: <http://www.bom.gov.au>
- Churchill, S. (2008). *Australian Bats*. 2nd Edition. Reed New Holland, Sydney.
- Cogger, H.G., Cameron, E.E., Sadler, R.A. and Eggler, P. (1993). *The Action Plan for Australian Reptiles*. Endangered Species Programme Project Number 124, Australian Nature Conservation Agency, Canberra.
- Cowan, M. Murchison 1 (MUR 1 – East Murchison Subregion). In 'A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002'. Ed by J.E. May and N.L. McKenzie. Department of Conservation and land Management, Western Australia.
- Debus, S. (1998). *The Birds of Prey of Australia: A Field Guide*. Oxford University Press, Australia.
- DBCA (2007-). *Naturemap: Mapping Western Australia's Biodiversity*. Department of Biodiversity, Conservation and Attractions. URL: <http://naturemap.dbca.wa.gov.au/>
- DoEE (2017). *Interim Biogeographic Regionalisation for Australia (IBRA)*, Version 7. Commonwealth of Australia.
- Environmental Protection Authority (EPA) (2016a). *Statement of Environmental Principles, Factors and Objectives*. EPA, Western Australia.
- EPA (2016b). *Environmental Factor Guideline – Terrestrial Fauna*. EPA, Western Australia.
- EPA (2016c). *Technical Guidance – Terrestrial Fauna Surveys*. EPA, Western Australia.
- EPA and DEC (Department of Environment and Conservation) (2010). *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*. Eds B.M. Hyder, J. Dell and M.A. Cowan. Perth, Western Australia.
- Garnett, S.T. Szabo, J.K. and Dutson, G. (2011). *The Action Plan For Australian Birds 2010*. CSIRO Publishing, Collingwood, Victoria.
- Geering, A., Agnew, L. and Harding, S. (2007). *Shorebirds of Australia*. CSIRO Publishing, Collingwood, Victoria.
- Government of Western Australia (2000). *Bush Forever Volume 2*. Department of Environmental Protection, Perth.
- Johnstone, R.E. & Storr, G.M. (1998). *Handbook of Western Australian Birds. Volume 1: Nonpasserines (Emu to Dollarbird)*. Western Australian Museum, Perth.
- Johnstone, R.E. & Storr, G.M. (2004). *Handbook of Western Australian Birds. Volume 2: Passerines (Blue-winged Pitta to Goldfinch)*. Western Australian Museum, Perth.
- Kingfisher Environmental Consulting (2014). *Sunrise Dam - Tropicana Infrastructure Corridor: Fauna Survey*. Unpublished Report to AngloGold Ashanti Australia.
- Menkhorst, P. and Knight, F. (2011). *A field guide to the mammals of Australia*. 3rd Edition. Oxford University Press, South Melbourne.

Native Vegetation Solutions (2019). *Reconnaissance Flora and Vegetation Survey of BIF Ridge and Mt Marven, September 2019*. Unpublished report prepared for Dacian Gold Limited.

Outback Ecology Services (2009). *Mt Morgans, The Craic Project: Level 1 flora and fauna assessment*. Unpublished report to Range River Gold Limited.

RPS (2011). *Level 1 flora and fauna assessment: Mt Morgans Mine, Morgans North Project Area*. Unpublished report to Range River Gold Limited.

Storr, G.M., Smith, L.A. and Johnstone, R.E. (1983). *Lizards of Western Australia. II. Dragons and Monitors*. W.A. Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone, R.E. (2002). *Snakes of Western Australia*. W.A. Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone, R.E. (1990). *Lizards of Western Australia. III. Geckoes and Pygopods*. W.A. Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone, R.E. (1999). *Lizards of Western Australia. I. Skinks*. 2nd edition. W.A. Museum, Perth.

TSSC (Threatened Species Scientific Committee) (2016). *Conservation Advice* *Pezoporus occidentalis night parrot*. Canberra: Department of the Environment. URL: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/59350-conservation-advice-15072016.pdf>. In effect under the EPBC Act from 15-Jul-2016.

Tyler, M.J. (1998). *The Action Plan for Australian Frogs*. Environment Australia, Canberra.

