Keith Lindbeck and Associates
Environmental Management Consultants
ABN 36 150 274 469

# JUPITER MINES LIMITED

## *CENTRAL YILGARN IRON PROJECT (CYIP)*
## *MT MASON*

## FAUNA ASSESSMENT

Prepared for: **Jupiter Mines Limited**

Prepared by:

Keith Lindbeck and Associates
PO Box 144
BULLCREEK WA 6149
Telephone: 08 9332 0671
Facsimile: 08 9332 0672
Mobile: 0412 419 468
E-Mail: keith@keithlindbeck.com.au
ABN: 36 150 274 469

**August 2012**

# EXECUTIVE SUMMARY

Jupiter Mines Limited (Jupiter) is engaged in the exploration and development of mineral resources in Australia. In particular, Jupiter holds interest in the Central Yilgarn Iron Project (CYIP) area located within the western edge of the Mt Ida greenstone belt.

The CYIP area is located approximately 530 km northeast of Perth, 100 km northwest of Menzies and 200 north-northwest of Kalgoorlie**.** Collectively, the tenements that make up the CYIP area cover approximately 27,500 ha. The two main project areas in the CYIP include Mt Mason and Mt Ida which are 100% owned by Jupiter.

Mt Mason, in particular, is reported to have an Inferred Mineral Resource of 5.90 million tonnes of iron ore at 60.1% Fe. In order to further pursue mining opportunities in the Mt Mason area, Jupiter commissioned Keith Lindbeck and Associates (KLA) to undertake a comprehensive Level 2 fauna assessment of the area proposed for mining activities in the Mt Mason tenement area.

In accordance with the Environmental Protection Authority (EPA) Statement and Guidelines, multiple seasonal surveys are required. KLA has completed a 'Spring 2011' survey and an 'Autumn 2012' survey to satisfy these requirements. Five trapping sites were established in the screes and flats adjacent to five smaller satellite sites that were located within areas of Banded Iron Formation (BIF).

**Results**

Pitfall traps, aluminium box traps, funnel traps and cage traps were open collectively for a total of 4613 trap nights.

The systematic surveys recorded 13 reptile species, five native terrestrial mammal species and one non-native terrestrial mammal species, six species of bats and 34 bird species, giving a total of 59 vertebrate fauna species.

The reptiles captured comprised three dragon species (Agamidae), two diplodactylid species (Diplodactylidae), two gecko species (Gekkonidae), four species of skink (Scincidae) and two varanids (Varanidae) totalling 36 individuals.

Nine species of reptiles were captured in each of the seasonal surveys. However, one agamid (*Pogona minor*) two diplodactilids (*Diplodactylus pulcher, Strophurus assimilis*) and one skink (*Ctenotus schomburgkii*) were captured during the Spring survey that were not captured during the Autumn survey and conversely, two geckos (*Gehyra variegata, Heteronotia bynoei*) one skink (*Ctenotus leonhardii*) and one varanid (*Varanus panoptes*) were captured during the Autumn survey that were not captured during the Spring survey.

Aberrant maxima and minima temperatures results in less reptiles (n = 22) being captured (trap rate = 1.0%) during the purported warmer temperatures of spring and more reptiles (n = 36) being captured (trap rate – 1.5%) in the purported cooler autumn temperatures. The overall trap rate of 1.25% across both seasonal surveys was considered low indicating that the habitat at the time did not support many reptiles.

The numbers of reptile captures between sites did differ but not consistently across seasons. During the Spring 2011 survey more reptiles were captured in the 'Mulga over *Eremophila forrestii* on undulating hills' and during the Autumn 2012 survey more reptiles were captured in the regenerating *Acacia* shrubland. While there were no captures of reptiles in the smaller satellite sites in the BIF areas during the Spring 2011 survey, one individual (*Heteronotia binoei*) was captured in one of the satellite sites during the Autumn 2012 survey.

No reptile species of conservation significance were recorded.

For the terrestrial mammals, five species of native terrestrial mammals representing two families and totalling 28 individuals were captured. During the Spring 2011 survey seven native mammals were captured represented by two species from the Family Dasyuridae: *Sminthopsis longicaudata* Long-tailed Dunnart and *S. dolichura* Little Long-tailed Dunnart. While not listed to occur in the area, *S. longicaudata* is a Priority 4 species on the Department of Environment and Conservation (DEC) Threatened and Priority Fauna Database. This capture represents the southernmost extent of this species and extends its distribution range. No other mammals species of conservation significance were recorded during either of the seasonal surveys.

Many more native mammals (n = 21) were captured during the Autumn 2012 survey. In addition to the above two species, a third dasyurid (*Pseudantechinus woolleyae* Woolley's Pseudantechinus) was captured being the only mammal captured in the smaller satellite sites located in areas of BIF. In addition, *Notomys alexis* Spinifex Hopping Mouse and *Pseudomys hermannsburgensis* Sandy Inland Mouse represented native Muridae species captured.

For the non-native mammals, a total of 44 *Mus musculus* House Mouse (Family: Muridae) were captured with ten captured during the Spring 2011 survey and 34 captured during the Autumn 2012 survey, with only two captured in the smaller satellite sites in the BIF areas. *Mus musculus* populations are known to fluctuate enormously depending on resources and rain. This is consistent with the large increase in numbers from those captured during the Spring 2011 survey to the great number captured during the Autumn 2012 survey.

The capture of 28 individual native mammals during the two seasonal surveys translates into a trap rate of 0.6%, which suggests that at the time of the surveys the area supported very low numbers of mammals. While the trap rate for *Mus musculus* was higher (1.0), the combined trap rate for all mammals (1.6) indicates a low abundance of mammals in the area.

Consistent with the reptile captures, more mammals were captured in the habitat described as ‘Mulga over *Eremophila forrestii* on undulating hills’.

Anabat detectors record the presence of bats, rather than the numbers present. Bats were recorded at all of the five trapping grid sites with between five and six species recorded at each site. While some calls were positively identified, others require confirmation and some could be one of two species. Notwithstanding this, it is reasonable to assume that the diversity of bats present extends throughout the Mt Mason area.

Systematic bird surveys yielded a total of 507 individuals of 34 species from 16 Families. For the Spring 2011 survey, the 12 Families comprised three non-passerine Families (n = eight species with 129 individual birds recorded) and nine passerine Families (n = 21 species with 178 individual birds recorded). While the numbers of birds recorded in each category suggest that the area supports marginally more passerines (58% of total number of birds) than non-passerines (42%), analysis of the results indicates that *Nymphicus hollandicus* Cockatiel (n = 40) and *Melopsittacus undulatus* Budgerigar (n = 45) were responsible for weighting of the non-passerine figures.

Within the passerines, 52% of the total number of passerines (n = 178) was represented by three species with the Malurid *Malurus splendens* Splendid Fairy-wren being the most ubiquitous (n = 35). *Acanthiza robustirostris* Slaty-backed Thornbill was the next most numerous bird (n = 33) followed by *Oreoica gutturalis* Crested Bellbird (n = 25).

For the Autumn 2012 survey, three non-passerine species from three Families accounted for only 17 birds whereas the 16 passerines species numbered 183 individuals from eight Families. Two species (*Malurus splendens* Splendid Fairy-wren (n = 45) and *Acanthiza apicalis* Inland Thornbill (n = 66)) accounted for 61% of all passerines during this seasonal survey. Thus, the percentage of passerines (91.5%) heavily outweighed the percentage of non-passerines (8.5%).

Overall, the number of birds recorded during the systematic sampling suggests that resources and/or habitat required were adequate to maintain the numbers and diversity present.

The distribution of birds throughout the Mt Mason area was not remarkably different between sites for the Spring 2011 survey. These results suggest that there was no significant correlation between distribution of birds across the length of the area surveyed and the vegetation communities in the areas surveyed. However, these results were not consistent for the Autumn 2012 survey period in which there was a marked difference in the species distribution across the sites. Given that all sites except the regenerating *Acacia* shrubland are dominated by a mulga upper story, it may be assumed that resource availability differs substantially in the cooler months in relation to topography and understorey species.

Of the birds considered of conservation significance listed for the area, evidence of *Leipoa ocellata* Malleefowl was found, *Oreoica gutteralis* Crested Bellbird was recorded at every site and opportunistically and *Pomatostomus superciliosus* White-browed Babbler was recorded at one site and opportunistically. Of four reportedly known Malleefowl mounds in the general area only three very old inactive mounds were located, and an additional four old, inactive mounds were identified during the surveys. Seven of the eight were located on the edge of or outside of the Mt Mason tenement. One new, active Malleefowl mound was identified 1.7 km south of the southern boundary of the Mt Mason tenement. Given the location of the proposed disturbance in the Mt Mason area and the presence of large areas of intact, undisturbed, remnant vegetation regionally, the conservation status of the Malleefowl, Crested Bellbird and White-browed Babbler is not likely to be altered by the proposed mining activity.

Of the invertebrate fauna collected, 101 individuals were identified and represented five Classes and nine Orders. Within the Arachnida, nine species totalling 26 individuals represented five Families, three Chilopoda accounted for three Families with one species from each, Diplopoda accounted for one species and Crustacea seven species from one Family. Five species of Gastropoda were identified representing three families and accounting for 64 specimens. Given the lack of taxonomic knowledge and reference collections, the results from the Western Australian Museum were often inconclusive depending on the families or genera. Up to 13 of the 19 species were considered not Short-range Endemic Invertebrates (SREs) whereas lack of knowledge preventing a conservation status to be determined for five of the species. For the remaining species (Family: Paradoxosomatidae), one single damaged female millipede did not facilitate identification. However all species in the presumed genus are known to be SREs.

The overall condition of the vegetation within the survey area can generally be described as “Very Good” to “Excellent” with almost all disturbances within the area directly related to recent exploration activity and associated tracks. No unique, restricted or fauna-specific habitat types for terrestrial vertebrate fauna were identified within the Mt Mason or local area. The BIF range at Mt Mason lies in a north to south orientation for approximately 10 km and appears to be well connected to the BIF range at Mt Ida (approximately 8.6 km in length). The potential invertebrate habitat supported by these ranges is extensive and is not limited to the area of proposed impact at Mt Mason. Thus, while the removal of up to approximately 220 ha of native vegetation and BIF will impact

on indigenous fauna, the vegetation cannot be considered to be significant habitat in a regional context.

**Recommendations**

The following general recommendations apply in the case of any major disturbance to large areas of native vegetation, as a consequence of the proposed development for the Mt Mason Project:

- Any clearing be minimised in extent given that the abundance and diversity of species lost will be proportional to the amount of habitat cleared;
- Where possible, all infrastructure associated with the development of the mining operation be aligned preferentially to areas of existing disturbance;
- Where possible, access routes be aligned to existing tracks and other barriers or follow the boundaries of broad-scale intact native vegetation;
- A rehabilitation plan is developed that progressively rehabilitates areas as soon as they are no longer required; and
- All members of the work force on site attend an environmental induction to ensure they are familiar with the value of native vegetation to fauna indigenous to Western Australia. This should include awareness of driving restrictions, ensuring that off-road driving is minimised, fire prevention is actively practised, and appropriate responses are followed in the event of an accident involving fauna.

In addition, specific recommendations are made in relation to the Malleefowl:

- A targeted Malleefowl survey should be undertaken by a suitably qualified team in the areas proposed for disturbance as soon as detailed boundaries of these areas have been confirmed.
- Given the evidence of Malleefowl within the zone of impact, a referral should be submitted to the Federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for approval in accordance with the EPBC Act 1999.
- Pending the results of the targeted Malleefowl survey in the confirmed areas for disturbance and outcome of the DSEWPaC referral, a Malleefowl Management Plan should be developed and implemented immediately post approval.

# TABLE OF CONTENTS

**Page No.**

## FIGURES



## TABLES

**PLATES**



**APPENDICES**

# 1.0 INTRODUCTION

## 1.1 BACKGROUND

Jupiter Mines Limited (Jupiter) is engaged in the exploration and development of mineral resources in Australia. In particular, Jupiter holds an interest in the Central Yilgarn Iron Project (CYIP) area located within the western edge of the Mt Ida greenstone belt. The Ida fault, a large scale regional structure, marks the boundary between the Southern Cross Granite-Greenstone and Eastern Goldfields.

The CYIP area is located approximately 530 km northeast of Perth, 100 km northwest of Menzies and 200 north-northwest of Kalgoorlie. Collectively, the tenements that make up the CYIP area cover approximately 27,500 ha. The two main project areas in the CYIP include Mt Mason and Mt Ida (Figure 1). Both projects are 100% owned by Jupiter.

Mt Mason, in particular, is reported to have an Inferred Mineral Resource of 5.90 million tonnes of iron ore at 60.1% Fe. In order to further pursue mining opportunities in the Mt Mason area, Jupiter commissioned Keith Lindbeck and Associates (KLA) to assist in the government approvals process.

## 1.2 SCOPE OF STUDY

As part of the government approval requirements, KLA was commissioned in July 2011 to undertake a comprehensive Level 2 fauna assessment of the vegetated areas encompassing the proposed mine and associated infrastructure related to the Mt Mason Project. The survey was planned and implemented in accordance with Environmental Protection Authority (EPA) Position Statement No 3 "*Terrestrial Biological Surveys as an Element of Biodiversity Protection*" (EPA 2002), Guidance Statement No. 56 "*Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*" (EPA 2004), Guidance Statement No. 20 "*Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia*" (EPA 2009) and "*Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*" (EPA and DEC 2010).

The EPA (2004) guidelines indicate that multiple, seasonal surveys are required for baseline information. Therefore, one Level 2 survey was conducted in Spring (August-September 2011) and a second Level 2 survey was conducted in Autumn (March 2012).

In January 2007, Jupiter commissioned a Level 1 desktop terrestrial vertebrate fauna assessment of the Mt Mason Project area (Outback Ecology Services (OES) 2007). The results of that fauna assessment were used to provide contextual data for the Level 2 survey.

The scope of work for the Level 2 fauna survey was to:

- generally describe the vegetation associations in the study area;
- identify habitat that may be of significance to fauna indigenous to Western Australia;
- identify any habitats of particular conservation significance for fauna within the study area;
- develop an inventory (baseline information) of terrestrial vertebrate fauna species and terrestrial Short-range Endemic invertebrate (SRE) species identified from within the survey area using a combined approach of desk-top research including a review of existing literature and site specific, seasonal fauna surveys comprising a suite of established survey techniques;
- assess the inventory in the regional context by comparisons with available data from other localities within the region;

- identify fauna of conservation significance in the area, including SRE species;
- provide a risk assessment to determine potential impacts to fauna of conservation significance; and
- provide recommendations, including the management of perceived impacts to fauna habitats and fauna of conservation significance within the study area.

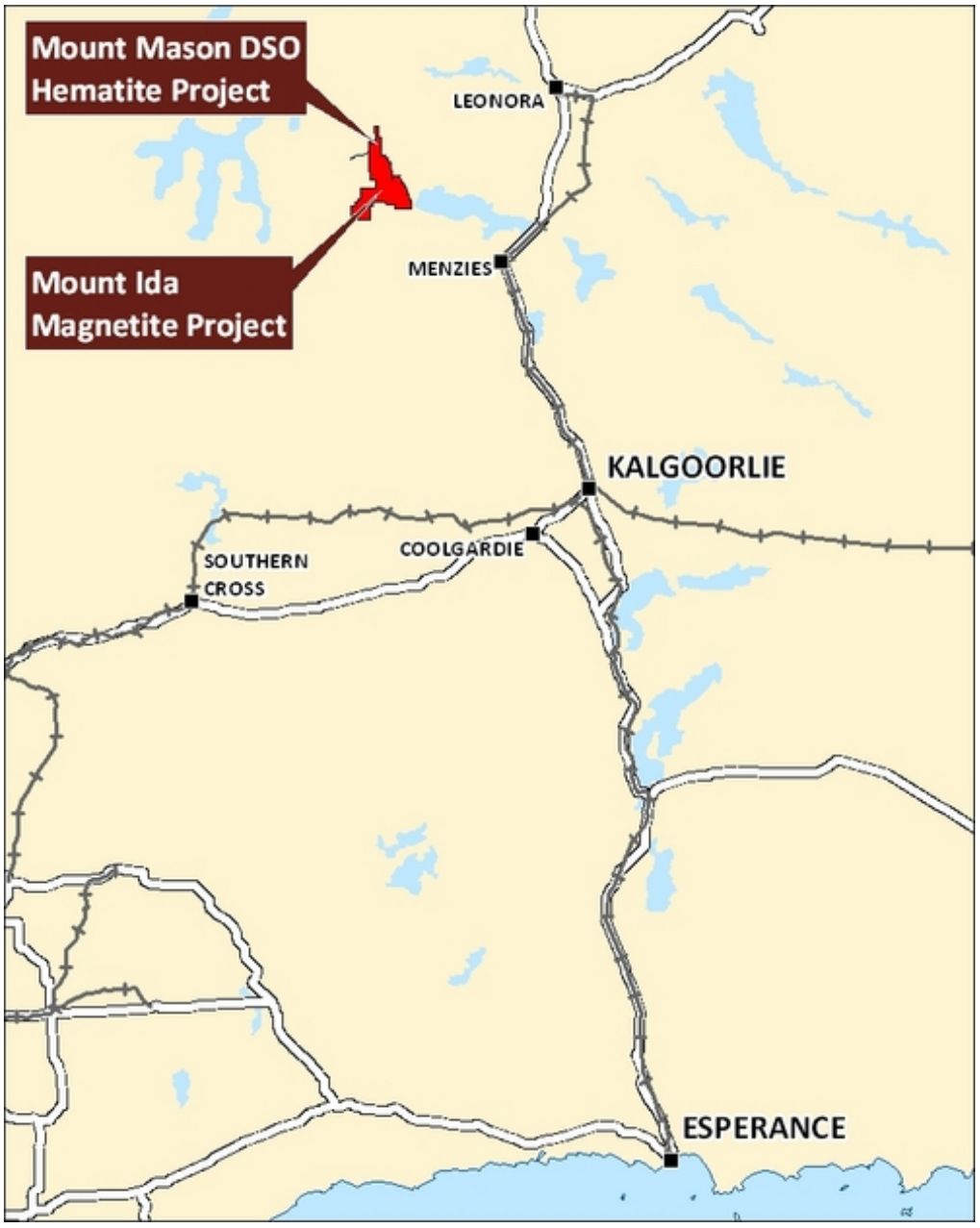



**Figure 1 - Location of Mt Mason and Mt Ida**

## 1.3 PURPOSE OF THIS REPORT

This report describes the methodology employed for two seasonal fauna surveys of the area encompassing the proposed mine and associated infrastructure relating to the Mt Mason Project. It documents the current knowledge of the potentially-occurring and surveyed fauna in the broader area and provides the results of the Spring 2011 and Autumn 2012 surveys conducted in the subject area. The report also provides recommendations that include minimising impacts of the proposed project on fauna habitat and assemblages.

This report is intended as a supporting document to accompany Jupiter's mining approvals submissions to satisfy statutory requirements.

This survey is subject to limitations and these are discussed in more detail in the appropriate sections.

# 2.0 EXISTING ENVIRONMENT

The Mt Mason Project area lies approximately 100 km northwest of Menzies, approximately 35 km northwest of Lake Ballard (an ephemeral salt lake) and 65 km east of Lake Barlee (an intermittent salt lake) in the Goldfields district of Western Australia (Figure 2). The operations will be carried out on M29/408 which is located on the Perrinvale Pastoral Lease (H91304) (Figure 3).

The Mt Mason Project area extends within the eastern aspect of M29/408 which measures approximately 1.9 km long and approximately 1.6 km wide and covers 300 ha (Figure 2 and Figure 3).

## 2.1 CLIMATE

The area encompassing Mt Mason is located close to the delineation between the Desert-Intermediate and Semi-Desert Mediterranean bioclimatic regions which are also described as semi-arid (Beard 1990). The area is dry for the majority of the year and beneficial rains fall in late summer to early winter (Beard 1990).

The nearest official meteorological station is located at Menzies, approximately 100 km southeast of the survey area. Recordings of the local climatic conditions commenced at Menzies in 1896, and although the station is still open, availability of data is limited (Bureau of Meteorology (BOM) 2012). The next closest station is Leonora, approximately 100 km northeast of Mt Mason which has records from 1898 and continues to monitor climatic conditions to date (BOM 2012). Data from both stations is presented in this report.

### 2.1.1 Temperature

For Menzies, the mean annual minimum temperature is 12.6$^{o}$C and the mean annual maximum temperature is 26.3$^{o}$C (Figure 4). The coldest month is July (mean minimum temperature 5.3$^{o}$C), the hottest is January (mean maximum temperature 35.1$^{o}$C), and diurnal temperature variations are relatively consistent throughout the year (Figure 4). Diurnal temperature variations for Leonora mirror those of Menzies. However, Leonora recorded overall slightly higher temperatures with the mean annual minimum being 14$^{o}$C, mean annual maximum 27.9$^{o}$C, coldest temperature 6.1$^{o}$C also in July and hottest also in January at 37.1$^{o}$C (Figure 5).