Tyler, M.J., Smith, L.A. and Johnstone, R.E. (2000). *Frogs of Western Australia*. W.A. Museum, Perth.

Van Dyck and Strahan, R. (Ed.) (2008). *The Mammals of Australia*. 3rd Edition. Australian Museum/Reed Books, Sydney.

Western Wildlife (2016). *Dacian Gold Limited: Mt Morgans Project. Level 1 vertebrate fauna survey March 2016*. Unpublished report to Dacian Gold Limited.

Western Wildlife (2018). *Mt Morgans Gold Project: Cameron Well. Level 1 vertebrate fauna survey December 2017*. Unpublished report to Dacian Gold Limited.

Wilson, S. and Swan, G. (2017). *A complete guide to the reptiles of Australia. 5th Edition*. New Holland Publishers (Australia).

Woinarski, J.C.Z., Burbidge, A.A. and Harrison, P.L. (2014). *The Action Plan for Australian Mammals 2012*. CSIRO Publishing.

Appendices.

Appendix 1. Amphibians potentially occurring in the study area.

This survey = species recorded at Mt Marven or Phoenix Ridge, August 2019.

Cameron Well = species recorded at Cameron Well during the 2017 level 1 fauna survey.

Mt Morgan = species recorded during the 2016 level 1 fauna survey at either the proposed camp (c), Jupiter pit (j), borefield (b) or workshop & irrigation area (w).

WAM = species recorded in the area on the Western Australian Museum Specimen Database (see Table 1).

FSDb = species recorded in the area on the Fauna Survey Returns Database (see Table 1).

TF = species recorded in the area on the DBCA Threatened and Priority Fauna Database (see Table 1).

EPBC = species or species habitat recorded in the area on the EPBC Protected Matters Search Tool (see Table 1).

Species	Conservation Status	Records						
		This survey	Cameron Well	Mt Morgan	WAM	FSDb	TF	EPBC
Pelodyadidae (tree frogs and water-holding frogs)								
Main's Frog <i>Cyclorana maini</i>					+	+		
Water-holding Frog <i>Cyclorana platycephala</i>					+	+		
Desert Tree Frog <i>Litoria rubella</i>				c		+		
Limnodynastidae (ground frogs)								
Northern Burrowing Frog <i>Neobatrachus aquilonius</i>								
Kunapalari Frog <i>Neobatrachus kunapalari</i>					+	+		
Desert Trilling Frog <i>Neobatrachus sudellae</i>								
Shoemaker Frog <i>Neobatrachus sutor</i>					+	+		
Plonking Frog <i>Neobatrachus wilsmorei</i>						+		
Centralian Burrowing Frog <i>Platyplectrum spenceri</i>					+			
Myobatrachidae (ground frogs)								
Western Toadlet <i>Pseudophryne occidentalis</i>						+		
# frog species expected in the study area:		10						
# frog species recorded in the study area in 2019:		0						

Appendix 2. Reptiles potentially occurring in the study area.

This survey = species recorded at Mt Marven or Phoenix Ridge, August 2019.

Cameron Well = species recorded at Cameron Well during the 2017 level 1 fauna survey.

Mt Morgan = species recorded during the 2016 level 1 fauna survey at either the proposed camp (c), Jupiter pit (j), borefield (b) or workshop & irrigation area (w).

WAM = species recorded in the area on the Western Australian Museum Specimen Database (see Table 1).

FSDB = species recorded in the area on the Fauna Survey Returns Database (see Table 1).

TF = species recorded in the area on the DBCA Threatened and Priority Fauna Database (see Table 1).

EPBC = species or species habitat recorded in the area on the EPBC Protected Matters Search Tool (see Table 1).

Species	Conservation Status	Records						
		This survey	Cameron Well	Mt Morgan	WAM	FSDB	TF	EPBC
Carphodactylidae (knob-tailed geckoes)								
Southern Barking Gecko <i>Underwoodisaurus milii</i>					+	+		
<i>Nephurus vertebralis</i>					+			
Diplodactylidae (geckoes)								
Variable Fat-tailed Gecko <i>Diplodactylus conspicillatus</i>					+			
Wheatbelt Stone Gecko <i>Diplodactylus granariensis</i>						+		
<i>Diplodactylus pulcher</i>					+	+		
Beaded Gecko <i>Lucasium dameum</i>						+		
<i>Lucasium squarrosus</i>					+			
Sand-plain Gecko <i>Lucasium stenodactylum</i>								
Western Beaked Gecko <i>Rhynchoedura ornata</i>					+	+		
Goldfields Spiny-tailed Gecko <i>Strophurus assimilis</i>					+	+		
Jewelled Gecko <i>Strophurus elderi</i>					+			
Western Spiny-tailed Gecko <i>Strophurus strophurus</i>						+		
<i>Strophurus wellingtonae</i>					+	+		
Gekkonidae (geckoes)								
<i>Gehyra purpurascens</i>					+	+		
<i>Gehyra variegata</i>		+			+	+		
Bynoe's Gecko <i>Heteronotia binoei</i>				j	+	+		
Pygopodidae (legless lizards)								
Black-headed Worm-lizard <i>Aprasia picturata</i>	LS				+			
<i>Delma butleri</i>					+			
<i>Delma nasuta</i>					+			
Burton's Legless Lizard <i>Lialis burtonis</i>					+			
<i>Pygopus nigriceps</i>					+	+		
Agamidae (dragon lizards)								
Crested Dragon <i>Ctenophorus cristatus</i>			+					
Mallee Sand Dragon <i>Ctenophorus fordi</i>								
Laverton Rong-tailed Dragon <i>Ctenophorus infans</i>					+	+		
Military Dragon <i>Ctenophorus isolepis</i>					+	+		
Central Netted Dragon <i>Ctenophorus nuchalis</i>					+	+		
Western Netted Dragon <i>Ctenophorus reticulatus</i>				b	+	+		

Appendix 2. (cont.)

Species	Conservation Status	Records						
		This survey	Cameron Well	Mt Morgan	WAM	FSDB	TF	EPBC
Agamidae (cont.)								
Claypan Dragon <i>Ctenophorus salinarum</i>					+			
Lozenge-marked Dragon <i>Ctenophorus scutulatus</i>			+	b	+	+		
Mulga Dragon <i>Diporiphora amphiboluroides</i>								
Thorny Devil <i>Moloch horridus</i>					+			
Bearded Dragon <i>Pogona minor</i>					+	+		
Pebble Dragon <i>Tympanocryptis cephalus</i>					+	+		
Scincidae (skink lizards)								
<i>Cryptoblepharus australis</i>								
<i>Cryptoblepharus buehneri</i>						+		
<i>Cryptoblepharus plagiocephalus</i>						+		
<i>Ctenotus atlas</i>						+		
<i>Ctenotus grandis</i>								
<i>Ctenotus greeri</i>								
<i>Ctenotus hanloni</i>					+			
<i>Ctenotus helenae</i>					+			
<i>Ctenotus leonhardii</i>					+	+		
<i>Ctenotus pantherinus</i>					+			
<i>Ctenotus schomburgkii</i>								
<i>Ctenotus severus</i>					+	+		
<i>Ctenotus uber</i>					+	+		
Slender Blue-tongue <i>Cyclodomorphus melanops</i>								
Pygmy Spiny-tailed Skink <i>Egernia depressa</i>					+	+		
<i>Egernia formosa</i>								
Broad-banded Sand Swimmer <i>Eremiascincus richardsonii</i>					+	+		
<i>Lerista bipes</i>								
<i>Lerista desertorum</i>					+	+		
<i>Lerista distinguenda</i>						+		
<i>Lerista kingi</i>								
<i>Lerista timida</i>					+	+		
Desert Skink <i>Liopholis inornata</i>					+			
Night Skink <i>Liopholis striata</i>								
Dwarf Skink <i>Menetia greyii</i>					+	+		
<i>Morethia butleri</i>					+	+		
Central Blue-tongue <i>Tiliqua multifasciata</i>						+		
Western Bluetongue <i>Tiliqua occipitalis</i>					+			
Bobtail <i>Tiliqua rugosa</i>						+		
Varanidae (monitors & goannas)								
Short-tailed Pygmy Monitor <i>Varanus brevicauda</i>								
Stripe-tailed Monitor <i>Varanus caudolineatus</i>					+	+		
Pygmy Desert Monitor <i>Varanus eremius</i>					+			
Perentie <i>Varanus giganteus</i>								

Appendix 2. (cont.)