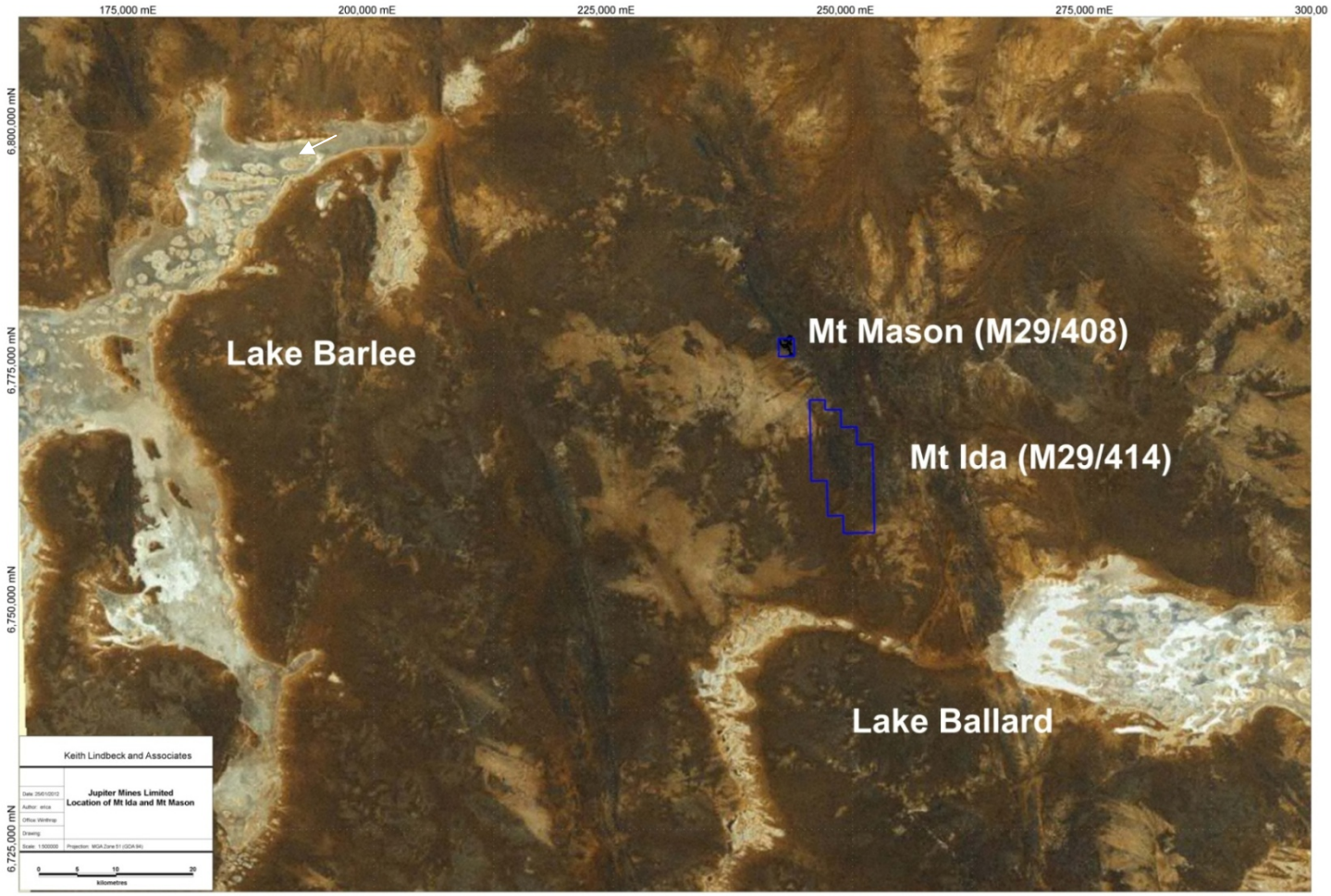



**Figure 2 - Location of Mt Mason Project area**

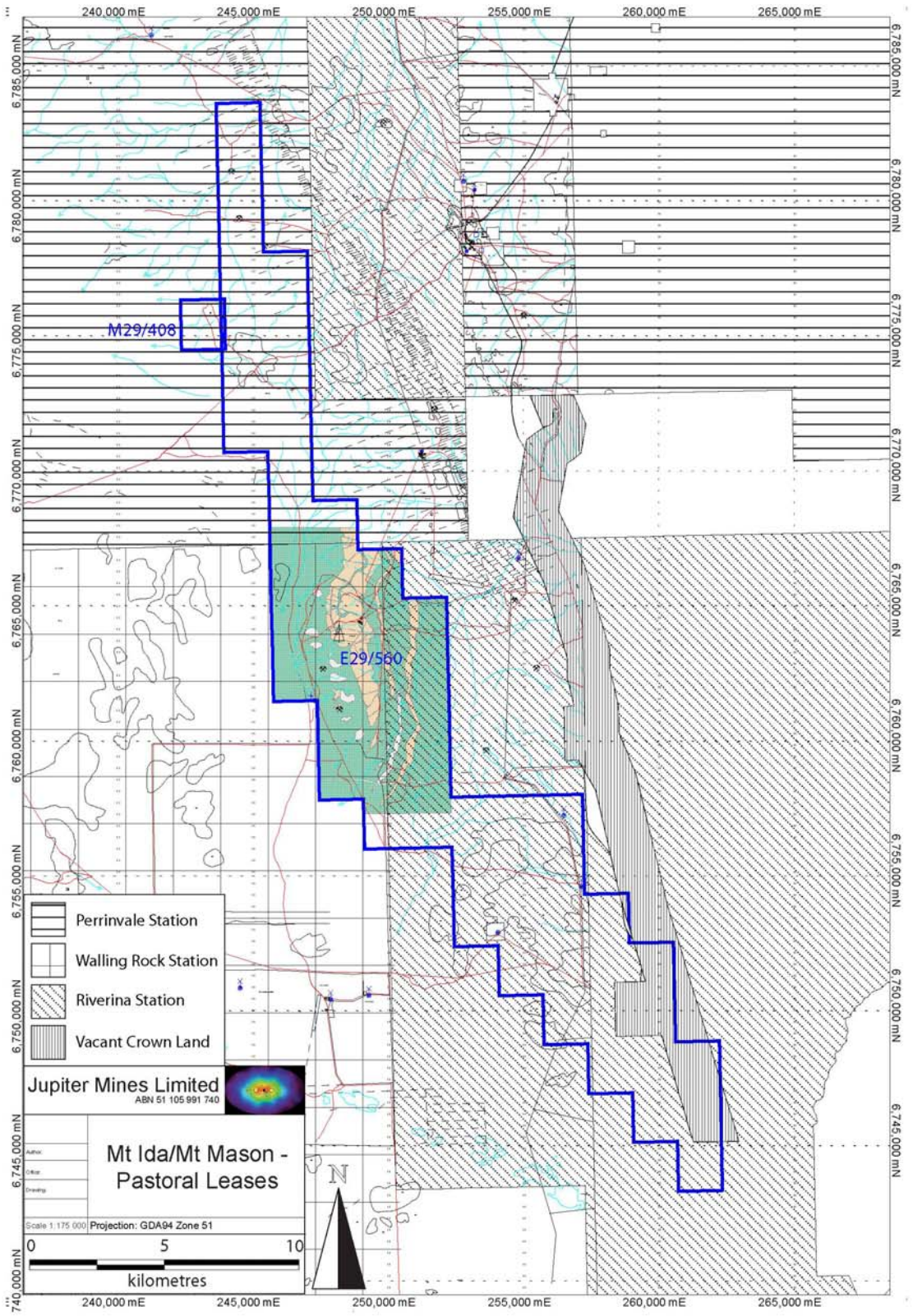



**Figure 3 - Pastoral Leases of the Mt Mason project area**

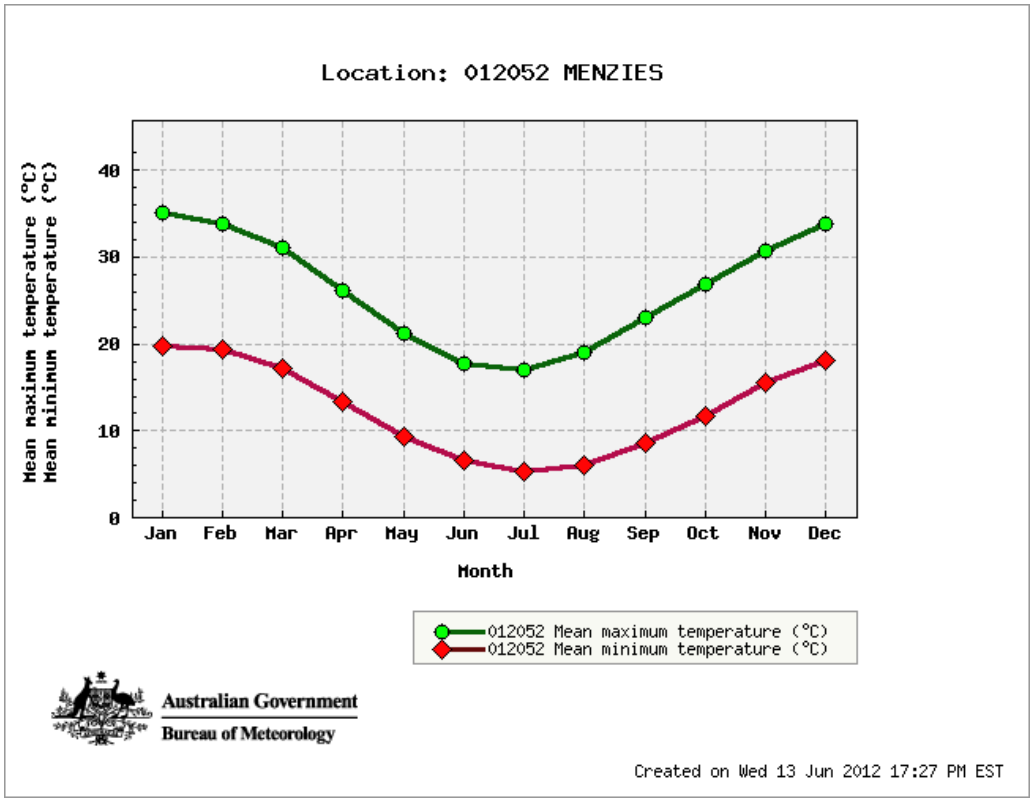



**Figure 4 - Mean maximum and minimum temperatures at Menzies Meteorological Station**

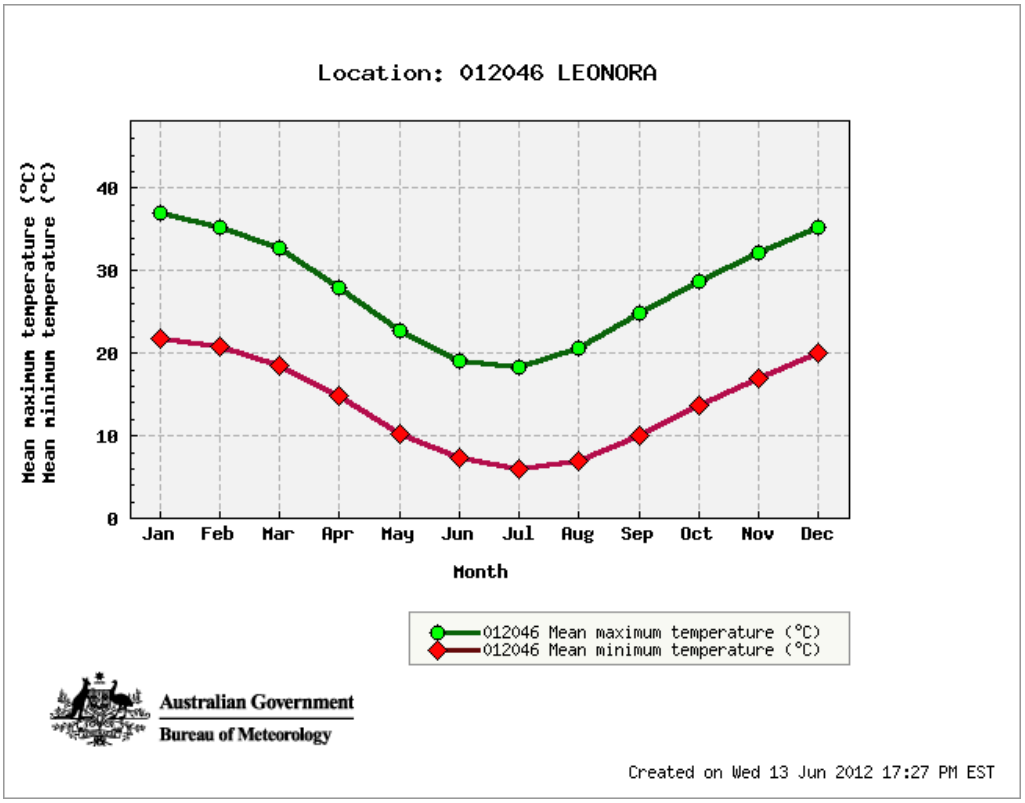



**Figure 5 - Mean maximum and minimum temperatures at Leonora Meteorological Station**

Mean minimum and maximum temperatures for the August and September 2011 survey period were considerably warmer than the historic mean, while those for the March 2012 survey period were slightly cooler.

The mean minimum temperature for the August-September 2011 survey period was 11.4°C, compared to 7°C for August and 10°C for September recorded over the last 63 years for the area. The mean maximum temperature for that survey period was warmer (26.4°C) than the long-term average of 20.6°C for August and 24.8°C for September (BOM 2012).

For the March 2012 survey period, the mean minimum temperature was somewhat lower (15.5°C) than the historic mean of 18.6°C and the mean maximum temperature was also lower (31.3°C) than the 63 year mean (32.7°C). Table 1 lists the minimum and maximum temperature recordings and rainfall for the periods spanning both seasonal fauna surveys recorded at the Leonora Station (28 August 2011 to 3 September 2011, and 1 to 7 March 2012). During the Autumn 2012 survey period, a thermometer (and rain gauge) were erected within the survey area. The temperatures recorded during this survey period differed slightly from Leonora; the mean minimum temperature was very similar (15.2°C) whereas the mean maximum temperature was higher at 35.8°C (Table 2). The accuracy of these temperature recordings must be taken into account and regarded as an estimate only.

**Table 1 - Daily temperatures and rainfall for selected dates in Spring 2011 (August-September) and Autumn 2012 (March) recorded at Leonora Meteorological Station**

| 2011 | Temperature | | Rainfall |
|---|---|---|---|
| **Date** | **Min °C** | **Max °C** | **mm** |
| 28-Aug | 9.1 | 28.7 | 0 |
| 29-Aug | 9.8 | 27.8 | 0 |
| 30-Aug | 15.9 | 28.5 | 0 |
| 31-Aug | 12.4 | 27.6 | 0 |
| 1-Sep | 12.7 | 28.3 | 0 |
| 2-Sep | 13.1 | 25.5 | 0 |
| 3-Sep | 6.9 | 18.3 | 4.2 |
| **Mean** | **11.4** | **26.4** | **0.6** |

| 2012 | Temperature | | Rainfall |
|---|---|---|---|
| **Date** | **Min °C** | **Max °C** | **mm** |
| 1-Mar | 14.2 | 26.4 | 0.4 |
| 2-Mar | 13.7 | 27.8 | 0 |
| 3-Mar | 12.9 | 29.1 | 0 |
| 4-Mar | 16.7 | - | 0 |
| 5-Mar | - | 33.6 | 0 |
| 6-Mar | 17.4 | 33.9 | 0 |
| 7-Mar | 18 | 37 | 0 |
| **Mean** | **15.5** | **31.3** | **0.06** |

**Table 2 - Daily temperatures and rainfall recorded within the survey area at Mt Mason during the Autumn 2012 survey**

| 2012 | Temperature | | Rainfall |
|---|---|---|---|
| **Date** | **Min °C** | **Max °C** | **mm** |
| 29-Feb | 16.0 | 26.0 | 0 |
| 1-Mar | 15.0 | 35.0 | 0 |
| 2-Mar | 12.0 | 37.0 | 0 |
| 3-Mar | 12.0 | 37.0 | 0 |
| 4-Mar | 12.5 | 33.0 | 0 |
| 5-Mar | 15.0 | 36.0 | 0 |
| 6-Mar | 18.0 | 37.5 | 0 |
| 7-Mar | 18.0 | 38.0 | 0 |
| 8-Mar | 18.0 | 43.0 | 0 |
| **Mean** | **15.7** | **35.83** | **0** |

### 2.1.2 Rainfall

The annual average rainfall at Menzies is 249.9 mm which falls (<1 mm) on approximately 32.1 rain days (BOM 2012). Leonora is located approximately 100 km north of Menzies and the annual average rainfall and number of rain days is marginally less with 236.8 mm falling on approximately 30.1 rain days. More rain (>20 mm per month) falls in the first half of the year than in the second half (<20 mm per month) and this amount does not vary greatly (Figure 6).

Rainfall preceding the spring survey was below average for the period March to May 2011, while June and July 2011 received above average rainfall. February 2011 recorded an excessive amount of rain (190.7 mm) equating to 37% of the entire annual rainfall for 2011 (Figure 6). A total of 15.1 mm of rain was recorded for August 2011, and 4.2 mm on 2 September 2011. A rain gauge at 'Mt Ida camp' located approximately 11 km east of Mt Mason recorded 11.0 mm of rain on 2 September 2011. Both August and September recorded below average rainfall for 2011.

The period prior to the autumn survey received above average rainfall from October 2011 through to January 2012. While February 2012 received below average rainfall (18.1 mm) rainfall for March 2012 (68.2 mm) far exceeded mean average for that month (28.8 mm) (BOM 2012). Only 0.4 mm of rain fell during the March 2012 survey period, and no rainfall was recorded at site.

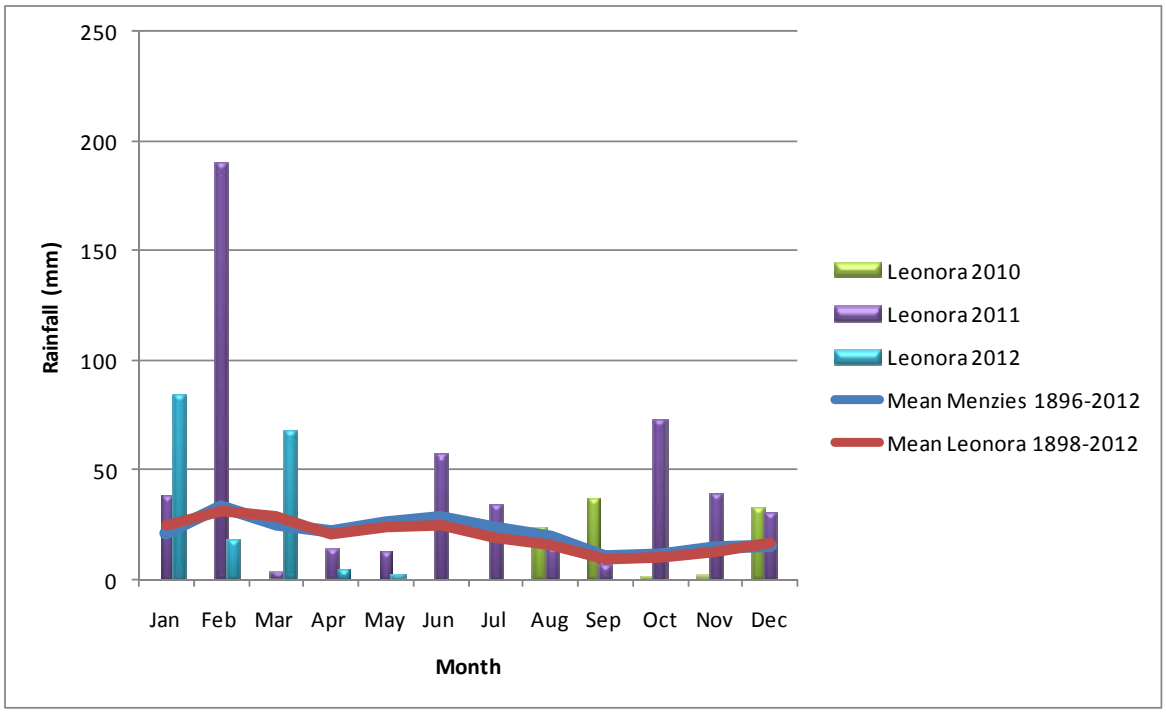



**Figure 6 - Rainfall data for Menzies and Leonora Meteorological Stations**

## 2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation for Australia (IBRA) divides the Australian continent into 85 bioregions and 403 subregions (Department of the Environment, Water, Heritage and the Arts 2009). The CYIP area is located within the Murchison IBRA region and (MUR1) East Murchison subregion (Cowan 2001).

The East Murchison bioregion which totals over seven million hectares is characterised by Mulga Woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and *Halosarcia* shrubland (Cowan 2001). The area is characterised by:

- internal drainage,
- extensive areas of elevated red desert sandplains with minimal dune development,
- salt lake systems that are associated with the occluded Paleodrainage system, and
- broad plains of red-brown soils and breakaway complexes as well as red sandplains (Cowan 2001).

The subregion is rich and diverse in both its flora and fauna. However, most species are wide ranging and usually occur in at least one, and often several, adjoining subregions (Cowan 2001). Notwithstanding this, known special values in relation to the landscape, ecosystem, species and genetic values in the subregion include:

- Rare Features such as calcrete aquifers in the northern parts that support a large variety of Short-range Endemic (SRE) subterranean aquatic fauna,
- Rare terrestrial species include Great Desert Skink *Egernia kintorei,* Malleefowl *Leipoa ocellata*, Alexandra's Parrot *Polytelis alexandrae*, Mulgara *Dasycercus cristicauda* and Yellow-bellied Black Snake *Pseudechis butleri*, and
- Lake Barlee which represents a most important breeding site for Banded Stilts *Cladorhynchus leucocephalus* and refugia for many other water birds (Burbidge and Fuller 1982 cited in Cowan 2001).

  Lake Barlee is usually dry but, given its importance when it is inundated, it is now recognised as an Important Bird Area (IBA) by Birdlife Australia (Birds Australia 2012). There are no other IBA's or lakes between Lake Barlee and Mt Mason.

The dominant land use for the East Murchison subregion is grazing which accounts for up to ~86% of land use, and Unallocated Crown Land and Crown Reserves account for ~11.34% (Cowan 2001). While there are many mining leases in the area, most still fall under the Land Administration Act 1997 and, as such, are still required to be stocked (Cowan 2001). Only 1.4% is located in International Union for Conservation of Nature (IUCN) 1 – 4 conservation reserves (CAR 2009).