Species	Conservation Status	Records						
		This survey	Cameron Well	Mt Morgan	WAM	FSDB	TF	EPBC
Varanidae (cont.)								
Gould's Goanna <i>Varanus gouldii</i>				b		+		
<i>Varanus panoptes</i>				b		+		
Black-tailed Monitor <i>Varanus tristis</i>					+			
Typhlopidae (blind snakes)								
Southern Blind Snake <i>Anilius australis</i>								
<i>Anilius bicolor</i>								
<i>Anilius hamatus</i>								
<i>Anilius waitii</i>								
Boidae (pythons)								
Stimpson's Python <i>Antaresia stimsoni</i>						+		
Elapidae (front-fanged snakes)								
Desert Death Adder <i>Acanthophis pyrrhus</i>								
Narrow-banded Shovel-nosed Snake <i>Brachyuropsis fasciolatus</i>					+			
Southern Shovel-nosed Snake <i>Brachyuropsis semifasciatus</i>								
Yellow-faced Whipsnake <i>Demansia psammophis</i>								
Moon Snake <i>Furina ornata</i>					+			
Monk Snake <i>Parasuta monachus</i>					+	+		
Mulga Snake <i>Pseudechis australis</i>					+			
Spotted Mulga Snake <i>Pseudechis butleri</i>					+			
Ringed Brown Snake <i>Pseudonaja modesta</i>				b	+			
Western Brown Snake <i>Pseudonaja mengdeni</i>					+			
Jan's Banded Snake <i>Simoselaps bertholdi</i>					+			
Rosen's Snake <i>Suta fasciata</i>					+	+		
# reptile species expected in the study area:		85						
# reptile species recorded in the study area in 2019:		1						

Appendix 3. Birds potentially occurring in the study areas.

This survey = species recorded at Mt Marven or Phoenix Ridge, August 2019.

Cameron Well = species recorded at Cameron Well during the 2017 level 1 fauna survey.

Mt Morgan = species recorded during the 2016 level 1 fauna survey at either the proposed camp (c), Jupiter pit (j), borefield (b) or workshop & irrigation area (w).

Birds Aust. = species recorded in the area on the Birds Australia Atlas Database (see Table 1).

Birddata = species recorded in the area on the Birddata Database (see Table 1).

WAM = species recorded in the area on the Western Australian Museum Specimen Database (see Table 1).

FSDB = species recorded in the area on the Fauna Survey Returns Database (see Table 1).

TF = species recorded in the area on the DBCA Threatened and Priority Fauna Database (see Table 1).

EPBC = species or species habitat recorded in the area on the EPBC Protected Matters Search Tool (see Table 1).

Species	Conservation Status	Records								
		This survey	Cameron Well	Mt Morgan	Birds Aust.	Birddata	WAM	FSDB	TF	EPBC
Dromaiidae (emu) Emu <i>Dromaius novaehollandiae</i>		+		b	+			+		
Megapodiidae (mound-builders) Malleefowl <i>Leipoa ocellata</i>	T							+		+
Phasianidae (quails) Stubble Quail <i>Coturnix pectoralis</i>					+					
Accipitridae (osprey, hawks, eagles and harriers) Black-shouldered Kite <i>Elanus caeruleus</i> Square-tailed Kite <i>Hamirostra isura</i> Black-breasted Buzzard <i>Hamirostra melanosternon</i> Black Kite <i>Milvus migrans</i> Whistling Kite <i>Haliastur sphenurus</i> Brown Goshawk <i>Accipiter fasciatus</i> Collared Sparrowhawk <i>Accipiter cirrocephalus</i> Little Eagle <i>Hieraaetus morphnoides</i> Wedge-tailed Eagle <i>Aquila audax</i> Spotted Harrier <i>Circus assimilis</i>					+			+		
Otididae (bustard) Australian Bustard <i>Ardeotis australis</i>								+		
Turnicidae (button-quails) Little Button-Quail <i>Turnix velox</i>					+	+		+		
Burhinidae (stone-curlews) Bush Stone-Curlew <i>Burhinus grallarius</i>										
Charadriidae (plovers, dotterels and lapwings) Inland Dotterel <i>Peltohyas australis</i> Oriental Plover <i>Charadrius veredus</i> Banded Lapwing <i>Vanellus tricolor</i>	Mi						+	+		+
Columbidae (pigeons and doves) Diamond Dove <i>Geopelia cuneata</i> Common Bronzewing <i>Phaps chalcoptera</i> Crested Pigeon <i>Ocyphaps lophotes</i>			+	j b	+	+		+		
		+		j b	+	+		+		

Appendix 3 (cont.)

Species	Conservation Status	Records								
		This survey	Cameron Well	Mt Morgan	Birds Aust.	Birddata	WAM	FSDB	TF	EPBC
Cuculidae (cuckoos)										
Pallid Cuckoo <i>Cacomantis pallidus</i>					+	+		+		
Black-eared Cuckoo <i>Chrysococcyx osculans</i>								+		
Horsfield's Bronze-Cuckoo <i>Chrysococcyx basalis</i>										
Strigidae (hawk owls)										
Boobook Owl <i>Ninox boobook</i>										
Tytonidae (barn owls)										
Eastern Barn Owl <i>Tyto alba</i>										
Podargidae (frogmouths)										
Tawny Frogmouth <i>Podargus strigoides</i>										
Caprimulgidae (nightjars)										
Spotted Nightjar <i>Eurostopodus argus</i>								+		
Aegothelidae (owlet-nightjars)										
Australian Owlet-Nightjar <i>Aegotheles cristatus</i>								+		
Apodidae (swifts)										
Fork-tailed Swift <i>Apus pacificus</i>	Mi									+
Alcedinidae (kingfishers)										
Red-backed Kingfisher <i>Todiramphus pyrrhopygius</i>										
Sacred Kingfisher <i>Todiramphus sanctus</i>										
Meropidae (bee-eaters)										
Rainbow Bee-eater <i>Merops ornatus</i>				j	+			+		+
Falconidae (falcons)										
Brown Falcon <i>Falco berigora</i>				j b w	+	+		+		
Australian Kestrel <i>Falco cenchroides</i>			+	j	+	+		+		
Grey Falcon <i>Falco hypoleucos</i>	T								+	
Australian Hobby <i>Falco longipennis</i>								+		
Peregrine Falcon <i>Falco peregrinus</i>	OS							+	+	
Cacatuidae (cockatoos)										
Galah <i>Cacatua roseicapilla</i>				j b	+		+	+		
Cockatiel <i>Nymphicus hollandicus</i>					+	+		+		
Psittacidae (parrots, lorikeets & rosellas)										
Budgerigar <i>Melopsittacus undulatus</i>			+	b w	+	+		+		
Bourkes Parrot <i>Neophema bourkii</i>			+		+			+		
Mulga Parrot <i>Platycercus varius</i>				j				+		
Australian Ringneck <i>Platycercus zonarius</i>		+			+			+		
Princess Parrot <i>Polytelis alexandrae</i>	T						+		+	+
Night Parrot <i>Pezoporus occidentalis</i>	T									+
Ptilonorhynchidae (bowerbirds)										
Western Bowerbird <i>Ptilonorhynchus maculatus</i>		+	+	w	+			+		

Appendix 3 (cont.)