## 2.3 FLORA AND VEGETATION MAPPING

The project area is located within the Austin District of the Eremaean Botanical Province (Beard 1990). The Austin Botanical District comprises predominantly mulga low woodland on plains with the vegetation reduced to scrub on hills, with tree steppe of *Eucalyptus* spp. over *Triodia basedowii*. The vegetation is dominated by *Acacia* forests and woodlands, *Acacia* shrublands, hummock grasslands and chenopod and samphire shrublands, with other shrublands also occurring and small areas of *Eucalyptus* woodlands and open woodlands (ANRA 2012).

Numerous flora and vegetation mapping surveys have previously been undertaken in the area (Paul Armstrong and Associates 2008, Meissner and Owen 2010, OES 2010). More recently, Native Vegetation Solutions (NVS) was commissioned to conduct a Level 2 flora and vegetation mapping survey of the areas proposed for disturbance in the Mt Mason area (NVS 2012).

Ten vegetation groups were described during the recent survey, largely following topographical features and dominant upper storey species (NVS 2012). While ten vegetation groups were identified via quadrat sampling, only nine were within the survey area (Figure 7):

- *Thryptomene* Shrubland: *Thryptomene costata* low open shrubland with emergent *Acacia quadrimarginea* over scattered mixed shrubs and herbs on low hillslopes and ridges
- Open Mulga woodland over laterite: *Acacia effusifolia* low open forest over *Acacia incurvaneaura, Eremophila forrestii* subsp. *forrestii* over *Hibbertia arcuata and Prostanthera althoferi* subsp. *althoferi and* scattered mixed shrubs and herbs on laterite hills.
- *Acacia* shrubland (adjacent to fire scar): *Acacia effusifolia* low open shrubland over scattered mixed shrubs and herbs on flats
- *Allocasuarina* over *Calytrix* shrubland (not in survey area): *Allocasuarina acutivalvis* subsp. *acutivalvis* and *Acacia incurvaneura* low woodland/tall shrubland over *Acacia balsamea*, *Philotheca brucei* subsp. *brucei* open shrubland over scattered mixed shrubs and herbs in minor drainage lines and Laterite breakaways
- Mulga over *Eremophila forrestii* subsp. *forrestii* on hills and ridges: *Acacia incurvaneura* woodland over *Eremophila forrestii* subsp. *forrestii* shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges
- Mulga over *Prostanthera althoferi* subsp. *althoferi* on hills and ridges: *Acacia incurvaneura* shrubland to tall open scrub over *Prostanthera althoferi* subsp. *althoferi* shrubland over scattered mixed shrubs and herbs on hills and ridges
- Mulga over *Philotheca brucei* subsp. *brucei* on hills and ridges: *Acacia incurvaneura* with *Acacia quadrimarginea* tall shrubland/ low woodland over *Philotheca brucei* subsp. *brucei* with *Acacia balsamea shrubland* over *Eremophila latrobei* subsp. *latrobei* and *Hibbertia exasperata* over mixed herbs and shrubs on hills and ridges
- *Mulga over Eremophila forrestii* subsp. *forrestii* on flats: *Acacia incurvaneura* with *Acacia mulganeura* tall shrubland over *Eremophila forrestii* subsp. *forrestii and Acacia effusifolia* low shrubland over *Waitzia acuminata* and mixed herbs on flat plains
- *Acacia burkittii* shrubland within drainage lines: *Acacia burkittii* and *Acacia quadrimarginea* tall shrubland over *Senna artemisioides* subsp. *artemisioides* over *Ptilotus obovatus* and mixed shrubs within drainage lines
- *Acacia cockertoniana* over *Eremophila oldfieldii* and *Eremophila pantonii* on flats: *Acacia cockertoniana* tall shrubland over *Eremophila oldfieldii* subsp. *angustifolia* over *Eremophila pantonii* and mixed shrubs on flats.

A total of 97 vascular plant taxa from 59 plant genera and 31 plant families were recorded within the survey area (NVS 2012). The majority of taxa were recorded within the Fabaceae with 16 species from two genera, dominated by *Acacia,* followed by Asteraceae with 12 species from ten genera. No introduced weed species were recorded.

No plant taxa located in the survey area are gazetted as Declared Rare Flora (DRF) pursuant to subsection 2 of section 23F of the WCA 1950 or listed as Threatened pursuant to Schedule 1 of the EPBC Act (1999). Only one Priority species (*Calotis* sp. Perinvale Range) (Priority 3) was recorded from one location within the survey area (NVS 2012). This population was located on the western edge of the survey area is an area of Banded Ironstone Formation (BIF).

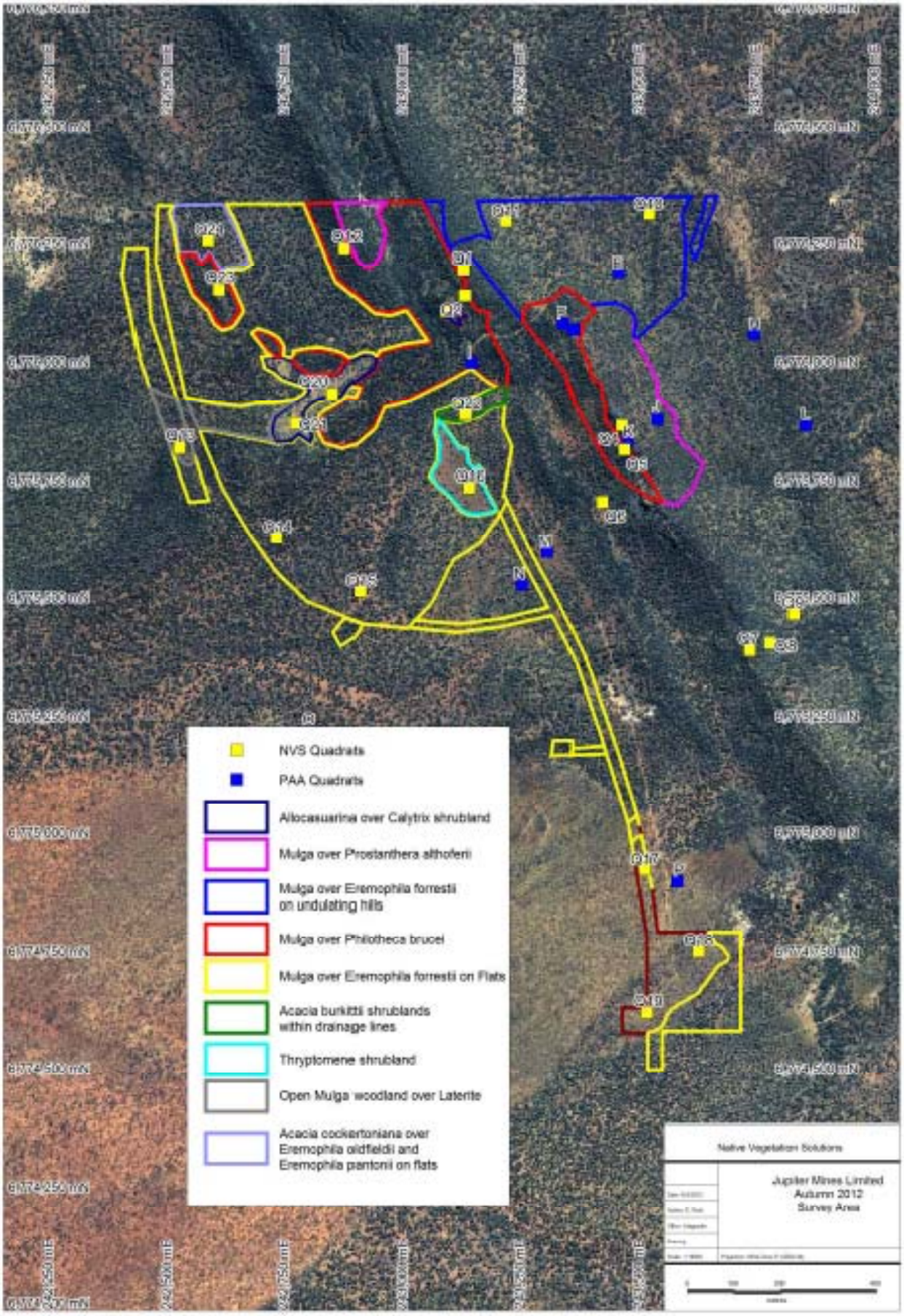



**Figure 7 - Vegetation communities identified in Mt Mason Project area**
after NVS (2012)

No Threatened Ecological Communities (TECs) are located in the Mt Mason area. However, the area surveyed lies within the buffer zone of a Priority Ecological Community (PEC) namely the Bulga Downs / Perinvale / Walling vegetation complex (NVS 2012). This community has not yet been described by the DEC on the list of PECs. However, it is inferred that the PEC relates to the vegetation specifically occurring on the BIF (NVS 2012).

### 2.3.1 Trapping site selection

Trapping site selection was undertaken prior to the receipt of the most recent flora survey and its delineation and description of vegetation communities. However, referring to previous vegetation descriptions (OES 2010), an attempt was made to sample fauna in representative vegetation communities within the area proposed for disturbance, and replicate these within the major vegetation groups where possible.

From a faunal perspective, the majority of the vegetation comprises Mulga shrubland with varied understorey and small pockets of other vegetation communities. It is also noted that a wildfire had gone through the southwestern portion of the tenement in 2006-2007 (Ian Ridley *pers. comm.* 2012).

Thus, five 'conventional' trapping grids (Sites 1 to 5) were established in Mulga shrubland within areas proposed for disturbance in the Mt Mason area (Figure 8). Site 2 was established within the fire scar that supported good regeneration. In addition, in areas of BIF which were not conducive to digging in of pitfall traps but were likely to be disturbed for mining operations, five small satellite trapping sites were established (Sites 6 to 10) (Figure 8, Plates 1 to 10). Thus, it is noted that the inability to dig pit traps into the unyielding BIF, with restricted vehicular access, was considered a limitation in terms of optimal trapping opportunities.

In accordance with the Keighery (1994) vegetation condition scales (Appendix A), and as determined by NVS (2012), the overall condition of the vegetation within the survey area can generally be described as "Very Good" to "Excellent". Almost all disturbances within the area were directly related to recent exploration activity and associated tracks. While every attempt was made to locate sampling sites in areas of least disturbance, access and practicality resulted in most sites being within close proximity to vehicular tracks or existing disturbance.

Table 3 lists the ten sampling areas and their respective vegetation associations and Plates 1 to 10 provide photographic representation of the trapping areas.

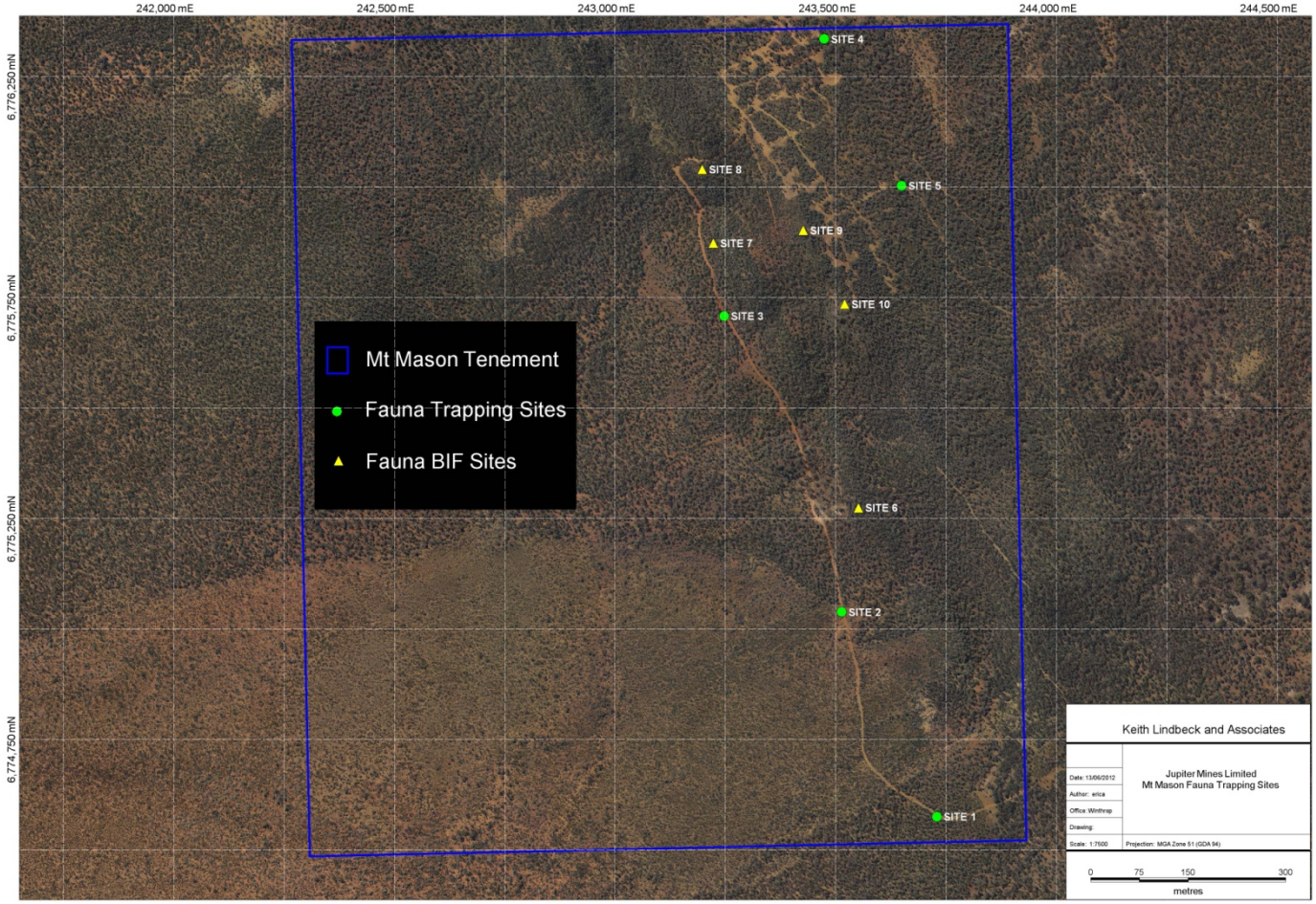



**Figure 8 - Locations of trapping sites**

**Table 3 - Site numbers and their associated vegetation descriptions**
(in accordance with NVS (2012))

| Site | Vegetation description |
|---|---|
| 1 | Mulga over *Eremophila forrestii* on Flats |
| 2 | *Acacia* shrubland (fire scar) |
| 3 | Mulga over *Eremophila forrestii* |
| 4 | Mulga over *Eremophila forrestii* on undulating hills |
| 5 | Mulga over *Eremophila forrestii* on undulating hills |
| 6 | Mulga over *Eremophila forrestii* |
| 7 | Mulga over *Eremophila forrestii* |
| 8 | Mulga over *Philotheca brucei* |
| 9 | Mulga over *Prostanthera althoferi* |
| 10 | Mulga over *Philotheca brucei* |

**Plate 1 - Site 1 Mulga over *Eremophila forrestii* on Flats**

**Plate 2 - Site 2 *Acacia* shrubland (fire scar)**

**Plate 3 - Site 3 Mulga over *Eremophila forrestii***

**Plate 4 - Site 4 Mulga over *Eremophila forrestii* on undulating hills**

**Plate 5 - Site 5 Mulga over *Eremophila forrestii* on undulating hills**

**Plate 6 - Site 6 Mulga over *Eremophila forrestii* associated with BIF**

**Plate 7 - Site 7 Mulga over *Eremophila forrestii* associated with BIF**

**Plate 8 - Site 8 Mulga over *Philotheca brucei* associated with BIF**

**Plate 9 - Site 9 Mulga over *Prostanthera althoferi* associated with BIF**

**Plate 10 - Site 10 Mulga over *Philotheca brucei* associated with BIF**

# 3.0 LITERATURE REVIEW

The CYIP – Mt Mason Project area is located on a pastoral lease and is surrounded by other pastoral leases and exploration and mining operations. In addition to the Level 1 desktop fauna assessment of the Mt Mason area (OES 2007), the results of a Level 2 survey conducted at Mt Ida in Spring 2011 and Autumn 2012 have been included for comparative purposes (KLA 2012 *in prep*).

Previous vertebrate surveys have also been completed regionally as part of environmental impact assessments of operational mines and exploration projects. With reference to the Mt Mason Project area, these include fauna surveys conducted within:

- the Barlee-Menzies study area by the Biological Surveys Committee (Burbidge *et al.* 1995) and,
- Snark Project – Lake Giles Project (KLA 2011).

The locations of these studies and their descriptions are briefly summarised in Table 4. Fauna recorded from these surveys are included in Appendix B and comparisons are discussed in each section (Section 5).

**Table 4 - Previous studies in and around the Mt Mason survey area**

| Citation | Title | Description of Study | Approximate distance from Mt Mason project area | Survey Effort |
|---|---|---|---|---|
| Burbidge *et al*. (1995) | The Biological Survey of the Eastern Goldfields Part 12: Barlee -Menzies Study Area | Inventory of vegetation, flora and fauna of study area prepared by the Biological Surveys Committee | Mt Manning Nature Reserve: ~95 km to southwest and Mt Elvrie: ~80 km to southwest | Sites and Quadrats with trapping, bird census and opportunistic sightings over three survey periods: Winter 1979, Spring 1980 and Late Summer 1981. |
| OES (2007) | Mt Mason Project. Desktop Study: Terrestrial Vertebrate Fauna | Desktop study only | Mt Mason tenement: 'EL 29/495' | Desktop assessment of fauna |
| KLA (2011) | Snark Project Fauna Assessment | Vertebrate fauna survey of the Snark deposit area | ~80 km southwest | Level 2 autumn survey 2011 |
| KLA (2012 *in prep*) | Jupiter Mines Limited. Central Yilgarn Iron Project (CYIP) Mt Ida: Fauna Assessment | Vertebrate and invertebrate terrestrial fauna surveys in the Mt Ida area | ~10 km south of Mt Mason | Formal trapping, bird census, bat census, opportunistic recordings during spring 2011 and Autumn 2012. |

# 4.0 SURVEY METHODOLOGY

## 4.1 DATABASE SEARCHES

The online EPBC Protected Matters Search Tool was used to determine any species listed under the EPBC Act 1999 for the area.

A search was commissioned of the Threatened and Priority Fauna Database held by the DEC as recognised under the Western Australian *Wildlife Conservation Act* (WCA) 1950 and considered by the DEC as species of conservation significance.

DEC's *NatureMap* was searched for records of fauna specimens vouchered at the Western Australian Museum and the Birds Australia Atlas Database was searched for bird species listed within the survey area.

A search was commissioned of the Western Australian Museum invertebrate database.

A species search was conducted of the International Union for Conservation of Nature (IUCN) database (IUCN 2001).

Categories and descriptions of the conservation status of fauna species are provided in Appendix C and the results of the databases searches are shown in Appendix B.

## 4.2 SURVEY TIMING

EPA Guidance Statement No. 56 states that the most important seasonal activity times for many faunal groups are related to rainfall and temperature (EPA 2004). A survey in the season that follows the season of maximum rainfall is generally the most productive and important survey time. Therefore, and conventionally, fauna surveys are conducted bi-seasonally in spring and autumn.

The climate in the Mt Mason region is generally described as semi-arid (Beard 1990). Rainfall is approximately 250 mm per annum and mostly falls between January and June (Section 2.1). Rainfall preceding both the spring and autumn surveys does not conform to long-term averages, with some below-average recordings and others above average. In 2011 seven out of 12 months received more than average rainfall and in the first few months of 2012 more than average rainfall was recorded for January and March. The timing of the surveys, therefore, was optimal inasmuch as more than average rainfall was recorded in the months immediately prior to the surveys: for the spring survey June recorded 57 mm (mean = 25.1 mm) and July recorded 34.8 mm (mean = 19.0 mm) and for the autumn survey January recorded 84.2 mm (mean = 24.6 mm) and March recorded 68.2 mm (mean = 28.8 mm).

Each survey was conducted over a ten day period with the spring fauna survey extending from 27 August to 3 September 2011 and the autumn survey from 1 March to 7 March 2012.

## 4.3 FAUNA SAMPLING

As per the recommendations of the EPA (2004) and EPA and DEC (2010), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's *Checklist of the Vertebrates of Western Australia* for herpetofauna and mammals and Christidis and Boles (2008) for avifauna. The authorities used for herpetofauna are Doughty and Maryan (2010) and for mammals How *et al*. (2010).

KLA acknowledges that the taxonomy of Western Australia vertebrates is continually being revised and the taxonomy of some of the species listed in the document might have changed since the publication of this report.

### 4.3.1 Reconnaissance survey

In accordance with EPA Position Statement No. 3 (EPA 2004), a site visit by qualified personnel must be undertaken to satisfy the requirement of a reconnaissance survey prior to the on-site comprehensive trapping program. A reconnaissance survey was conducted by Dr Vi Saffer and Erica MacIntyre, both of KLA, to delineate key fauna values, to determine fauna habitat types and to determine trapping site locations.

Seven species of birds were identified during the reconnaissance survey and are listed in Appendix B.

### 4.3.2 Systematic censuring

The extensive diversity of Australia's terrestrial habitats is such that no single approach accurately samples all species within a community (Garden *et al.* 2007). It is acknowledged that surveys aimed at detecting multiple species must employ a suitable combination of survey methods (Garden *et al.* 2007).

In order to maximise the capture rate of diverse faunal species, systematic fauna sampling was undertaken using five trapping techniques:

- Pitfall traps (20 L buckets buried in the ground with the rims flush with the ground surface),
- Funnel traps,
- Elliot-type aluminium box traps (8cm x 9 cm x 32 cm),
- Medium and large cage traps, and
- Anabat detectors which detect and record ultrasonic echolocation calls emitted during bat flight (Section 4.3.4).