Species	Conservation Status	Records								
		This survey	Cameron Well	Mt Morgan	Birds Aust.	Birddata	WAM	FSDB	TF	EPBC
Climacteridae (treecreepers)										
White-browed Treecreeper <i>Climacteris affinis</i>								+		
Maluridae (fairy-wrens, grasswrens and emu-wrens)										
Striated Grasswren <i>Amytornis striatus</i>	P								+	
Variegated Fairy-wren <i>Malurus lamberti</i>						+		+		
White-winged Fairy-wren <i>Malurus leucopterus</i>			+	j b w		+		+		
Splendid Fairy-wren <i>Malurus splendens</i>		+	+	j w		+		+		
Meliphagidae (honeyeaters and chats)										
Spiny-cheeked Honeyeater <i>Acanthagenys rufogularis</i>			+	j b w	+	+	+	+		
Black Honeyeater <i>Sugomel niger</i>										
Pied Honeyeater <i>Certhionyx vareigatus</i>						+		+		
Brown Honeyeater <i>Lichmera indistincta</i>					+			+		
Singing Honeyeater <i>Gavicalis virescens</i>		+	+	c j b w	+	+	+	+		
Grey-fronted Honeyeater <i>Ptilotula plumula</i>					+	+				
Yellow-throated Miner <i>Manorina flavigula</i>			+	j b w	+	+		+		
White-fronted Honeyeater <i>Purnella albifrons</i>				b	+			+		
White-fronted Chat <i>Epthianura albifrons</i>					+	+				
Orange Chat <i>Epthianura aurifrons</i>						+				
Crimson Chat <i>Epthianura tricolor</i>			+		+	+		+		
Pardalotidae (pardalotes)										
Red-browed Pardalote <i>Pardalotus rubricatus</i>								+		
Striated Pardalote <i>Pardalotus striatus</i>					+	+	+			
Acanthizidae (thornbills, gerygones & allies)										
Inland Thornbill <i>Acanthiza apicalis</i>		+	+	b	+	+		+		
Yellow-rumped Thornbill <i>Acanthiza chrysorrhoa</i>		+	+	j b	+	+	+	+		
Slender-billed Thornbill <i>Acanthiza iredalei</i>								+		
Slaty-backed Thornbill <i>Acanthiza robustirostris</i>		+	+	b	+		+	+		
Chestnut-rumped Thornbill <i>Acanthiza uropygialis</i>		+	+	c j b w	+	+		+		
Southern Whiteface <i>Aphelocephala leucopsis</i>		+	+		+		+	+		
Western Gerygone <i>Gerygone fusca</i>					+			+		
Redthroat <i>Pyrrholaemus brunneus</i>		+						+		
Weebill <i>Smicrornis brevirostris</i>		+			+			+		
Pomatostomidae (babblers)										
White-browed Babbler <i>Pomatostomus superciliosus</i>		+	+	j b	+			+		
Psophodidae (whipbird, wedgebills & quail-thrush)										
Western Quail-thrush <i>Cinclosoma marginatum</i>			+	b	+	+	+	+		
Western Chestnut Quail-thrush <i>Cinclosoma clarum</i>			+							
Western Wedgebill <i>Psophodes occidentalis</i>										

Appendix 3 (cont.)