The systematic fauna sampling consisted of five trapping grids (Sites 1 to 5) and an additional five smaller satellite sites (Sites 6 to 10) located across the Mt Mason Project area (Figure 8). The additional smaller sites were located within areas of BIF where the use of conventional trapping grids was not achievable.

Trapping grids conventionally comprised 20 x 20L buckets, 20 funnel traps, 16 aluminium box traps and four large cage traps all approximately 25 m apart (Figure 9 and Figure 10). This pattern was achieved for four of the five trapping grid sites. However, due to the presence of disturbance from exploration and associated access tracks, the configuration of trap installation differed for Site 4. In this instance, two parallel lines of 10 trapping units 25 m apart was installed (Figure 11). A 6m x 30cm drift line fence was extended over all buckets at all sites to increase the efficacy of the pitfall traps.

During the spring survey, five smaller sites (Sites 6 to 10) consisted of one pair of traps at each site with two sites having two pairs (Site 6 and Site 9). Each pair comprised an aluminium box trap and a medium cage trap. However, during the autumn survey, Sites 6 to 10 each had three sets of traps with each set comprising an aluminium box trap, a funnel trap and a medium cage trap. The aim of these additional traps was to increase the trapping potential in areas of BIF.

In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010). All traps in the trapping grids were open for seven consecutive nights, overlapping for seven nights. The overall trapping effort is shown in Table 5 and Table 6.

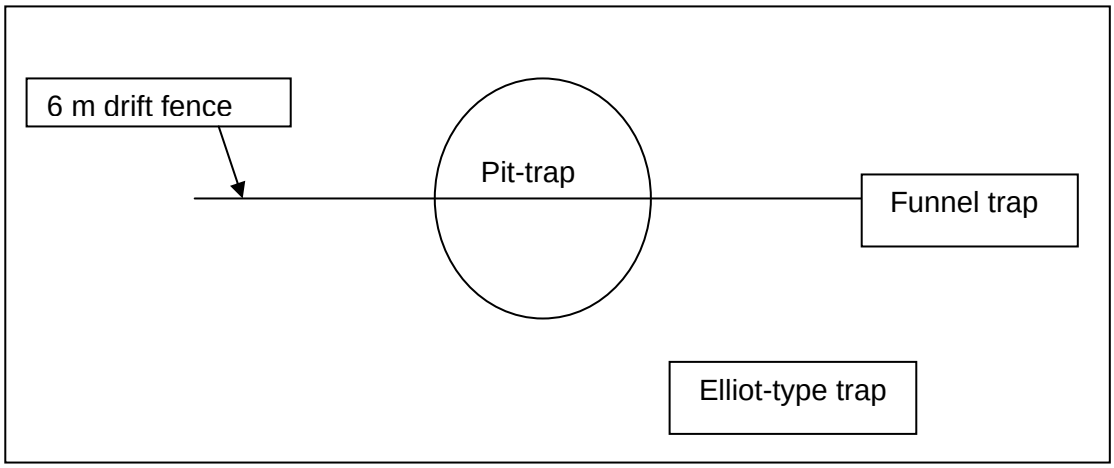



**Figure 9 - Schematic diagram of trapping unit**

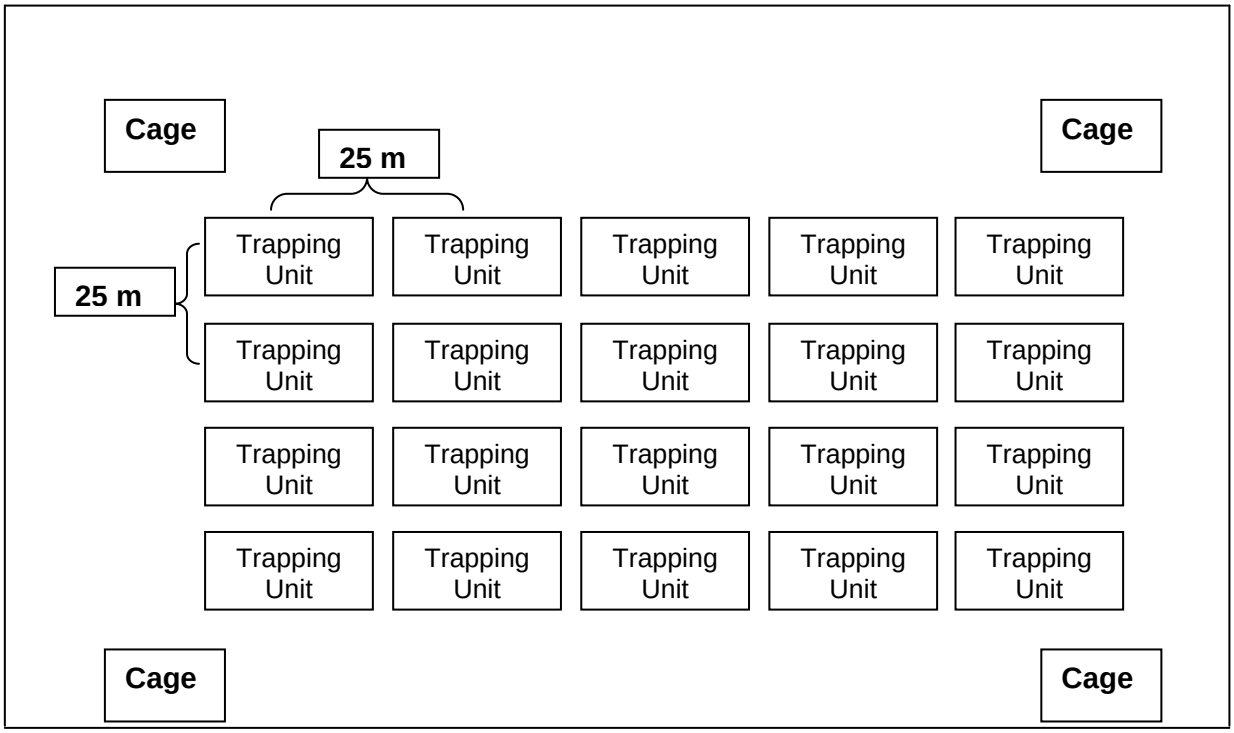
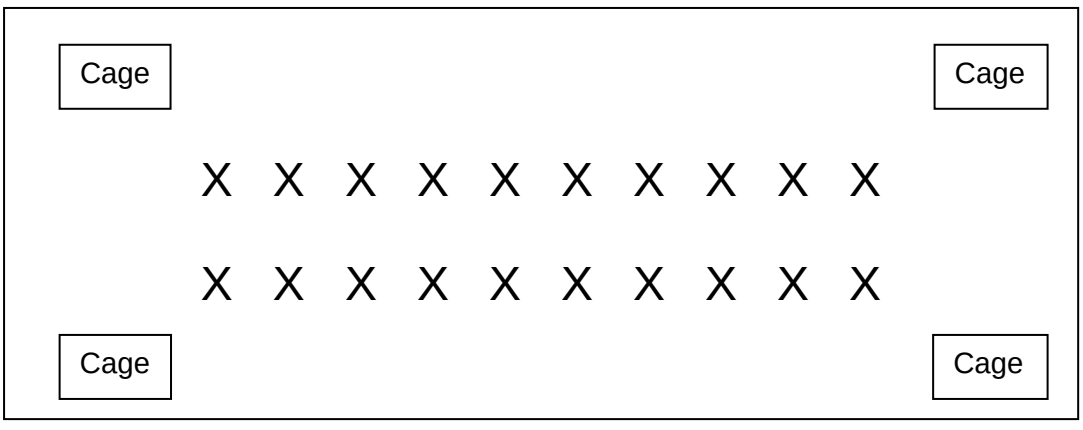



**Figure 10 - Schematic diagram of trapping unit configuration for Sites 1, 2, 3 and 5**




X = Trapping Unit

**Figure 11 - Schematic diagram of trapping unit configuration for Site 4**

**Table 5 - Trapping grid locations and trapping effort for the Spring 2011Survey**

| Spring Survey (August-September 2011) | | | | | |
|---|---|---|---|---|---|
| Site | Location | Trap type | Date opened | Date closed | Total trapping effort |
| Site 1: | 29°07'53.4"S | Pit | 27-Aug | 3-Sep | 140 |
| | 120°21'57.7"E | Funnel | 27-Aug | 3-Sep | 140 |
| | | Aluminium box | 27-Aug | 3-Sep | 112 |
| | | Cage (large) | 27-Aug | 3-Sep | 28 |
| | | | | | |
| Site 2: | 29°07'38.2"S | Pit | 27-Aug | 3-Sep | 140 |
| | 120°21'50.1"E | Funnel | 27-Aug | 3-Sep | 140 |
| | | Aluminium box | 27-Aug | 3-Sep | 112 |
| | | Cage (large) | 27-Aug | 3-Sep | 28 |
| | | | | | |
| Site 3: | 29°07'16.3"S | Pit | 27-Aug | 3-Sep | 140 |
| | 120°21'40.9"E | Funnel | 27-Aug | 3-Sep | 140 |
| | | Aluminium box | 27-Aug | 3-Sep | 112 |
| | | Cage (large) | 27-Aug | 3-Sep | 28 |
| | | | | | |
| Site 4: | 29°06'54"S | Pit | 27-Aug | 3-Sep | 140 |
| | 120°21'46.08"E | Funnel | 27-Aug | 3-Sep | 140 |
| | | Aluminium box | 27-Aug | 3-Sep | 112 |
| | | Cage (large) | 27-Aug | 3-Sep | 28 |
| | | | | | |
| Site 5: | 29°07'07.0"S | Pit | 27-Aug | 3-Sep | 140 |
| | 120°21'55.9"E | Funnel | 27-Aug | 3-Sep | 140 |
| | | Aluminium box | 27-Aug | 3-Sep | 112 |
| | | Cage (large) | 27-Aug | 3-Sep | 28 |
| | | | | | |
| | | | | **Sub-total** | **2100** |

| Site | Location | Trap type | Date opened | Date closed | Total trapping effort |
|---|---|---|---|---|---|
| Site 6 | 29°07'30.6"S | Aluminium box | 27-Aug | 3-Sep | 14 |
| | 120°21'51.7"E | Cage (medium) | 27-Aug | 3-Sep | 14 |
| | | | | | |
| Site 7 | 29°07'10.9"S | Aluminium box | 27-Aug | 3-Sep | 7 |
| | 120°21'40.1"E | Cage (medium) | 27-Aug | 3-Sep | 7 |
| | | | | | |
| Site 8 | 29°07'05.5"S | Aluminium box | 27-Aug | 3-Sep | 7 |
| | 120°21'39.3"E | Cage (medium) | 27-Aug | 3-Sep | 7 |
| | | | | | |
| Site 9 | 29°07'10.1"S | Aluminium box | 27-Aug | 3-Sep | 14 |
| | 120°21'47.6"E | Cage (medium) | 27-Aug | 3-Sep | 14 |
| | | | | | |
| Site 10 | 29°07'15.6"S | Aluminium box | 27-Aug | 3-Sep | 7 |
| | 120°21'50.9"E | Cage (medium) | 27-Aug | 3-Sep | 7 |
| | | | | | |
| | | | | **Sub-total** | **98** |
| | | | | **GRAND TOTAL** | **2198** |

**Table 6 - Trapping grid locations and trapping effort for the Autumn 2012 Survey**

| Autumn Survey (March 2012) | | | | | |
|---|---|---|---|---|---|
| **Site** | **Location** | **Trap type** | **Date opened** | **Date closed** | **Total trapping effort** |
| Site 1: | 29°07'53.4"S | Pit | 1-Mar | 7-Mar | 140 |
| | 120°21'57.7"E | Funnel | 1-Mar | 7-Mar | 140 |
| | | Aluminium box | 1-Mar | 7-Mar | 112 |
| | | Cage (large) | 1-Mar | 7-Mar | 28 |
| | | | | | |
| Site 2: | 29°07'38.2"S | Pit | 1-Mar | 7-Mar | 140 |
| | 120°21'50.1"E | Funnel | 1-Mar | 7-Mar | 140 |
| | | Aluminium box | 1-Mar | 7-Mar | 112 |
| | | Cage (large) | 1-Mar | 7-Mar | 28 |
| | | | | | |
| Site 3: | 29°07'16.3"S | Pit | 1-Mar | 7-Mar | 140 |
| | 120°21'40.9"E | Funnel | 1-Mar | 7-Mar | 140 |
| | | Aluminium box | 1-Mar | 7-Mar | 112 |
| | | Cage (large) | 1-Mar | 7-Mar | 28 |
| | | | | | |
| Site 4: | 29°06'56.1"S | Pit | 1-Mar | 7-Mar | 140 |
| | 120°21'49.7"E | Funnel | 1-Mar | 7-Mar | 140 |
| | | Aluminium box | 1-Mar | 7-Mar | 112 |
| | | Cage (large) | 1-Mar | 7-Mar | 28 |
| | | | | | |
| Site 5: | 29°07'07.0"S | Pit | 1-Mar | 7-Mar | 140 |
| | 120°21'55.9"E | Funnel | 1-Mar | 7-Mar | 140 |
| | | Aluminium box | 1-Mar | 7-Mar | 112 |
| | | Cage (large) | 1-Mar | 7-Mar | 28 |
| | | | | | |
| | | | | **Sub-total** | **2100** |

| Site | Location | Trap type | Date opened | Date closed | Total trapping effort |
|---|---|---|---|---|---|
| Site 6 | 29°07'30.6"S | Aluminium box | 1-Mar | 7-Mar | 21 |
| | 120°21'51.7"E | Cage (medium) | 1-Mar | 7-Mar | 21 |
| | | Funnel | 1-Mar | 7-Mar | 21 |
| | | | | | |
| Site 7 | 29°07'10.9"S | Aluminium box | 1-Mar | 7-Mar | 21 |
| | 120°21'40.1"E | Cage (medium) | 1-Mar | 7-Mar | 21 |
| | | Funnel | 1-Mar | 7-Mar | 21 |
| | | | | | |
| Site 8 | 29°07'05.5"S | Aluminium box | 1-Mar | 7-Mar | 21 |
| | 120°21'39.3"E | Cage (medium) | 1-Mar | 7-Mar | 21 |
| | | Funnel | 1-Mar | 7-Mar | 21 |
| | | | | | |
| Site 9 | 29°07'10.1"S | Aluminium box | 1-Mar | 7-Mar | 21 |
| | 120°21'47.6"E | Cage (medium) | 1-Mar | 7-Mar | 21 |
| | | Funnel | 1-Mar | 7-Mar | 21 |
| | | | | | |
| Site 10 | 29°07'15.6"S | Aluminium box | 1-Mar | 7-Mar | 21 |
| | 120°21'50.9"E | Cage (medium) | 1-Mar | 7-Mar | 21 |
| | | Funnel | 1-Mar | 7-Mar | 21 |
| | | | | | |
| | | | | **Sub-total** | **315** |
| | | | | **GRAND TOTAL** | **2415** |

All traps were checked as soon after sunrise as possible each morning. Each mammal captured had a small amount of fur cut on its right rump so that it could be identified if captured a second time. For second time captures a small amount of fur was cut on the left rump for further identification. Universal bait was placed in all aluminium box traps and cage traps and renewed at least once during each seven-day survey, and when required.

In addition to the above trapping techniques, two Bushnell Trophy Cam™ Remote Cameras were deployed with each camera left *in* situ at each site for 24 hours on a rotational basis (Table 7 and Table 8). One camera was also left at the active Malleefowl mound 1.7 km south of the Mt Mason tenement boundary (Figure 8). At each of the trapping grids, the cameras were secured just above ground level to a star picket and in the BIF areas, the cameras were strategically positioned using rocks to stabilise the units. The cameras were operated in accordance with the DEC's Standard Operating Procedure for *Remote operation of cameras* (DEC 2011).

Opportunistic observations were also carried out when inspecting traps on site, when travelling between sites and when conducting bird surveys in the area.

**Table 7 - Dates and Sites of remote camera placement during the Spring 2011 survey**

| Site | Unit 1 | Unit 2 |
|---|---|---|
| 1 | 1-Sep | |
| 2 | 28-Aug | |
| 3 | 30-Aug | |
| 4 | 29-Aug | |
| 5 | 31-Aug | |
| 6 | | 1-Sep |
| 7 | | 29-Aug |
| 8 | | 28-Aug |
| 9 | | 30-Aug |
| 10 | | 31-Aug |

**Table 8 - Dates and Sites of remote camera placement during the Autumn 2012 survey**

| Site | Unit 1 | Unit 2 |
|---|---|---|
| 1 | 3-Mar | |
| 1 | 5-Mar | |
| 2 | 4-Mar | |
| 3 | 29-Feb | |
| 4 | 1-Mar | |
| 5 | 2-Mar | |
| 6 | | 3-Mar |
| 7 | | 2-Mar |
| 8 | | 4-Mar |
| 9 | | 29-Feb |
| 10 | | 6-Mar |
| MFM* | 6-Mar | |

* Malleefowl Mound

Hand-foraging for reptiles was conducted opportunistically and during spot-lighting forays and included turning over rocks and logs, peeling off bark, *etc.*

### 4.3.3 Birds surveying

Surveying of birds was carried out using a combination of techniques including:

- Four, 20 minute, 2 ha surveys at each of the five trapping grid sites in accordance with Atlas Search Methods for the Atlas of Australian Birds. Censuses were commenced as soon after sunrise as practicable and commencement was rotated through the sites to reduce time of day bias where practicable (Table 9, Table 10).
- Opportunistic observations when inspecting traps on site, when travelling between sites and in the area, and when conducting other surveys in the region.

**Table 9 - Dates and times of systematic bird censuses commenced at each site during the Spring 2011 survey**

| Date: | 29-Aug | 30-Aug | 31-Aug | 1-Sep | 2-Sep | ToTtal (mins) |
|---|---|---|---|---|---|---|
| Site | Time commenced (hrs)* | | | | | |
| 1 | 800 | 920 | 1020 | | 700 | 80 |
| 2 | 830 | 850 | | 655 | 730 | 80 |
| 3 | 920 | 700 | 740 | 810 | | 80 |
| 4 | | 705 | 800 | 850 | 855 | 80 |
| 5 | 645 | 740 | 910 | 925 | | 80 |
| **Total** | | | | | | **400** |

* Censuses continued for 20 minutes at each site.

**Table 10 - Dates and times of systematic bird censuses commenced at each site during the Autumn 2012 survey**

| Autumn AM 2012* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date: | 1-Mar | 2-Mar | 3-Mar | 4-Mar | 5-Mar | 6-Mar | Total (mins) |
| Site | Time commenced (hrs)* | | | | | | |
| 1 | | 1015 | | 615 | 735 | 820 | 80 |
| 2 | 930 | | 620 | 705 | 815 | | 80 |
| 3 | 830 | 625 | 710 | | 910 | | 80 |
| 4 | 625 | 740 | 800 | 900 | | | 80 |
| 5 | 715 | 850 | 845 | | 645 | | 80 |
| **Total** | | | | | | | **400** |

### 4.3.4 Bat surveying

Bat echolocation calls were recorded using Anabat SD1 detectors, which detect and record ultrasonic echolocation calls emitted during bat flight. Two Anabat detectors were used and were positioned on the ground in each trapping grid site before sunset and retrieved the following morning. Table 11 and Table 12 list the dates that bat recordings were taken at each site during the Spring and Autumn surveys respectively.

The calls were stored on a compact flash card, downloaded and sequences were examined using AnalookW software. The frequency division ratio was set to a factor of eight. Three call variables were measured on good quality search phase pulses in representative call sequences: pulse duration (milliseconds), maximum frequency (kHz) and characteristic frequency (kHz). Species were identified based on information in McKenzie and Muir (2000) and Pennay *et al*. (2004) cited in Armstrong and Konishi (2011, 2012). Details supporting the identifications are provided, as recommended by the Australasian Bat Society (2006).

**Table 11 - Dates bat calls were recorded at each site during the Spring 2011 survey**

| Site | Unit 1 | Unit 2 |
|---|---|---|
| 1 | 28-Aug | 1-Sep |
| 2 | 29-Aug | 28-Aug |
| 3 | 30-Aug | 29-Aug |
| 4 | 31-Aug | 30-Aug |
| 5 | 1-Sep | 31-Aug |

**Table 12 - Dates bat calls were recorded at each site during the Autumn 2012 survey**

| Site | Unit 1 | Unit 2 |
|---|---|---|
| 1 | 4-Mar | 3-Mar |
| 2 | 2-Mar | 4-Mar |
| 3 | 3-Mar | 29-Feb |
| 4 | 29-Feb | 1-Mar |
| 5 | 1-Mar | 2-Mar |

### 4.3.5 Spotlighting survey

Spotlighting was conducted on three evenings during each of the seasonal surveys. A total of 15 hours and 30 minutes was spent spotlighting during the Spring 2011 survey (Table 13) and 11 hours and 30 minutes during the Autumn 2012 survey (Table 14).

Spotlighting was conducted from a slow-moving vehicle (less than 10 km/hr) using high-powered hand-held spotlights and commenced at least one hour after sunset. In addition, spotlighting forays with head-torches were conducted twice on foot for approximately 15 minutes each during all spotlighting evenings. A 390nm Ultraviolet Lantern was also used to detect and collect scorpions that fluoresce under UV light (Section 4.3.6). Spotlighting was conducted immediately adjacent to and within 10 km of all sites.

**Table 13 - Dates and duration of spotlighting forays, including numbers of personnel involved, during the Spring 2011 survey**

| Date | Time commenced (hrs) | Duration | Number of observers, including driver | Total (hrs) |
|---|---|---|---|---|
| 28-Aug | 1920 | 1 hr 45 min | 3 | 4 hr 35 min |
| 30-Aug | 1915 | 2 hr 15 min | 3 | 6 hr 45 min |
| 1-Sep | 1930 | 1 hr 50 min | 3 | 4 hr 50 min |
| **TOTAL** | | | | **15 hr 30 min** |

**Table 14 - Dates and duration of spotlighting forays, including numbers of personnel involved, during the Autumn 2012 survey**

| Date | Time commenced (hrs) | Duration | Number of observers, including driver | Total (hrs) |
|---|---|---|---|---|
| 1-Mar | 1940 | 2hr 5 min | 2 | 4 hr 10 min |
| 3-Mar | 1925 | 2hr 5 min | 2 | 4 hr 10 min |
| 5-Mar | 1925 | 1 hr 35 min | 2 | 3 hr 10 min |
| **TOTAL** | | | | **11 hr 30 min** |

### 4.3.6 Invertebrate sampling

In addition to vertebrate sampling, targeted searches were conducted for SRE's during the Spring 2011 survey.

Invertebrate groups targeted during the survey were those considered most likely to potentially contain SRE taxa including:

- Mygalomorphae (trapdoor spiders);
- Diplopoda (millipedes);
- Pseudoscorpionida (pseudoscorpions)
- Scorpiones (scorpions); and
- Pulmonata (land snails).

In accordance with generic advice from the Office of the EPA, 10 m x 10 m quadrats were established in selected habitats and up to one hour was spent searching for invertebrates in each of these quadrats. Searches included under rocks, under bark, under logs, in hollows of logs and in other leaf litter and debris lying on the ground. At each of the trapping grids, a quadrat was established within the trapping area and outside of the trapping area and one quadrat was searched at each of the BIF sites (Figure 12).

Only one of each trapdoor species type was excavated and sent to the Western Australian Museum for identification. Once excavated, the spiders were placed in a freezer for approximately 10 minutes to sedate them. They were then placed in cold 100% Ethanol to narcotise them before the third left leg was removed and placed in a separated vial of 100% ethanol, in accordance with Western Australian Museum guidelines.

In addition to the above searches, a collection of leaf litter and soils was collected from each quadrat and transferred back to Perth for examination. Collections were made from shadowed moist areas, for example, from the south eastern aspect of the bases of tree trunks, large rocks or overhanging rocks etc. Large particles were removed and the remaining collection was examined under a 10X20 Dissecting Microscope. All invertebrate fauna or parts thereof were collected and preserved in accordance with the Western Australian Museum guidelines and sent to appropriate specialists at the Museum for identification.

Searches were also conducted for invertebrates during the spotlighting surveys (Section 4.3.5). In addition to generally searching for SRE's during spotlighting forays, a 390nm Ultraviolet Lantern was used to detect and collect scorpions that fluoresce under UV light.

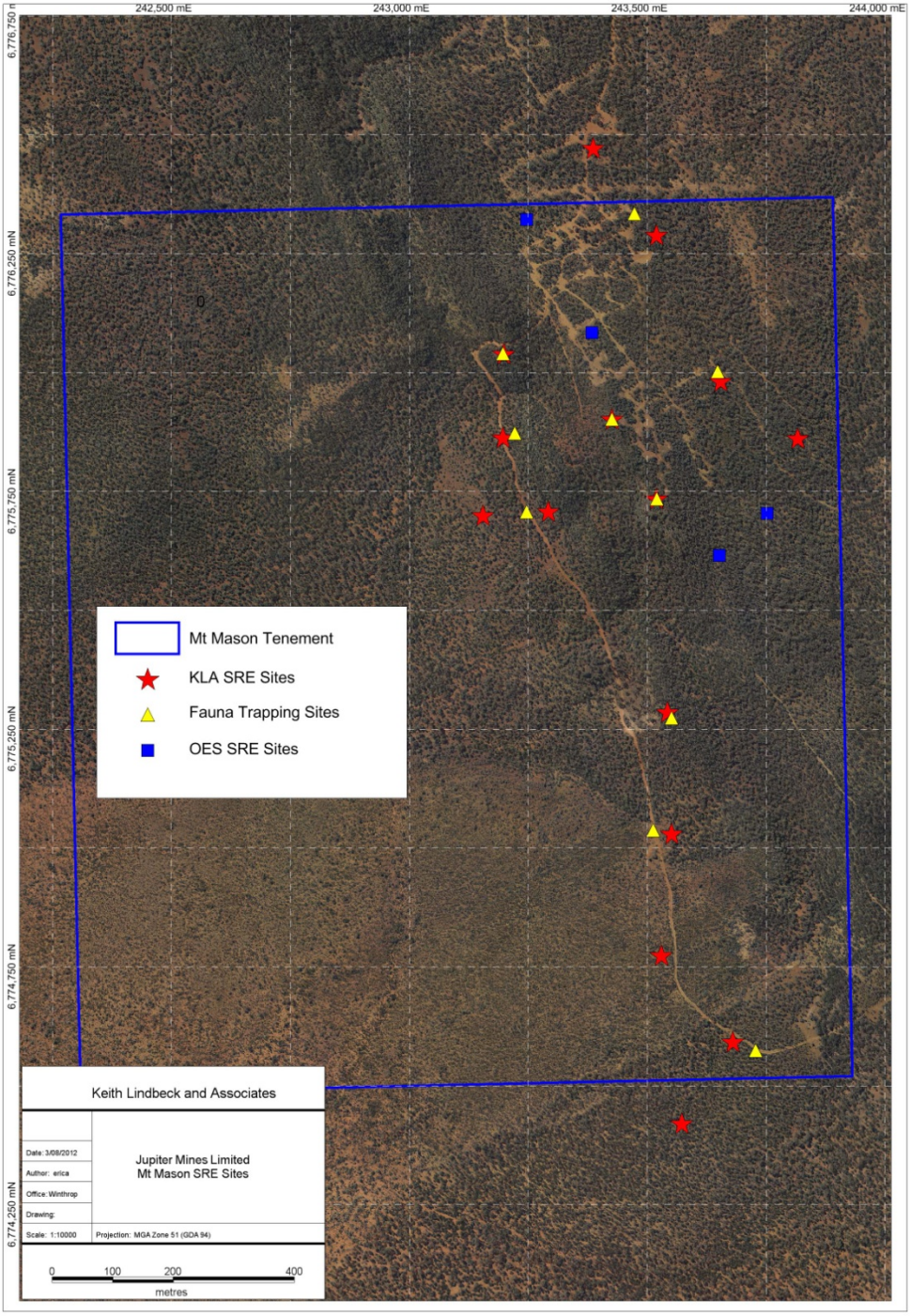



**Figure 12 - Location of invertebrate survey sites at Mt Mason**

While a targeted SRE survey was only conducted during the Spring survey, all opportunistic sightings and captures of invertebrates in other trapping equipment were collected during the Autumn survey. In addition, searches were also conducted during spotlighting forays and with the use of the Ultraviolet Light during the Autumn surveys.

## 4.4 FAUNA SURVEY TEAM

The team assisting with the establishment of the trapping grids and conducting the Spring 2011 survey comprised Dr Vi Saffer, Erica MacIntyre and Hamish Burnett from KLA. Mark Peddey from Orbit Drilling assisted with the mechanical digging of the holes for the pit traps and Cliff Ashwin, Gerard Ashwin and David Kirk of the Wutha Aboriginal Community assisted with the installation of the trapping equipment.

For the Autumn 2012 survey, Dr Vi Saffer and Erica MacIntyre from KLA conducted the survey. Adele Bonney, Guy Evans and Stephen Carr assisted with the installation of the trapping gear and Andrew Laurens and Caleb Sceghi assisted with the demobilisation of the trapping gear.

A "LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES" was issued to Dr Vi Saffer as an instrument under Regulation 17 of the WCA 1950 to undertake these surveys (Appendix D). The licence number for the Spring 2011 survey was SF008183 and the authorised persons associated with that licence included Erica MacIntyre and Hamish Burnett. For the Autumn 2012 survey, the Licence number was SF008484 and the authorised persons associated with that licence included Erica MacIntyre, Dr Ronald Snook and Dr Wesley Bancroft.

Analysis of bat recordings was completed by Dr Kyle Armstrong and Yuki Konishi of 'Specialised Zoological'.

## 4.5 SURVEY LIMITATIONS

Not all areas of the Mt Mason Project region were ground-truthed or sampled equally for fauna. Vehicular access, road conditions and rocky terrain prevented sampling in the centre of all associations, and regular checking of fauna traps in these areas would, therefore, not have been possible. Notwithstanding this, five trapping grids were located within representative vegetation communities in the study area in addition to five sites that were located on the BIF ridges.

As indicated above, not all sites could accommodate the same trapping grid pattern. Where buckets could not be installed, other grid patterns and trapping techniques (funnels and medium-sized cages) were used so that the overall trapping effort was not compromised.

Trapping sites were selected based on information provided to KLA at the time of commissioning and in relation to the proposed footprint of disturbance. Since that time, the zone of impact has changed. Notwithstanding this, trapping was conducted along the length of the tenement in representative vegetation associations.

Other limitations are included in the relevant sections.

# 5.0 VETEBRATE FAUNA INVENTORY

## 5.1 OVERVIEW OF VERTEBRATE FAUNA OF THE SURVEY AREA

Overall, 130 individuals from 19 non-volant terrestrial species representing seven Families were captured during the systematic sampling during the Spring 2011 and Autumn 2012 surveys. Of the bird species, a total of 507 individuals representing 16 Families and 34 species were recorded over both seasonal surveys (Appendix B).

Figure 13 provides a visual representation of the number of species recorded from each major vertebrate group during the Spring 2011 and Autumn 2012 systematic surveys and Table 15 provides a summary of the number of taxa recorded for each of the five trapping grid sites and five additional sites. A summary of all species known and likely to be present in the survey areas is provided in Appendix B. This includes a summary of all the results of the database searches, all species recorded during regional surveys, all species recorded during the reconnaissance survey and all species recorded during the systematic sampling, opportunistic sightings and evidence, and spotlighting.

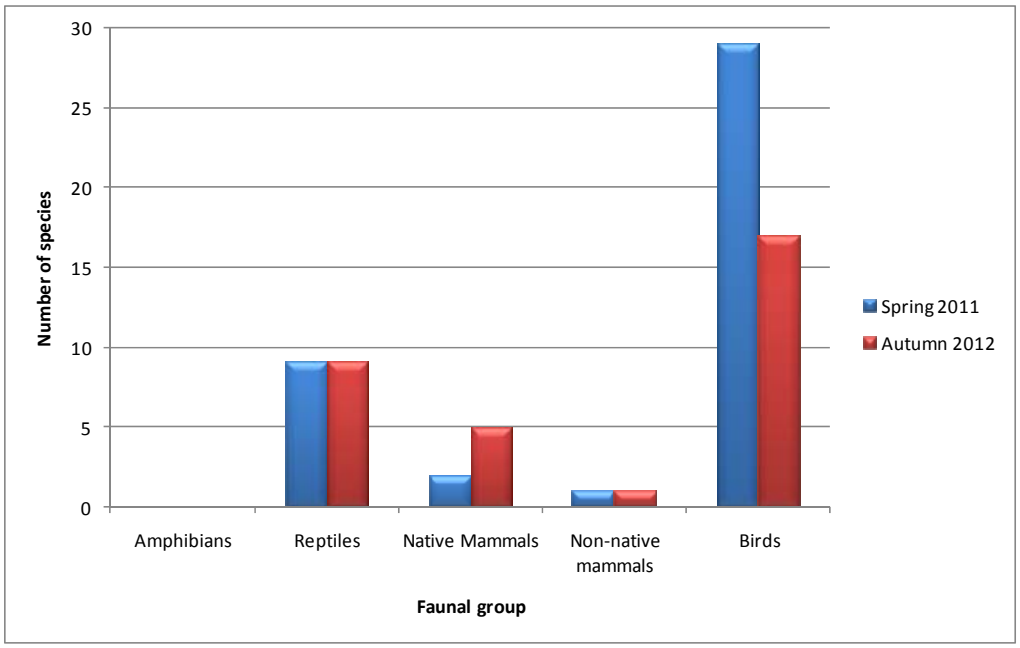



**Figure 13 - Number of terrestrial vertebrate species recorded during the Spring 2011 and Autumn 2012 systematic surveys**

**Table 15 - Number of individual terrestrial vertebrate species recorded at each site during the Spring 2011 and Autumn 2012 systematic surveys**

| Faunal group | Site 1 | | Site 2 | | Site 3 | | Site 4 | | Site 5 | | Sub-total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn |
| **Amphibians** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Reptiles** | 2 | 5 | 4 | 13 | 4 | 8 | 5 | 4 | 7 | 5 | 22 | 35 |
| **Native mammals** | 1 | 8 | 1 | 1 | 1 | 5 | 1 | 5 | 3 | 1 | 7 | 20 |
| **Non-native mammals** | 0 | 4 | 0 | 2 | 0 | 2 | 7 | 16 | 2 | 8 | 9 | 32 |
| **Birds** | 62 | 35 | 44 | 24 | 65 | 65 | 89 | 35 | 47 | 41 | 307 | 200 |
| **Sub-total** | **65** | **52** | **49** | **40** | **70** | **80** | **102** | **60** | **59** | **55** | **345** | **287** |

| Faunal group | Site 6 | | Site 7 | | Site 8 | | Site 9 | | Site 10 | | Sub-total | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn |
| **Amphibians** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Reptiles** | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 22 | 36 |
| **Native mammals** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 7 | 14 |
| **Non-native mammals** | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 2 | 10 | 30 |
| **Birds** | - | - | - | - | - | - | - | - | - | - | 0 | 0 | 307 | 200 |
| **Sub-total** | **0** | **1** | **0** | **0** | **1** | **1** | **0** | **2** | **0** | **0** | **1** | **4** | **346** | **280** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Grand Total** | **65** | **53** | **49** | **40** | **71** | **81** | **102** | **62** | **59** | **55** |

## 5.2 AMPHIBIANS

### 5.2.1 The assemblage

No frog species were captured or heard during either of the seasonal survey periods.

Searches were conducted in moister areas and opportunistically in small pools of transient standing water. However no adults or tadpoles were sighted and there was no evidence of used burrows.

### 5.2.2 Discussion

No amphibian species of conservation significance are listed for the area using the EPBC Protected Matters Search Tool or listed on the DEC Threatened and Priority Fauna Database.

The Mt Mason Project area has no natural water source areas or large granite outcrops that may support pockets of water. Any water on the ground as a result of episodic rainfall does not remain *in situ* for very long. The nearest lake, Lake Barlee, is approximately 60 km from the Mt Mason area and is an intermittent salt lake that fills about once in ten years after which the water persists for less than a year. Therefore, the habitat at Mt Mason and in the local area does not provide suitable habitat or conditions for most species of amphibians. Any frogs that may be in the area are likely to be burrowing species that have adapted to living in the drier conditions. These species are generally under-represented in field surveys. Burrowing species are only active following large rainfall events. Given the irregular and infrequent downpours in semi-arid and arid areas, it is not unreasonable that these frogs are not captured very often during terrestrial surveys. Testament to this scenario is the capture of one frog (*Neobatrachus sutor* Shoemaker Frog) following an above average rainfall event (25 mm on 3 October 2011) during a comprehensive Spring survey at Jupiter's Mt Ida deposit area approximately 10 km southwest, and the capture of ten frogs at the same site during an Autumn survey in March 2012 (KLA 2012 *in prep*). This latter survey was conducted one week after Cyclone Lua passed through the area resulting in a large regional rainfall event, in addition to a large rainfall event (20 mm) that occurred on site during the survey period. Eight of the ten frogs captured were *N. sutor* and the remaining two were *Pseudophryne occidentalis*, both of which are burrowing species.

That frogs are not captured very often during terrestrial surveys is exemplified by the results of regional surveys inasmuch as only two species were captured during the extensive Barlee-Menzies study (Burbidge *et al.* 1995) and none were recorded during the Lake Giles Project area study (KLA 2011).

## 5.3 REPTILES

### 5.3.1 The assemblage

Collectively, 13 species of reptiles were captured from all sites totalling 58 individuals representing five Families (Table 16 and Appendix B).

For the Spring 2011 survey, nine species of reptiles were captured totalling 22 individuals representing four Families (Table 16 and Appendix D). The reptiles captured comprised three dragon species (Agamidae), two diplodactylid species (Diplodactylidae), three species of skink (Scincidae), and one varanid (Varanidae).

The Scincidae Family had the highest number of captures (n = 10, 45%), followed by Agamidae (n = 8, 36%). Only three Diplodactylidae (n = 3, 14%) were captured and a single Varanidae (*Varanus caudolineatus*) (Plate 11) was captured at Site 1.

**Plate 11 - *Varanus caudolineatus***

Within the Scincidae Family, more *Menetia greyii* were captured than the remaining two species and at only three of the ten sites with only one captured at Site 2, three at Site 4 and one at Site 5. Only one *Ctenotus schomburgkii* was captured at Site 2 and one at Site 3, and *Egernia depressa* (n = 2) was only captured at Site 5.

Within the Agamidae, four *Ctenophorus scutulatus* (Plate 12) were captured with two at Site 3 and one each at Site 4 and at Site 5. Of the two *Caimanops amphiboluroides* that were captured, one was captured at Site 3 and one at Site 5 and one *Pogona minor* was captured at Site 2 and one at Site 4.

**Plate 12 - *Ctenophorus scutulatus***

Two *Diplodactylus pulcher* (Diplodactylidae) were captured with one at Site 2 and one at Site 5 and only one *Strophurus assimilis* was captured at Site 1.

Not one reptile was captured at any of the smaller satellite sites established in the areas of BIF.

For the Autumn 2012 survey, nine species of reptiles from four Families were also captured but totalling 36 individuals (Table 16 and Appendix B). However, the reptiles captured during this seasonal survey comprised two similar dragon species (Agamidae), two gecko species (Gekkonidae), three species of skink (Scincidae) of which only two were the same as those captured during the Spring survey, and one different varanid (Varanidae).

Of these species captured during the Autumn 2012 survey, once again the Scincidae Family had the highest number of captures (n = 14, 39%), followed by an equal number of Adamidae (n = 10, 28%) and Varanidae (n = 10, 28%). Only two Gekkonidae were captured representing 5% of all reptiles captured: while one species (*Gehyra variegata*) was captured at Site 5, one *Heteronotia bynoei* was the only taxa captured in one of smaller satellite sites (Site 6) positioned in the BIF.

Within the Scincidae Family, 12 of the 14 species captured were *Ctenotus leonardii* with eight captured at Site 2, two at Site 3 and one at each of Sites 1 and 4. The remaining two skinks (*Egernia depressa* and *Menetia greyii*) were captured at Site 5.

Nine of the ten Agamidae were *Ctenophorus scutulatus* with three captured at Site 2 and at Site 3, two at Site 4 and one at Site 1. The remaining specimen, *Caimanops amphiboluroides* (Plate 13), was captured at Site 3.

**Plate 13 - *Caimanops amphiboluroides***

The Varanidae were represented more evenly between species with five *Varanus panoptes* and four *V. caudolineatus* captured. At least one and only up to two varanids were captured at each of the five trapping sites.

The largest number of reptiles captured during the Spring 2011 survey was at Site 5 (n = 7) followed by five at Site 4. The least number (n = 1) was captured at Site 2. For the Autumn 2012 survey, Site 2 recorded the most captures (n = 13) followed by eight at Site 3 and five each at Sites 1 and 5. Only one reptile (*Heteronotia bynoei*) was captured in

one of the smaller satellite sites (Site 6) located in the BIF. Collectively, more taxa were captured at Site 2 (n = 17) followed by 12 at both Sites 3 and 5. Nine were recorded at Site 4 with 7 at Site 1.

Collectively, pitfall traps with drift line fencing proved to be the most effective trapping apparatus for reptiles (n = 37, 64%) with 29% (n = 17) captured in funnel traps. Only four individuals were captured in cage traps (7%) and none were captured in the aluminium box traps.

Nine species of reptile were recorded opportunistically during the Spring 2011 survey and only two during the Autumn 2012 survey (Appendix B). The species recorded when temperatures were higher (Spring 2011) included two species of Agamidae (*Caimanops amphiboluroides* and *Pogona minor* (Plate 14)); three species of Scincidae (*Cryptoblepharus plagiocephalus*, *Egernia depressa* (one living and one carcass) and *Menetia greyii*), at least one species of varanidae (*Varanus panotes*) and unidentified varanid tracks and two identified Elapidae (*Pseudechis butleri* and *Pseudonaja nuchalis)* in addition to unidentified snake tracks.