Species	Conservation Status	Records								
		This survey	Cameron Well	Mt Morgan	Birds Aust.	Birddata	WAM	FSDB	TF	EPBC
Artamidae (woodswallows)										
Masked Woodswallow	<i>Artamus personatus</i>				+	+		+		
Black-faced Woodswallow	<i>Artamus cinereus</i>		+	j b w	+	+		+		
Little Woodswallow	<i>Artamus minor</i>							+		
Cracticidae (magpies, butcherbirds & currawongs)										
Grey Butcherbird	<i>Cracticus torquatus</i>			j	+	+		+		
Pied Butcherbird	<i>Cracticus nigrogularis</i>	+	+	j b w	+	+		+		
Australian Magpie	<i>Cracticus tibicen</i>				+		+	+		
Grey Currawong	<i>Strepera versicolor</i>				+			+		
Campephagidae (cuckoo-shrikes and trillers)										
Black-faced Cuckoo-Shrike	<i>Coracina novaehollandiae</i>		+	b w	+	+		+		
Ground Cuckoo-Shrike	<i>Coracina maxima</i>			c	+	+		+		
White-winged Triller	<i>Lalage tricolor</i>			j				+		
Neosittidae (sittellas)										
Varied Sittella	<i>Daphoenositta chrysoptera</i>			b						
Oreoicidae (crested bellbird)										
Crested Bellbird	<i>Oreoica gutturalis</i>		+	j b w	+	+	+	+		
Pachycephalidae (shrike-tits, whistlers and allies)										
Rufous Whistler	<i>Pachycephala rufiventris</i>	+	+	j b w	+	+		+		
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	+	+	j b	+	+		+		
Rhipiduridae (fantails)										
Willie Wagtail	<i>Rhipidura leucophrys</i>		+	j b w	+	+		+		
Grey Fantail	<i>Rhipidura albiscapa</i>				+					
Monarchidae (flycatchers, monarchs & magpie-lark)										
Magpie-lark	<i>Grallina cyanoleuca</i>			c b w	+	+		+		
Corvidae (ravens and crows)										
Torresian Crow	<i>Corvus orru</i>	+		j b w	+	+		+		
Little Crow	<i>Corvus bennetti</i>				+	+	+	+		
Petroicidae (robins)										
Jacky Winter	<i>Microeca fascians</i>									
Hooded Robin	<i>Melanodryas cucullata</i>		+	b	+	+		+		
Red-capped Robin	<i>Petroica goodenovii</i>	+	+	j b w	+			+		
Hirundinidae (swallows and martins)										
White-backed Swallow	<i>Cheramoeca leucosterna</i>			j	+	+				
Welcome Swallow	<i>Hirundo neoxena</i>			j b	+	+		+		
Tree Martin	<i>Petrochelidon nigricans</i>	+		j w	+	+				
Fairy Martin	<i>Petrochelidon ariel</i>				+	+		+		

Appendix 3 (cont.)

Species	Conservation Status	Records								
		This survey	Cameron Well	Mt Morgan	Birds Aust.	Birdata	WAM	FSDB	TF	EPBC
Locustellidae (grassbirds, songlarks & old world warblers)										
Rufous Songlark <i>Megalurus mathewsi</i>					+	+		+		
Brown Songlark <i>Megalurus cruralis</i>					+					
Dicaeidae (flowerpeckers)										
Mistletoebird <i>Dicaeum hirundinaceum</i>			+	j	+	+		+		
Estrildidae (grassfinches and allies)										
Zebra Finch <i>Taeniopygia guttata</i>			+	j b w	+	+		+		
Motacillidae (pipits and wagtails)										
Australian Pipit <i>Anthus australis</i>			+	b				+		
# bird species expected in the study area:		110								
# bird species recorded in the study area in 2019:		20								

Appendix 4. Mammals potentially occurring in the study area.

This survey = species recorded at Mt Marven or Phoenix Ridge, August 2019.

Cameron Well = species recorded at Cameron Well during the 2017 level 1 fauna survey.

Mt Morgan = species recorded during the 2016 level 1 fauna survey at either the proposed camp (c), Jupiter pit (j), borefield (b) or workshop & irrigation area (w).

WAM = species recorded in the area on the Western Australian Museum Specimen Database (see Table 1).

FSDB = species recorded in the area on the Fauna Survey Returns Database (see Table 1).

TF = species recorded in the area on the DBCA Threatened and Priority Fauna Database (see Table 1).

EPBC = species or species habitat recorded in the area on the EPBC Protected Matters Search Tool (see Table 1).