**Plate 14 - *Pogona minor***

**Table 16 - Reptiles species recorded (including method) during the Spring 2011 and Autumn 2012 systematic surveys**

| Family | Species | Common Name | Site 1 | | Site 2 | | Site 3 | | Site 4 | | Site 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn |
| Agamidae | *Caimanops amphiboluroides* | Mulga Dragon | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| | *Ctenophorus scutulatus* | | 0 | 1 | 0 | 3 | 2 | 3 | 1 | 2 | 1 | 0 |
| | *Pogona minor* | Bearded Dragon | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Diplodactylidae | *Diplodactylus pulcher* | | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | *Strophurus assimilis* | Goldfields Spiny-tailed Gecko | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gekkonidae | *Gehyra variegata* | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | *Heteronotia binoei* | Bynoe's Gecko | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scincidae | *Ctenotus leonhardii* | | 0 | 1 | 0 | 8 | 0 | 2 | 0 | 1 | 0 | 0 |
| | *Ctenotus schomburgkii* | | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | *Egernia depressa* | Spiny-tailed Skink | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| | *Menetia greyii* | | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 2 | 1 |
| Varanidae | *Varanus caudolineatus* | | 1 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Varanus panoptes* | Yellow-spotted Monitor | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 2 |
| | | | | | | | | | | | | |
| | Trapping method | Pitfall trap | 1 | 4 | 4 | 4 | 4 | 4 | 5 | 2 | 7 | 2 |
| | | Funnel trap | 1 | 1 | 0 | 9 | 0 | 2 | 0 | 2 | 0 | 1 |
| | | Cage trap | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| | | Aluminium box trap | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | |
| | | **Total** | **2** | **5** | **4** | **13** | **4** | **8** | **5** | **4** | **7** | **5** |
| | | **Cumulative Total** | | | **6** | **18** | **10** | **26** | **15** | **30** | **22** | **35** |

| Family | Species | Common Name | Site 6 | | Site 7 | | Site 8 | | Site 9 | | Site 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn |
| Agamidae | *Caimanops amphiboluroides* | Mulga Dragon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Ctenophorus scutulatus* | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Pogona minor* | Bearded Dragon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Diplodactylidae | *Diplodactylus pulcher* | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Strophurus assimilis* | Goldfields Spiny-tailed Gecko | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gekkonidae | *Gehyra variegata* | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Heteronotia binoei* | Bynoe's Gecko | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scincidae | *Ctenotus leonhardii* | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Ctenotus schomburgkii* | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Egernia depressa* | Spiny-tailed Skink | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Menetia greyii* | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Varanidae | *Varanus caudolineatus* | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Varanus panoptes* | Yellow-spotted Monitor | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | |
| | Trapping method | Pitfall trap | - | - | - | - | - | - | - | - | - | - |
| | | Funnel trap | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Cage trap | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Aluminium box trap | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | |
| | | **Total** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| | | **Cumulative Total** | **22** | **36** | **22** | **36** | **22** | **36** | **22** | **36** | **22** | **36** |

### 5.3.2 Discussion

A total of 58 individual reptiles were captured during the systematic seasonal surveys. Given the different trapping techniques and that the traps were open for a total of 4613 trap nights over both seasons, the trap rate of 1.26% was particularly low.

Being ectotherms, reptiles are most active during higher temperatures, between September and April (EPA and DEC 2010). While the Spring survey was conducted in the warmer months (end of August through to beginning September) and temperatures recorded at Leonora and Menzies for the survey period were slightly higher than long-term averages, overall temperatures may not have been high enough for long enough to stimulate reptilian activity from their winter brumation. While temperatures in the cooler months of Autumn (March April) were within long-term average range, they were higher than those for the Spring survey period. Therefore, it was not surprising that more reptiles were captured during the Autumn survey (n = 36) (trap rate 1.5%) than during the Spring survey (n = 22) (trap rate 1.0%).

While nine species of reptile were captured in each of the seasonal surveys, not all the species were the same. For example, one agamid (*Pogona minor*), two diplodactilids (*Diplodactylus pulcher, Strophurus assimilis*) and one skink (*Ctenotus schomburgkii*) were captured during the Spring survey that were not captured during the Autumn survey and conversely, two geckos (*Gehyra variegata, Heteronotia bynoei*), one skink (*Ctenotus leonhardii*) and one varanid (*Varanus panoptes*) were captured during the Autumn survey that were not captured during the Spring survey.

The numbers of reptile captures between sites did differ but not consistently across seasons. For example, more species were captured in the 'Mulga over *Eremophila forrestii* on undulating hills' (Sites 4 and 5) during the Spring 2011 survey followed by an equal number in the post-fire regenerating '*Acacia* shrubland' (Site 2) and 'Mulga over *Eremophila forrestii'* (Site 3). Only two species were captured in 'Mulga over *Eremophila forrestii* on Flats' (Site 1) and there were no captures at the smaller satellite sites located in the BIF areas.

For the Autumn 2012 survey, many more species were captured in the *Acacia* Shrubland (Site 2) which had had a further six months of regeneration since the previous survey. This was followed by the number captured in 'Mulga over *Eremophila forrestii'* (Site 3) and equal numbers in 'Mulga over *Eremophila forrestii* on Flats' (Site 1) and in 'Mulga over *Eremophila forrestii* on undulating hills' (Site 5). Marginally fewer were recorded in the same vegetation complex 'Mulga over *Eremophila forrestii* on undulating hills' (Site 4). While there were no captures of reptiles in the smaller satellite sites in the BIF areas during the Spring 2011 survey, one individual (*Heteronotia binoei*) was captured in one of the satellite sites (Site 6) during the Autumn 2012 survey.

The EPA and DEC (2010) Technical Guide suggests that pitfall trapping is particularly productive for small to medium sized reptiles. The results of these surveys add weight to this suggestion as up to 64% of all captures of reptiles were in pitfall traps. While 30% were captured in funnel traps only four individuals were captured in cage traps. It is noted however, that all four were large varanids (*Varanus panoptes*) that were too big to be captured in anything other than the larger of the cage traps. It is also noted, and not surprisingly, that no reptiles were captured in aluminium box traps.

No reptile species of conservation significance are listed for the area under the EPBC Act 1999. However, the Woma *Aspidites ramsayi* is listed under the WCA 1950 as a Schedule 4 – Other Specially Protected Fauna species. The most recent recording of this species dates back to 1966 south of Menzies. No evidence of the Woma was recorded during the surveys. Further, the habitat was not conducive to utilisation by this species inasmuch as there were no hollow logs of sufficient size to accommodate a Woma and

there were few rabbit warrens which Woma are known to use as refugia. No other reptilian species of conservation significance or evidence of their presence was recorded during the survey.

Given that the CYIP area has not been well surveyed, it is not surprising that only one reptile species, Pygmy Spiny-tailed Skink *Egernia depressa,* has been vouchered at the Western Australian Museum previously for this area (Appendix B). This species was captured twice during the Spring 2011 survey at Site 5 and both a live individual and carcass of another were sighted opportunistically. During the Autumn 2012 survey, one individual was also captured at Site 5. It is noted that none of the remaining reptile species captured have been vouchered with the Western Australian Museum for this area.

Using a log/log transformation of the accumulated number of species captured during the seven night trapping programmes per seasonal survey, a strong linear relationship occurred between sampling intensity (nights) and the number of species ($R^2$ = 0.9623) (Figure 14). An asymptote has not been reached, although a large majority of species present (62%) were collected after the second night and up to 77% after the third night of trapping. It is reasonable to assume that all common species are represented in the curve but rare and transient species would only be detected with a far higher sampling intensity. In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010).

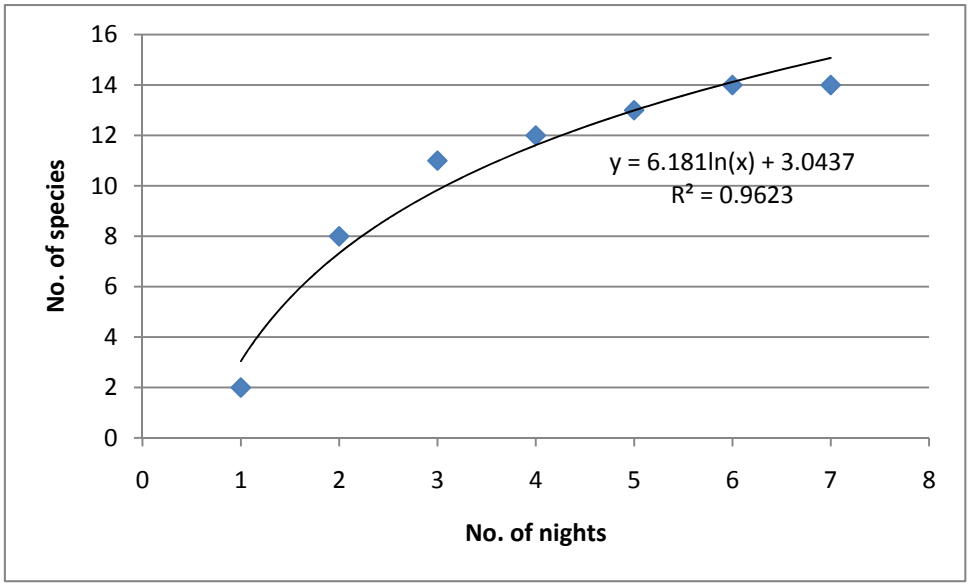



**Figure 14 - Species accumulation curve for reptiles captured during the systematic fauna surveys**

Seasonal trapping, conducted over many years, would be required to determine the full complement of reptiles that utilise the habitats of the Mt Mason Project area.

The many variables associated with other studies in the area make comparisons difficult. These variables include survey timing, duration and year the survey was completed; and also the trapping techniques utilised. For example, the Biological Surveys Committee study (Burbidge *et al.* 1995) was conducted over three seasons and over a three year time period from 1979 to 1981 that make taxonomic name changes since that time difficult to trace (Burbidge *et al.* 1995). Notwithstanding this, 51 species were recorded during that survey and up to 12 were captured during a Level 2 survey approximately 80 km southwest of the CYIP area (KLA 2011)(Appendix B). Of the species captured during the present survey, none are unique to the area and all have been captured elsewhere.

## 5.4 MAMMALS

### 5.4.1 The assemblage

A total of five native mammals species from two Families were captured during both seasonal surveys totalling 28 individuals (Table 17 and Appendix B). During the Spring 2011 survey native mammals (n = 7) were represented by two species from the Family Dasyuridae: *Sminthopsis longicaudata* Long-tailed Dunnart (Plate 15) and *S. dolichura* Little Long-tailed Dunnart (Plate 16) (Table 17 and Appendix B). While only one *S. longicaudata* was captured (at Site 3), six *S. dolichura* were captured with three captured at Site 5 and one at each of Sites 1, 2 and 4.

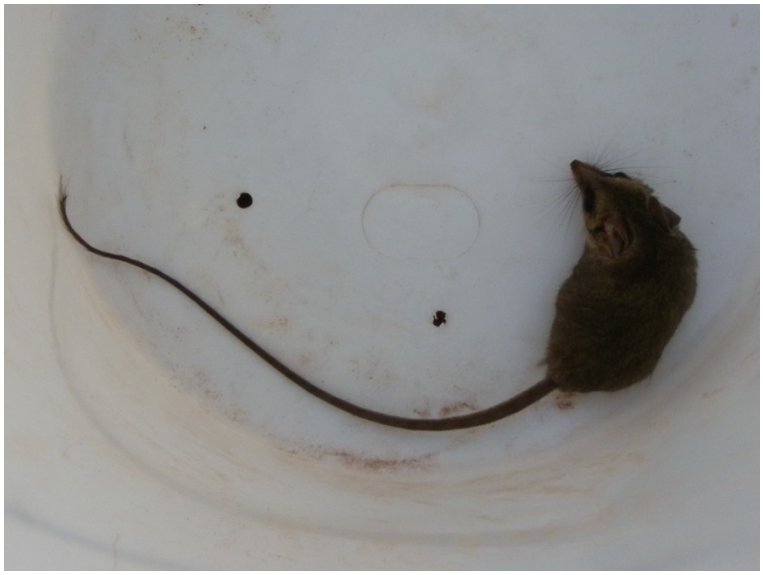


**Plate 15 - *Sminthopsis longicaudata***

For the Autumn 2012 survey, a total of 21 native mammals were captured from two Families: Dasyuridae and Muridae (Table 17 and Appendix B). Once again only one *S. longicaudata* was captured at Site 3. Seven *S. dolichura* were captured with one at Site 2 and three at Site 3 and at Site 4. Within the Dasyuridae, one additional species was captured: one *Pseudantechinus woolleyae* Woolley's Pseudantechinus (Plate 17) was captured in an aluminium box trap at one of the BIF sites (Site 9). Indeed, *P. woolleyae* was the only native mammal captured in all of the BIF sites.

**Plate 16 - *Sminthopsis dolichura***

**Plate 17 - *Pseudantechinus woolleyae***

While no Muridae were captured during the Spring 2011 survey, two species were captured during the Autumn 2012 survey: five *Notomys alexis* Spinifex Hopping Mouse were captured at Site 1 and seven *Pseudomys hermannsburgensis* Sandy Inland Mouse were captured with three at Site 1, two at Site 4 and one at Site 3 and at Site 5.

Of the fauna species captured, *Sminthopsis longicaudata* is listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database. No other mammals of conservation significance potentially occur in the area and none were captured during the Spring 2011 survey or the Autumn 2012 survey.

For the non-native mammals, a total of 44 *Mus musculus* House Mouse (Family: Muridae) were captured with ten captured during the Spring 2011 survey and 34 captured during the Autumn 2012 survey (Table 17 and Appendix B). Of the ten captured during the Spring 2011 survey, seven were captured at Site 4, two at Site 5 and one at Site 8. For the Autumn 2012 survey, Site 4 once again recorded the most (n = 16) followed by eight at Site 5. In addition, four were captured at Site 1, two at Site 2 and at Site 3 and one at Site 9. No *M. musculus* were captured at Sites 6, 7 or 10.

Collectively, all fauna were captured in two of the three types of trapping equipment with the most (n = 43, 60%) captured in aluminium box traps and only one *M. musculus* captured in a cage trap. The remaining fauna (n = 28, 39%) were captured in pitfall traps. However, for native mammals, more were captured in pitfall traps (n = 19, 68%) than in aluminium box traps (n = 9, 32%) whereas more *M. musculus* were captured in aluminium box traps (n = 34, 77%) than in pitfall traps (n = 9, 21%).

Kyle Armstrong and Yuki Konishi of Specialised Zoological analysed the bat calls recorded on the Anabats (Armstrong and Konishi 2011, 2012). The presence of six species of bats was identified with five recording unambiguous identification and one (*Nyctophilus* sp. Long-eared Bat) requiring confirmation (Table 18).

Bats were recorded at all of the five trapping grid sites with between five and six species recorded at each site. Four of the species were recorded at all five sites, whereas *Scotorepens balstoni* was recorded at all sites except for Site 5 (Table 18). Further, some species were only recorded during the Spring 2011 survey and not the Autumn 2012 survey at some sites (*Tadarida australis* White-striped Freetail-bat Site 1) and others were

recorded during the Autumn 2012 survey and not the Spring 2011 survey (*Nyctophilus* sp. Long-eared Bat, Site 1 and Site 4).

Armstrong and Konishi (2011, 2012) highlight the difficulties in distinguishing the differences in some calls. For example, the calls of the Long-eared bats *Nyctophilus* spp. are typically difficult to identify to species, and those recorded may be attributed to the Lesser Long-eared Bat *Nyctophilus geoffroyi* or the central Greater Long-eared Bat *N. major tor*. In addition, calls of *Chalinolobus gouldii* Gould's Wattled Bat are similar to those of the inland Freetail-bat *Mormopterus* sp. 3. However, positive identifications of both these species were made from other high quality diagnostic call sequences.

Evidence of native mammals seen opportunistically during the survey was limited to *Tachyglossus aculeatus* Echidna and Dunnart tracks (*Sminthopsis* spp.). However, evidence of five non-native species were recorded including *Oryctolagus cuniculus* Rabbit, *Canis* sp. Dog/Dingo, *Felis catus* Cat, *Bos taurus* European Cattle and *Equus asinus* Donkeys. All sightings are included in Appendix B.
.

**Table 17 - Mammal species recorded (including method) during the Spring 2011 and Autumn 2012 systematic surveys**

| Family | Species | Common Name | Site 1 | | Site 2 | | Site 3 | | Site 4 | | Site 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn |
| | | | | | | | | | | | | |
| Dasyuridae | *Pseudantechinus woolleyae* | Woolley's Pseudantechinus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Sminthopsis dolichura* | Little long-tailed Dunnart | 1 | 0 | 1 | 1 | 0 | 3 | 1 | 3 | 3 | 0 |
| | *Sminthopsis longicaudata* | Long-tailed Dunnart | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Muridae | *Mus musculus** | House Mouse | 0 | 4 | 0 | 2 | 0 | 2 | 7 | 16 | 2 | 8 |
| | *Notomys alexis* | Spinifex Hopping Mouse | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Pseudomys hermannsburgensis* | Sandy Inland Mouse | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 1 |
| | | | | | | | | | | | | |
| | Pitfall trap | | 1 | 3 | 1 | 1 | 1 | 6 | 2 | 9 | 3 | 1 |
| | Funnel trap | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Cage trap | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Aluminium box trap | | 0 | 9 | 0 | 2 | 0 | 1 | 6 | 12 | 2 | 8 |
| | | | | | | | | | | | | |
| | **Total** | | **1** | **12** | **1** | **3** | **1** | **7** | **8** | **21** | **5** | **9** |
| | **Cumulative Total** | | | | **2** | **15** | **3** | **22** | **11** | **43** | **16** | **52** |

| Family | Species | Common Name | Site 6 | | Site 7 | | Site 8 | | Site 9 | | Site 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn |
| | | | | | | | | | | | | |
| Dasyuridae | *Pseudantechinus woolleyae* | Woolley's Pseudantechinus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | *Sminthopsis dolichura* | Little long-tailed Dunnart | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Sminthopsis longicaudata* | Long-tailed Dunnart | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Muridae | *Mus musculus** | House Mouse | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | *Notomys alexis* | Spinifex Hopping Mouse | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Pseudomys hermannsburgensis* | Sandy Inland Mouse | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | |
| | Pitfall trap | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Funnel trap | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Cage trap | | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | Aluminium box trap | | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 |
| | | | | | | | | | | | | |
| | **Total** | | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **2** | **0** | **0** |
| | **Cumulative Total** | | **16** | **52** | **16** | **52** | **17** | **53** | **17** | **55** | **17** | **55** |

**Table 18 - Site by species matrix of bat identifications recorded during the Spring 2011 and Autumn 2012 systematic surveys**

| Family | Species | Common Name | Site 1 | | Site 2 | | Site 3 | | Site 4 | | Site 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn |
| **Vespertilionidae** | *Chalinolobus gouldii* | Gould's Wattled Bat | + | + | + | + | + | + | + | + | + | + |
| | *Nyctophilus sp.* | Long-eared Bat | - | NC | NC | NC | NC | NC | - | NC | NC | NC |
| | *Scotorepens balstoni* | Inland Broad-nosed Bat | + | NC | + | NC | + | NC | + | - | - | - |
| | *Vespadelus finlaysoni* | Finlayson's Cave Bat | + | + | + | + | + | + | + | + | + | + |
| **Molossidae** | *Mormopterus sp. 3* | Freetail-bat | + | + | + | NC | + | NC | + | NC | + | NC |
| | *Tadarida australis* | White-striped Freetail-bat | + | - | + | + | + | + | + | + | + | + |

Key:
NC = needs confirmation
+ = positive identification
- = not recorded

### 5.4.2 Discussion

Four different trap types were open for a collective total of 4613 trap nights during the seven night surveys in Spring 2011 and in Autumn 2012. The capture of 28 individual native mammals during these periods equates to a trap rate of 0.6%, which suggests that the area surveyed supported very low numbers of mammals. The trap rate for the non-native *Mus musculus* is slightly higher (1.0%), and collectively the trap rate of 1.6% for both native and non-native mammals suggests that both the abundance and diversity of mammals was low.

As mammals are homeothermic, survey timing is not constrained as it is for reptiles (EPA and DEC 2010). However, mammal species have different population cycles which are often related to climate and resource availability. During these seasonal surveys. there was a three-fold increase in the number of native mammals captured in autumn (n = 21) compared to the number captured in spring (n = 7). The scenario was similar to that of *Mus musculus,* the only non-native mammal which was captured at seven of the ten sites. *Mus musculus* populations are known to fluctuate enormously and, while they do breed opportunistically, many are born from September to April (Menkhorst and Knight 2011). This is consistent with the large increase in numbers from ten captured during the Spring 2011 survey to 34 captured during the Autumn 2012 survey. Females can produce up to nine litters a year with 4 – 6 young in each litter increasing local populations exponentially.

Given the overall low numbers of mammals captured, it is difficult to comment on any significance of spatial differences or preferred habitat. A general observation indicates that mammals were captured at all five trapping sites and at two of the smaller satellite sites in the BIF areas. For the latter, only one (*Pseudantechinus woolleyae*) was captured at Site 9 in addition to one *M. musculus* at this site, and two *M. musculus* at Site 8. *Pseudantechinus woolleyae* tend to be sparsely distributed on rocky hillsides with acacia scrub (Menkhorst and Knight 2011); its presence in the BIF site, therefore, was not unexpected. Being generalists, *M. musculus* do not appear to have any habitat preferences are can be found everywhere.

More detailed analysis indicates that more mammals were captured at Site 4 'Mulga over *Eremophila forrestii* on undulating hills' during both seasonal surveys than at all other sites. During the Spring 2011 survey this was followed by the number captured in the same vegetation group ('Mulga over *Eremophila forrestii* on undulating hills') (Site 5) followed by one captured at each of the remaining sites where animals were captured. For the Autumn 2012 survey, more mammals were captured on the flats 'Mulga over *Eremophila forrestii* on Flats' at Site 1 followed by the number captured on the undulating hills at Site 5. It is noted that five of the nine captures overall at Site 1 were *Notomys alexis.* Site 1 comprised unburnt and primarily undisturbed sandplain supporting mulga, which is consistent with the preferred habitat of this species (Menkhorst and Knight 2011). While this vegetation was not limited to this area, *N. alexis* were only captured at this site and not at any other site.

It is also noted that the only two *Sminthopsis longicaudata* (Priority 4) were captured with one in each season and in the same locale (<50 m from each other at Site 3). On site observation indicates that both species were captured at the base of an area of a rocky scree. The preferred habitat of this species is varied but does include rocky scree in addition to plateau areas, generally with little vegetation or spinifex hummock grassland, shrubs, and open Mulga woodland (Burbidge *et al.* 2008). Within its distributional range, *S. longicaudata* tends to be in low abundance, as demonstrated by the results of this survey.

Using the EPBC Protected Matters Search Tool and interrogating the DEC Threatened and Priority Fauna Database, no mammal species of conservation are listed for the area. However, as mentioned above, one *Sminthopsis longicaudata* was captured during each of the seasonal surveys and in the same area. This species is listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database. This capture represents the southernmost extent of this species and extends its distribution range.

A Level 2 fauna survey was conducted recently approximately 200 km northeast of Mt Mason (Terrestrial Ecosystems 2011a). Three *S. longicaudata* were captured with one in a funnel trap and two in pitfall traps. The report suggested that their presence in this area was unexpected as they were "not normally caught in open, flat, mulga woodland with no spinifex, low shrubs and little ground cover" and certainly not that far south. Subsequently, a targeted survey for this species in that area resulted in the capture of one individual albeit over 8,400 trap nights (0.01% trap rate) (Terrestrial Ecosystems 2011b). However, it is noted that 840 box traps were used (over ten nights). Of the three *S. longicaudata* captured during the earlier Level 2 fauna survey, one was captured in a funnel trap and the remaining two were captured in pitfall traps. In this current survey at Mt Mason, both *S. longicaudata* were captured in pitfall traps. Further, three *S. longicaudata* were also captured in pitfall traps during the fauna assessment at Jupiter's Mt Ida site ~10 km south of Mt Mason (KLA 2012 *in prep*). Therefore the use of box traps for *S. longicaudata* may not be the most appropriate trapping tool for this species. Notwithstanding this, the results from these trapping programs (Terrestrial Ecosystems 2011a and b, KLA 2012 *in prep*) and the current survey suggest that the distributional range of this species is far greater than previously mapped and that they are present in low abundance over an extensive part of Western Australia, excluding the southern portion of the state. Further, the habitat occupied by these specimens suggests that there is no obvious habitat attribute particularly associated with the species. Given this, the conservation status of *S. longicaudata* is not likely to be compromised by the proposed mining activity at Mt Mason.

The EPBC Protected Matters Search Tool does list four invasive species that are likely to occur in the area namely *Capra hircus* Goat, *Felis catus* Cat, *Oryctolagus cuniculus* Rabbit and *Vulpes vulpes* Fox. Of these, evidence of *F. catus* and *O. cuniculus* was recorded. Canid faeces were noted but were unable to be attributed to *Canis lupis* sp. being either a Dingo or a non-native Dog. Anecdotal sightings of *Equus asinus* Donkey were reported and these were only seen after the completion of the survey. Nevertheless, they have been included in opportunistic sightings. Notwithstanding this, the low number of smaller mammals in the area may be attributable to a degree of predation and loss of habitat from trampling and grazing by larger ungulates.

For this and many fauna surveys, pitfall traps and aluminium box traps are generally the most effective in capturing small mammals (EPA and DEC 2010). However, some species have a penchant for particular traps. In this study, for example, all the dunnarts (*Sminthopsis dolicura* and *S. longicaudata*) were captured in pitfall traps and all the *Notomys alexis* were captured in box traps. Other than the single *M. musculus* captured in a cage trap in the BIF area, no other animals were captured in cage traps and none were captured in funnel traps.

Given the low numbers of mammals captured, a species accumulation curve may not depict mammal presence adequately. However, log/log transformation of the accumulated number of species captured during the seven night trapping programmes resulted in a strong linear relationship between sampling intensity (nights) and the number of species ($R^2$ = 0.9368) (Figure 15). While an asymptote has not been reached, 67% of all species were captured by the second night of trapping and 83% by the fourth night of trapping. In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010).

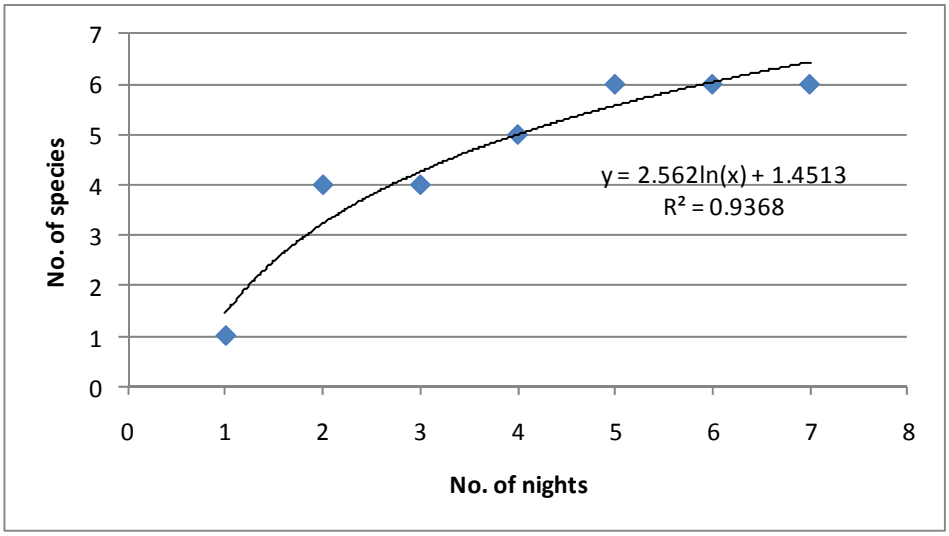



**Figure 15 - Species accumulation curve for non-volant native and non-native mammals captured during the systematic fauna surveys**

Anabat detectors record the presence of bats, rather than the numbers present. Bats were recorded at all of the five trapping grid sites with between five and six species recorded at each site. While some calls were positively identified, others require confirmation and some could be one of two species. Notwithstanding this, it is reasonable to assume that the diversity of bats present extends throughout the Mt Mason area.

Interestingly, not one mammal has been vouchered at Western Australian Museum for the area. As noted for the reptiles, comparisons with other studies are limited due to differences in timing, trapping programs and taxonomic changes. Notwithstanding this, other surveys have captured as few as 13 species (KLA 2011) and as many as 28 species (Burbidge *et al.* 1995) (Appendix B). It is noted that the 28 species were recorded over three seasons (winter, spring and late summer) over a three year time period (1979, 1980 and 1981) (Burbidge *et al.* 1995). This adds weight to the fact that seasonal trapping conducted over many years is required to provide a more complete representation of the assemblage of mammals that utilise the area.

## 5.5 BIRDS

### 5.5.1 The assemblages

A total of 507 individual birds representing 34 species from 16 Families were recorded during the 20 minute observations for the Spring 2011 and Autumn 2012 surveys (Table 19). The total species tally comprised 307 individuals with 29 species representing 12 Families recorded during the Spring 2011 survey and 200 individuals with 19 species representing 11 Families recorded during the Autumn 2012 survey.

For the Spring 2011 survey, the 12 Families comprised three non-passerine Families (n = 8 species with 129 individual birds recorded) and nine passerine Families (n = 21 species with 178 individual birds recorded). While the numbers of birds recorded in each category suggest that the area supports marginally more passerines (58% of total number of birds) than non-passerines (42%), analysis of the results indicates that *Nymphicus hollandicus* Cockatiel (n = 40) and *Melopsittacus undulatus* Budgerigar (n = 45) were responsible for weighting of the non-passerine figures. Large numbers of these species were recorded at most sites and many more were seen opportunistically and in flight. Of the remaining non-passerines, 18 *Barnardius zonarius* Australian Ringneck outnumbered the remaining species with less than seven individuals of each species recorded (Table 19). Interestingly, three species of cuckoo were recorded but never more than two species at any one site.

Within the passerines, 52% of the total number of passerines (n = 178) was represented by three species with the Malurid *Malurus splendens* Splendid Fairy-wren being the most ubiquitous (n = 35). Few *M. splendens* were recorded at every site. *Acanthiza robustirostris* Slaty-backed Thornbill was the next most numerous bird (n = 33) followed by *Oreoica gutturalis* Crested Bellbird (n = 25). The remaining species all recorded less than 10% each of the total number of birds recorded.

Similar numbers of species were recorded at all sites (<18, >15). However, more individual birds were recorded at Site 4 (n = 89) with similar numbers recorded at Site 3 (n= 65) and at Site 1 (n = 62) and similar numbers recorded at Site 5 (n = 47) and at Site 2 (n = 44).

For the Autumn 2012 survey, three non-passerine species from three Families accounted for only 17 birds whereas the 16 passerines species numbered 183 individuals from eight Families. Two species (*Malurus splendens* Splendid Fairy-wren (n = 45) and *Acanthiza apicalis* Inland Thornbill (n = 66)) accounted for 61% of all passerines during this seasonal survey. Thus, the percentage of passerines (91.5%) heavily outweighed the percentage of non-passerines (8.5%).

More species (n = 12) and more individual birds (n = 65) were recorded at Site 3 than at the other four sites. This was followed by Site 5 that accounted for nine species and 45 individual birds. While Sites 1 and 2 recorded the same number (n = 8) species, Sites 1 and 4 recorded the same number (n = 35) number of individual birds. The least number of species was recorded at Site 4 (n = 5) and the least number of birds (n = 24) was recorded at Site 2.

**Table 19 - Avifauna species recorded (including method) during the Spring 2011 and Autumn 2012 systematic surveys**

| Family | Species | Common Name | Site 1 | | Site 2 | | Site 3 | | Site 4 | | Site 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SPRING | AUTUMN | SPRING | AUTUMN | SPRING | AUTUMN | SPRING | AUTUMN | SPRING | AUTUMN |
| **Columbidae** | *Phaps chalcoptera* | Common Bronzewing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| **Aegothelidae** | *Aegotheles cristatus* | Australian Owlet-nightjar | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **Cacatuidae** | *Eolophus roseicapillus* | Galah | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | *Nymphicus hollandicus* | Cockatiel | 13 | 0 | 3 | 0 | 0 | 0 | 21 | 0 | 3 | 0 |
| **Psittacidae** | *Platycercus zonarius* | Australian Ringneck (Ring-necked Parrot) | 4 | 4 | 2 | 3 | 4 | 4 | 5 | 0 | 3 | 2 |
| | *Melopsittacus undulatus* | Budgerigar | 10 | 0 | 0 | 0 | 20 | 0 | 15 | 0 | 0 | 0 |
| | *Neopsephotus bourkii* | Bourke's Parrot | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| **Cuculidae** | *Chalcites basalis* | Horsfield's Bronze Cuckoo | 1 | 0 | 2 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| | *Chalcites osculans* | Black-eared Cuckoo | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | *Cuculus pallidus* | Pallid Cuckoo | 0 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 1 | 0 |
| **Ptilonorhynchidae** | *Ptilonorhynchus guttatus* | Western Bowerbird | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maluridae** | *Malurus splendens* | Splendid Fairy-wren | 9 | 6 | 8 | 2 | 3 | 17 | 4 | 10 | 11 | 10 |
| **Acanthizidae** | *Calamanthus campestris* | Rufous Fieldwren | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | *Pyrrholaemus brunneus* | Redthroat | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | *Smicrornis brevirostris* | Weebill | 2 | 0 | 0 | 0 | 4 | 6 | 5 | 0 | 0 | 0 |
| | *Acanthiza robustirostris* | Slaty-backed Thornbill | 5 | 0 | 5 | 0 | 8 | 6 | 6 | 2 | 9 | 3 |
| | *Acanthiza chrysorrhoa* | Yellow-rumped Thornbill | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Acanthiza apicalis* | Inland Thornbill | 3 | 16 | 2 | 8 | 2 | 16 | 0 | 11 | 1 | 15 |
| **Meliphagidae** | *Lichenostomus virescens* | Singing Honeyeater | 1 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 2 |
| | *Manorina flavigula* | Yellow-throated Miner | 0 | 0 | 0 | 0 | 1 | 0 | 7 | 0 | 0 | 0 |
| | *Acanthagenys rufogularis* | Spiny-cheeked Honeyeater | 1 | 0 | 1 | 0 | 5 | 0 | 1 | 4 | 6 | 0 |
| | *Anthochaera carunculata* | Red Wattlebird | 0 | 0 | 0 | 0 | 2 | 0 | 5 | 0 | 0 | 0 |

| Family | Species | Common Name | Site 1 | | Site 2 | | Site 3 | | Site 4 | | Site 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SPRING | AUTUMN | SPRING | AUTUMN | SPRING | AUTUMN | SPRING | AUTUMN | SPRING | AUTUMN |
| | *Epthianura tricolor* | Crimson Chat | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pomatostomidae** | *Pomatostomus superciliosus* | White-browed Babbler | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Campephagidae** | *Coracina novaehollandiae* | Black-faced Cuckoo-shrike | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| **Pachycephalidae** | *Pachycephala rufiventris* | Rufous Whistler | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | *Colluricincla harmonica* | Grey Shrike-thrush | 2 | 0 | 2 | 0 | 1 | 1 | 1 | 0 | 1 | 2 |
| | *Oreoica gutturalis* | Crested Bellbird | 5 | 1 | 6 | 2 | 5 | 1 | 5 | 0 | 4 | 1 |
| **Artamidae** | *Cracticus nigrogularis* | Pied Butcherbird | 0 | 0 | 0 | 2 | 1 | 0 | 2 | 0 | 1 | 0 |
| | *Strepera versicolor* | Grey Currawong | 0 | 3 | 0 | 1 | 1 | 4 | 1 | 0 | 1 | 3 |
| **Rhipiduridae** | *Rhipidura fuliginosa* | Grey Fantail | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Corvidae** | *Corvus bennetti* | Little Crow | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | *Corvus orru* | Torresian Crow | 0 | 3 | 0 | 2 | 0 | 4 | 0 | 0 | 0 | 0 |
| **Petroicidae** | *Petroica goodenovii* | Red-capped Robin | 0 | 0 | 0 | 4 | 0 | 4 | 0 | 5 | 0 | 3 |
| | | **Subtotal** | **62** | **35** | **44** | **24** | **65** | **65** | **89** | **35** | **47** | **41** |
| | | **Cumulative total** | | | **106** | **59** | **171** | **124** | **260** | **159** | **307** | **200** |

Opportunistic recordings collectively accounted for 27 bird species identified during the two seasonal survey periods (Appendix B). While 18 species were recorded during the Spring 2011 survey period, a total of 15 were recorded during the Autumn 2012 survey period (Table 20). Of these, 12 were recorded during the Spring 2011 survey period that were not recorded during the Autumn 2012 survey and nine were recorded during the Autumn 2012 survey that were not recorded during the Spring 2011 survey. Only six species were common to both survey periods.

Of the birds recorded opportunistically, eight were recorded that were not recorded during the systematic bird surveys (Appendix B). Conversely, ten bird species recorded during the systematic surveys were not seen opportunistically (Appendix B).

**Table 20 - Bird species recorded opportunistically during the Spring 2011 and Autumn 2012 bird surveys**

| Family | Species | Common Name | Spring 2011 | Autumn 2012 |
|---|---|---|---|---|
| Casuariidae | *Dromaius novaehollandiae* | Emu | √ | √ |
| Megapodiidae | *Leipoa ocellata* | Malleefowl | | √ |
| Columbidae | *Phaps chalcoptera* | Common Bronzewing | √ | |
| Podargidae | *Podargus strigoides* | Tawny Frogmouth | □ | √ |
| Aegothelidae | *Aegotheles cristatus* | Australian Owlet-nightjar | | √ |
| Accipitridae | *Aquila audax* | Wedge-tailed Eagle | √ | |
| Cacatuidae | *Eolophus roseicapillus* | Galah | √ | |
| | *Nymphicus hollandicus* | Cockatiel | √ | |
| Psittacidae | *Barnardius zonarius* | Australian Ringneck | √ | |
| | *Melopsittacus undulatus* | Budgerigar | √ | |
| Meropidae | *Merops ornatus* | Rainbow Bee-eater | □ | √ |
| Maluridae | *Malurus splendens* | Splendid Fairy-wren | √ | √ |
| Acanthizidae | *Acanthiza robustirostris* | Slaty-backed Thornbill | | √ |
| Meliphagidae | *Manorina flavigula* | Yellow-throated Miner | √ | √ |
| | *Acanthagenys rufogularis* | Spiny-cheeked Honeyeater | √ | |
| | *Anthochaera carunculata* | Red Wattlebird | √ | |
| Pomatostomidae | *Pomatostomus superciliosus* | White-browed Babbler | √ | |
| Campephagidae | *Coracina novaehollandiae* | Black-faced Cuckoo-shrike | √ | √ |
| Pachycephalidae | *Pachycephala rufiventris* | Rufous Whistler | | √ |
| | *Colluricincla harmonica* | Grey Shrike-thrush | √ | |
| | *Oreoica gutturalis* | Crested Bellbird | √ | √ |
| Artamidae | *Strepera versicolor* | Grey Currawong | √ | |
| Rhipiduridae | *Rhipidura fuliginosa* | Grey Fantail | | √ |
| | *Rhipidura leucophrys* | Willie Wagtail | | √ |
| Corvidae | *Corvus orru* | Torresian Crow | √ | √ |
| Petroicidae | *Petroica goodenovii* | Red-capped Robin | √ | |
| | *Melanodryas cucullata* | Hooded Robin | | √ |

Of the birds considered of conservation significance listed for the area, evidence of *Leipoa ocellata* Malleefowl was found, *Oreoica gutteralis* Crested Bellbird was recorded at every site and opportunistically and *Pomatostomus superciliosus* White-browed Babbler was recorded at Site 2 and opportunistically.

Malleefowls are listed as a Schedule 1 species under the WCA 1950. Unconfirmed reports suggested that there were up to four Malleefowl mounds in the Mt Mason area. During the survey period, an audit of these mounds established that three of the mounds were old, inactive mounds and the fourth was unable to be found (Figure 16). While on site during the Spring 2011 survey, KLA was notified of a new active mound not far from the Jupiter camp (1.7 km south of the southern boundary of the Mt Mason tenement). Table 21 provides the coordinates of all reported Malleefowl mounds including their status as of September 2011. Plate 11 provides photographic evidence of the active mound, with two Malleefowl in attendance.

Both the Crested Bellbird and the White-browed Babbler are listed as Priority 4 species on the DEC Threatened and Priority Fauna database. These species, the Malleefowl, and other species of conservation significance listed to potentially occur in the area will be discussed further in Section 7.1.

Interrogation of the Birds Australia Atlas database listed 50 species for the area (Appendix B). Of those birds recorded collectively during the survey, 21 species were listed as having been seen/heard in the area with an additional five species seen opportunistically. Eight species were seen during systematic surveys that were not on the Birds Australia list for the area and an additional one species not on the list was seen opportunistically during the reconnaissance survey (Appendix B). Conversely, 22 species were on the list from Birds Australia that were not recorded during the survey.

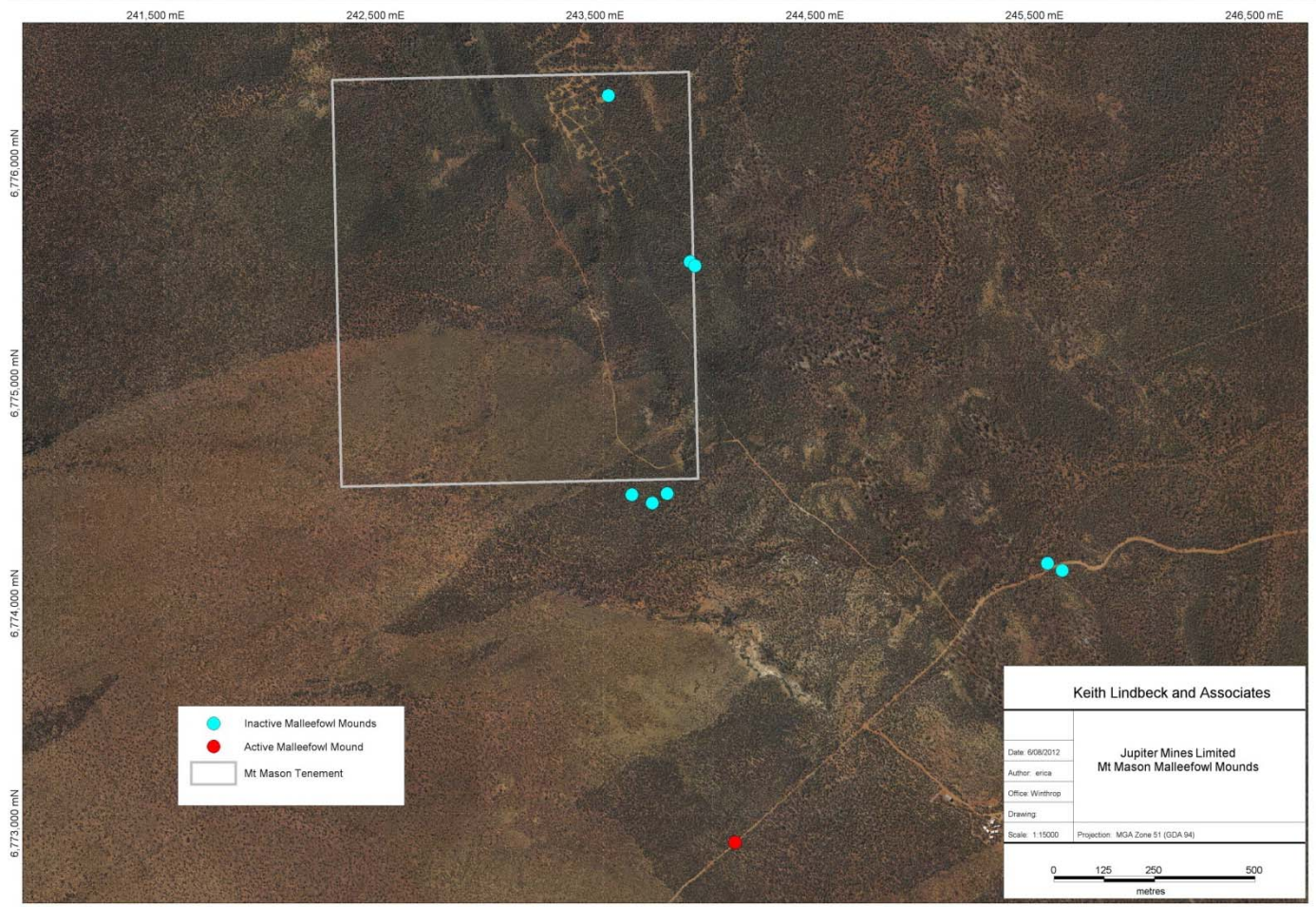



**Figure 16 - Location and status of Malleefowl mounds**

**Table 21 - Malleefowl Mound Locations and their status**

| Mound Number | Location | | Status of Mound | | |
|---|---|---|---|---|---|
| | Easting | Northing | Active/ Inactive | Approximate Age | Approximate Size (m) |
| 1 | 245522 | 6774136 | Inactive | > 10 years | 6 x 6 |
| 2 | 245590 | 6774104 | Unable to locate | | |
| 3 | 243523 | 6776262 | Inactive | >30 years | 5 x 5 |
| 4 | 243917 | 6775489 | Inactive | > 30 years | 7 x 7 |
| 5 | 244107 | 6772871 | Active | new | 2.5 x 2.5 |
| Other Mounds located during fauna assessment | | | | | |
| 6 | 243723 | 6774411 | Inactive | > 50 years | 4 x 4 |
| 7 | 243631 | 6774448 | Inactive | > 50 years | 6 x 6 |
| 8 | 243791 | 6774455 | Inactive | >100 | 5 x 5 |
| 9 | 243895 | 6775506 | Inactive | >100 | 4 x 4 |

**Plate 18 – Active Malleefowl Mound**

### 5.5.2 Discussion

Season and rainfall were taken into account when planning the optimal time for conducting both these seasonal surveys. Conventionally, surveys are undertaken in spring and autumn. For the Spring 2011 survey, above average rainfall was recorded for June 2011 and July 2011. Given the recent rainfall, this survey was planned in the spring months to take advantage of the above average rainfall that fell in the previous months. Similarly, for the Autumn 2012 survey, above average rainfall was recorded from October 2011 through

to January 2012. Therefore, timing of the surveys was in accordance with suggested timelines.