Species	Conservation Status	Records						
		This survey	Cameron Well	Mt Morgan	WAM	FSDB	TF	EPBC
Tachyglossidae (echidnas)								
Echidna <i>Tachyglossus aculeatus</i>						+		
Dasyuridae (dasyurid marsupials)								
Kultarr <i>Antechinomys laniger</i>						+		
Wongai Ningau <i>Ningaui ridei</i>					+			
Fat-tailed Dunnart <i>Sminthopsis crassicaudata</i>					+	+		
Little Long-tailed Dunnart <i>Sminthopsis dolichura</i>						+		
Hairy-footed Dunnart <i>Sminthopsis hirtipes</i>					+	+		
Long-tailed Dunnart <i>Sminthopsis longicaudata</i>	P					+	+	
Striped-faced Dunnart <i>Sminthopsis macroura</i>						+		
Ooldea Dunnart <i>Sminthopsis ooldea</i>								
Macropodidae (kangaroos and wallabies)								
Euro <i>Osphranter robustus</i>		+		c j b w		+		
Red Kangaroo <i>Osphranter rufus</i>		+	+	j		+		
Muridae (rats and mice)								
House Mouse <i>Mus musculus</i>	Int.					+		
Spinifex Hopping-Mouse <i>Notomys alexis</i>					+	+		
Desert Mouse <i>Pseudomys desertor</i>								
Sandy Inland Mouse <i>Pseudomys hermannsburgensis</i>					+	+		
Leporidae (rabbits & hares)								
Rabbit <i>Oryctolagus cuniculus</i>	Int.	+	+	j b w		+		
Emballonuridae (sheath-tail bats)								
Hill's Sheath-tail Bat <i>Taphozous hilli</i>								
Molossidae (freetail bats)								
Inland Freetail Bat <i>Ozimops petersi</i>								
White-striped Freetail Bat <i>Austronomus australis</i>								
Vespertilionidae (ordinary bats)								
Gould's Wattled Bat <i>Chalinolobus gouldii</i>								
Chocolate Wattled Bat <i>Chalinolobus morio</i>						+		
Finlayson's Cave Bat <i>Vespadelus finlaysoni</i>						+		
Inland Forest Bat <i>Vespadelus baverstocki</i>								
Inland Broad-nosed Bat <i>Scotorepens balstoni</i>								
Lesser Long-eared Bat <i>Nyctophilus geoffroyi</i>					+	+		

Appendix 4. (cont.)

Species	Conservation Status	Records						
		This survey	Cameron Well	Mt Morgan	WAM	FSDB	TF	EPBC
Canidae (dogs and foxes)								
Fox <i>Vulpes vulpes</i>	Int.	+						
Dingo <i>Canis dingo</i>						+		
Dog <i>Canis familiaris</i>	Int.							
Felidae (cats)								
Feral/House Cat <i>Felis catus</i>	Int.			j		+		
Equidae (horses and donkeys)								
Donkey <i>Equus asinus</i>	Int.							
Camelidae (camels)								
Camel <i>Camelus dromedarius</i>	Int.							
Bovidae (horned ruminants)								
Cow <i>Bos taurus</i>	Int.	+		j b w		+		
Goat <i>Capra hircus</i>	Int.					+		
# mammal species expected in the study area:		33 (24 native, 9 introduced)						
# mammal species recorded in the study area in 2019:		5 (2 native)						

Appendix 5. EPBC Protected Matters Search Tool results.

Species listed for the area 20km in radius from 28.76778 °S, 122.13722 °E on the EPBC Protected Matters Search Tool.

Species	Status	Type of Presence
Malleefowl <i>Leipoa ocellata</i>	Vu	Species or species habitat likely to occur within area
Night Parrot <i>Pezoporus occidentalis</i>	En	Species or species habitat may occur within area
Princess Parrot <i>Polytelis alexandrae</i>	Vu	Species or species habitat likely to occur within area
Chuditch <i>Dasyurus geoffroyi</i>	Vu	Species or species habitat may occur within area
Fork-tailed Swift <i>Apus pacificus</i>	Mi	Species or species habitat likely to occur within area
Grey Wagtail <i>Motacilla cinerea</i>	Mi	Species or species habitat may occur within area
Yellow Wagtail <i>Motacilla flava</i>	Mi	Species or species habitat may occur within area
Common Sandpiper <i>Actitis hypoleucos</i>	Mi	Species or species habitat may occur within area
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	Mi	Species or species habitat may occur within area
Pectoral Sandpiper <i>Calidris melanotos</i>	Mi	Species or species habitat may occur within area
Oriental Plover <i>Charadrius veredus</i>	Mi	Species or species habitat may occur within area
Common Greenshank <i>Tringa nebularia</i>	Mi	Species or species habitat likely to occur within area