For the Spring 2011 survey, the bird censuses yielded a total of 307 individuals of 29 species from 12 Families. The percentages of non-passerines (58%) to passerines (42%) were weighted due to the inordinate numbers of Cockatiels and Budgerigars. The populations of these two species are known to fluctuate based on resource availability, and the large numbers recorded were not surprising given the verdant vegetative response to the recent above average rainfall.

Excluding these species, non-passerines (20%) were outnumbered by the passerines (80%) which is a more typical scenario in the northern Goldfields at this time of the year. The non-passerines were heavily represented by the Australian Ringneck (n = 18) followed by only five other non-passerine species which collectively totalled 26 individual birds.

Three species of passerines accounted for 52% of all the passerines recorded: the Splendid Fairy-wren was the most ubiquitous of the passerines followed by the Slaty-backed Thornbill. The characteristic call of the Crested Bellbird was heard at every site and was recorded opportunistically. The Crested Bellbird is listed as a Priority 4 species on the DEC Threatened and Priority Fauna database and will be discussed in Section 7.1 that addresses species of conservation significance. Similarly, the White-browed Babbler, another of the passerines recorded at Mt Mason is also a Priority 4 species and will be discussed in Section 7.1.

For the Autumn 2012 survey, the more typical scenario of passerines (91.5%) to non-passerines (8.5%) was evident with the Splendid Fairy Wren (n = 45) and Inland Thornbill (n = 66) responsible for much of this weighting, collectively representing 61% of all passerines recorded during the survey. Of the non-passerines, the Australian Ringneck again was the dominant species accounting for 13 of the 17 non-passerines recorded. While the White-browed Babbler was not recorded during the Autumn 2012 survey, the Crested Bellbird was recorded at four of the five sites, albeit in far fewer numbers than during the warmer months of spring. As mentioned above, these Priority species will be discussed in Section 7.1, in addition to the presence of the Malleefowl.

The distribution of birds throughout the Mt Mason area was not remarkably different between sites for the Spring 2011 survey. These results suggest that there was no significant correlation between distribution of birds across the length of the area surveyed and the vegetation communities in the areas surveyed. However, these results were not consistent for the Autumn 2012 survey period in which there was a marked difference in the species distribution across the sites. Given that all sites except the regenerating *Acacia* shrubland are dominated by a mulga upperstorey, it may be assumed that resource availability differs substantially in the cooler months in relation to topography and understorey species. These results confirm the necessity of multiple seasonal surveys in order to better understand resource availability and use by avifauna of different habitats across a landscape.

A log/log transformation of the accumulated number of species recorded during the four mornings of systematic sampling resulted in a fairly strong linear relationship between sampling intensity (mornings) and the number of species ($R^2 = 0.877$) (Figure 17). While an asymptote has not been reached, 94% of species had been recorded by the second morning with only two more species recorded on the following two mornings. As discussed in Section 5.3.2, it is reasonable to assume that all common species are represented in the curve but rare and transient species would only be detected with a far higher sampling intensity. Based on these results and that two seasonal surveys have been undertaken, it is likely that a reasonable representation of the majority of the birds that utilise this area were sighted.

Only one bird species *Cracticus tibicen* Australian Magpie has been vouchered at the Western Australian Museum for the area (Appendix B). Interestingly this species was neither heard nor seen during the systematic sampling and was not recorded opportunistically. Results from Birds Australia identify 51 species that have been recorded in the area (Appendix B). Of these, 25 were recorded during the two seasonal surveys, 26 were not recorded that appeared on the list and nine species were recorded during the surveys that do not appear on the Birds Australia list (Appendix B)

As noted elsewhere, a comparison with other surveys is limited given the seasonal, temporal and habitat differences. Notwithstanding this and excluding species associated with water bodies, other regional surveys have listed a total of 94 additional species collectively that were not recorded during this spring survey (Appendix B). As mentioned elsewhere, seasonal surveys, conducted over many years during different seasons and climatic conditions would be required to determine the full complement of birds that utilise the habitats and adjacent areas of the Mt Mason Project.

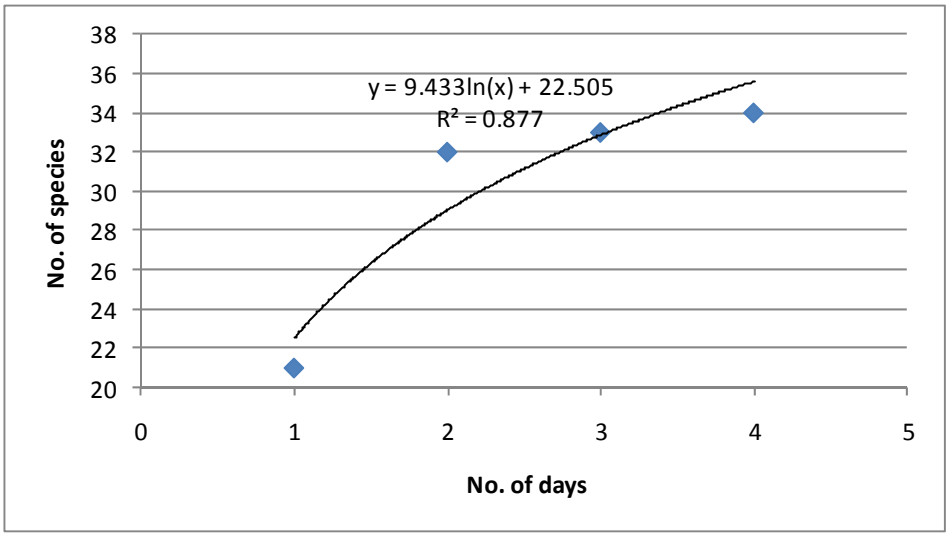



**Figure 17 - Species accumulation curve for birds recorded during the systematic sampling surveys**

## 5.6 SPOTLIGHTING

### 5.6.1 The assemblages

A total of 27 person hours was spent spotlighting during both seasonal surveys; five hours and fifty minutes over three evenings totalling 15.5 spotlighting hours were spent traversing the survey areas during the Spring 2011 survey and five hours and forty-five minutes over three evenings totalling 11.5 spotlighting hours were spent traversing the survey areas during the Autumn 2012 survey. Established tracks were followed within and adjacent to the survey area and the trapping grid areas were not entered so that mammals in the immediate areas of the traps would not be disturbed.

For the Spring 2011 survey, collectively, during spotlighting and head-torch searches, two *Macropus robustus* Euros were seen, one *Eurostopodus argus* Spotted Nightjar was positively identified by its call and one *Antaresia stimsoni* Stimson's Python was recorded. Two other birds were seen but unidentified as well as numerous unidentified bats flying overhead. One gecko was also seen but not captured or identified.

During the Autumn 2012 spotlighting surveys, four mammals species were recorded including one *Pseudantechinus woolleyae* Woolley's Pseudantechinus, *Macropus rufus* Red Kangaroo, unidentified bats and the non-native *Oryctolagus cuniculus* Rabbit. In addition, seven bird species were recorded that included *Phaps chalcoptera* Common Bronzewing, *Podargus strigoides* Tawny Frogmouth, *Aegotheles cristatus* Australian Owlet-nightjar, *Acanthiza apicalis* Inland Thornbill, *Pachycephala rufiventris* Rufous Whistler, *Petroica goodenovii* Red-capped Robin and a small unidentified species.

All species recorded during the spotlighting surveys are presented in Appendix B.

In addition to the vertebrates, three scorpions and two slaters were collected during the Spring 2011 survey. These were sent to the appropriate specialist at the Western Australian Museum for identification.

### 5.6.2 Discussion

Given the low number of small mammal and reptile species captured, it was not surprising that few were seen during the spotlighting forays.

It is interesting to note that of the vertebrate taxa identified during the spotlighting surveys only one mammal (Red Kangaroo) was not recorded during the systematic sampling or opportunistically. Albeit only one species, this highlights the value of including varied techniques when recording fauna assemblages in any one area.

All invertebrates sent to the Western Australian Museum were identified. Of the scorpions, all three belong to the Family Buthidae and included one male and one juvenile *Isometroides* ‘goldfields1’ and one juvenile *Lycas jonesae* (Volschenk 2012). The slaters that were collected were identified as *Buddelundia* sp.nov. 39 (Family: Armadillidae)(Judd and Hosie 2012). None of the species above are considered to be short-range endemics.

# 6.0 TARGETED INVETEBRATE FAUNA SURVEY

### 6.1.1 The assemblages

Of the species vouchered at the Western Australian Museum, 101 species were identified and comprised Arachnida, Chilopoda, Diplopoda, Crustacea and Gastropoda (Table 22).

Within the Arachnida, nine species totalling 26 individuals represented five Families, three Chilopoda accounted for three Families with one species from each, Diplopoda accounted for one species and Crustacea seven species from one Family. Five species of Gastropoda were identified representing three families and accounting for 64 specimens.

Given the lack of taxonomic knowledge and reference collections, the results from the Western Australian Museum were often inconclusive depending on the families or genera. For example, while the genus *Eucrytops* (Family: Idiopidae) is common throughout Western Australia, based on the females and juvenile collected, it is currently not possible to say if the *Eucyrtops* spp. represent SREs, whereas the single juvenile *Neosprassus* sp. (Family: Sparassidae) is not a SRE species (Burger *et al.* 2012).

Within the Order Pseudoscorpiones, while many species of *Synsphyronus* (Family: Garypidae) may represent SREs, the single female *Synsphyronus mimulus* collected is widespread and occurs in all Australian mainland states (Harvey 1987 cited in Burger *et al.* 2012). Similarly *Geogarypus taylorii* (Family: Geogarypidae) is extremely widespread in southern Australia. However, based on current knowledge, it is not possible to state whether the three males and one female *Austrohorus* sp. or the two female *Euryolpium* sp. from the Family Olipidae are SREs.

Three species of scorpions (Family: Buthidae) were identified and while the taxonomy of Buthidae remains problematic, the three species were identified as not being SREs (Volschenk 2012).

Three species representing three families of centipede (Chilopda) were identified (Burger *et al.* 2012). Of these, full taxonomic treatment of Chilenophilidae is required before the endemicity of the single specimen vouchered can be determined, whereas the other species (*Scolopendra laeta* Family: Scolopendridae and *Pilbarascutigera incola* Family: Scutigeridae) are not considered SREs.

A single millipede sample submitted (Family: Paradoxosomatidae) was a damaged female which did not facilitate identification beyond family level. In the Mt Mason area, the most abundant and diverse genus is *Antichiropus*. All species of the genus are known to be SREs (Burger *et al.* 2012).

Seven isopod specimens from four sites that were submitted to the Museum contained only a single species of the genus *Budddelundia* (Family: Armadillidae) (Judd and Hosie 2012). While this species remains undescribed it is not considered a SRE.

Five species of land snails were identified belonging to the Families Punctidae, Pupillidae and Succineidae (Whisson 2012). None of the species are considered SREs. Although the family Succineidae in Australia is poorly known taxonomically, species are considered to have wide distributional ranges.

Overall, similar numbers of specimens were collected from within the sites and from out of the sites. However, it is noted that many more individuals were collected from Site 3 and for the smaller satellite sites associated with BIF, Site 7 (Table 22).

**Table 22 – Invertebrates collected during the Spring 2011 and Autumn 2012 surveys**

| Class | Family | Species | Site 1 | | Site 2 | | Site 3 | | Site 4 | | Site 5 | | Site 6 | Site 7 | Site 8 | Site 9 | Site 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Order | | | In | Out | In | Out | In | Out | In | Out | In | Out | | | | | |
| **Arachnida** | | | | | | | | | | | | | | | | | |
| Aranea | | | | | | | | | | | | | | | | | |
| | Idiopidae | *Eucyrtops* 'sp female' | - | - | - | - | 1 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | - |
| | | *Eucyrtops* `sp juv` | - | - | - | - | - | - | 1 | - | - | 1 | - | - | - | - | - |
| Pseudoscorpiones | | | | | | | | | | | | | | | | | |
| | Garypidae | *Synsphyronus mimulus* | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - |
| | Geogarypidae | *Geogarypus taylori* | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - |
| | Olpiidae | *Eurypolpium* sp. | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - |
| | | *Austrohorus* sp. | - | - | - | 1 | - | - | 1 | - | 2 | - | - | - | - | - | - |
| Scorpiones | | | | | | | | | | | | | | | | | |
| | Buthidae | *Isometroides* 'goldfields1' | - | - | - | - | 1 | - | - | - | 3 | - | - | - | - | 1 | 1 |
| | | *Lychas jonesae* | - | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| | | *Lychas* 'splendens' | - | - | - | - | 1 | - | - | - | 1 | - | - | - | - | - | - |
| **Chilopoda** | | | | | | | | | | | | | | | | | |
| Geophilomorpha | | | | | | | | | | | | | | | | | |
| | Chilenophilidae | sp. | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - |
| Scolopendromorpha | | | | | | | | | | | | | | | | | |
| | Scolopendridae | *Scolopendra laeta* | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - |
| Scutigeromorpha | | | | | | | | | | | | | | | | | |
| | Scutigeridae | *Pilbarascutigera incola* | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Diplopoda** | | | | | | | | | | | | | | | | | |
| Polydesmida | | | | | | | | | | | | | | | | | |
| | Paradoxosomatidae | sp. | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| **Crustacea** | | | | | | | | | | | | | | | | | |
| Isopoda | | | | | | | | | | | | | | | | | |
| | Armadillidae | *Buddelundia* sp. nov. 39 | - | - | - | - | - | - | 1 | - | 1 | - | - | - | 2 | 3 | - |

| **Class** | **Family** | **Species** | **Site 1** | | **Site 2** | | **Site 3** | | **Site 4** | | **Site 5** | | **Site 6** | **Site 7** | **Site 8** | **Site 9** | **Site 10** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Order | | | **In** | **Out** | **In** | **Out** | **In** | **Out** | **In** | **Out** | **In** | **Out** | | | | | |
| **Gastropoda** | | | | | | | | | | | | | | | | | |
| Stylommatophora | | | | | | | | | | | | | | | | | |
| | Pupillidae | *Gastrocopta bannertonensis* | - | - | 6 | - | 2 | 9 | 3 | 2 | - | 2 | - | 9 | - | - | 5 |
| | | *Gastrocopta* cf. *bannertonensis* | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | *Gastrocopta* sp. (juv.) | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - |
| | | *Pupoides* cf. *adelaidae* | - | - | - | - | 5 | - | - | - | - | - | - | 3 | - | - | - |
| | | *Pupoides* cf. *myoporinae* | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - |
| | Punctidae | *Westralaoma expicta* | - | - | - | - | 4 | 5 | - | - | 1 | - | - | 4 | - | - | - |
| | Succineidae | *Succinea* sp. | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - |

### 6.1.2 Discussion

Short-range endemic invertebrate fauna generally possess similar ecological and life history characteristics, especially poor powers of dispersal, confinement to discontinuous habitats, slow growth and low fecundity (EPA 2004, 2009). While there are occasional SREs among the vertebrates and insects, there are much higher numbers among molluscs, earthworms, some spider groups, particularly the mygalomorphs, millipedes and some groups of crustaceans. Mountainous terrains, freshwater habitats, caves and other subterranean cavities provide suitable habitat for a wide variety of both terrestrial and aquatic (vertebrate and invertebrate) fauna (Harvey 2002).

No invertebrate species of conservation significance are listed for the survey area under the EPBC Act 1999, the WCA 1950 or in the DEC Threatened and Priority Fauna Database. However, it is recognised that few invertebrate surveys have been undertaken in the CYIP area. While Jupiter's Mt Mason project area does not support freshwater habitats, there are mountainous terrains in the form of BIFs and subterranean areas may support invertebrate fauna. The invertebrate survey targeted only terrestrial invertebrates in potential SRE habitat.

Of the 19 species identified, the classification of six species could not be determined. It is also noted that for one of the six, while the sample collected could not be identified, it is likely to belong to a genus in which all species are considered to be SREs. The remaining 13 species are not considered to be SREs.

Within the area proposed for disturbance in the Mt Mason tenement, no unique landscape was identified and there appeared to be no unique habitat that did not occur elsewhere in the area. While most sites comprised Mulga overstorey, the differences in the number of invertebrates collected suggest subtle differences between sites most likely in relation to their aspect and understorey flora species. For example, fewer invertebrates were collected from Sites 1 and 2 which were in the southern portion of the tenement. The topography of this area was rather flat and comprised sandy areas with few outcrops and certainly no BIF. The remaining sites, however, were more closely associated with BIF with five actually located in areas of BIF. Not surprisingly, few invertebrates were collected from these areas.

There appeared to be no large differences between the number of species collected within the trapping areas and those collected outside of the trapping areas. This clearly indicates that the invertebrate fauna at Mt Mason is not limited to particular areas but may be found throughout the tenement, albeit at varying densities.

A targeted SRE survey was conducted in 2008 in the Mt Mason area that also searched areas within the potential impact footprint and in non-impact areas proposed at that time (OES (2011). Four sampling sites were selected and all were located in areas of BIF (Figure 12). Results indicate that of the specimens collected, only one species *Aganippe* 'MYG224' (Family Idiopidae) is an SRE. No evidence of this species was recorded or collected during the current survey. In addition, two species from the Mollusc database have a low-level potential for short-range endemism. These include *Pupoides adelaidae* and *Succinea* sp. It is noted that a species (*Pupoides* cf. *adelaidae*) similar to the former was identified from those collected during this survey and was determined not to be a SRE (Whisson 2012).

The BIF range at Mt Mason lies in a north to south orientation for approximately 10 km and appears to be well connected to the BIF range at Mt Ida (approximately 8.6 km in length) (OES 2011). The potential SRE habitat supported by these ranges is extensive and is not limited to the area of proposed impact at Mt Mason.

# 7.0 ENVIRONMENTAL IMPACTS

## 7.1 Fauna of Conservation Significance

Native fauna species that are rare, threatened with extinction, or have high conservation value are protected by law under the Federal EPBC Act 1999, in addition to the Western Australia WCA 1950.

The EPBC Act 1999 lists two terrestrial bird species and three migratory bird species of national importance likely to occur within the area of the proposed mining activity, and the DEC Threatened and Priority Fauna Database lists one threatened reptile and six threatened bird species, with the reptile and two bird species protected under the WCA 1950 (Table 23). A short description of each of the species follows, with the potential impact on their conservation status.

**Table 23 - Conservation significant terrestrial fauna potentially occurring in the study area**

| SPECIES | COMMON NAME | CONSERVATION SIGNIFICANCE | | | PREVIOUS RECORD |
|---|---|---|---|---|---|
| | | EPBC | WCA | DEC | |
| REPTILES | | | | | |
| *Aspidites ramsayi* | Woma | | S4 | | 1966 Menzies |
| **AVIFAUNA** | | | | | |
| *Leipoa ocellata* | Malleefowl | Vulnerable | S1 | | 1998 Leonora |
| | | | | | 2001, 2007 Ularring |
| | | | | | 2007 Menzies |
| *Apus pacificus* | Fork-tailed Swift | Migratory | | | |
| *Ardea alba modesta* | Great Egret | Migratory | | | |
| *Falco peregrinus* | Peregrine Falcon | | S4 | | 1978 Leonora<br>1999 Ularring |
| *Ardeotis australis* | Australian Bustard | | | P4 | 1973 Leonora<br>1980 Menzies |
| *Thinornis rubricollis* | Hooded Plover | | | P4 | 1980 Ularring<br>1992 Menzies |
| *Merops ornatus* | Rainbow Bee-eater | Migratory | | | |
| *Acanthiza iredalei iredalei* | Slender-billed Thornbill | Vulnerable | | | |
| *Pomatostomus superciliosus* | White-browed Babbler | | | P4 | 1980 Ularring |
| *Oreoica gutturalis* subsp. *gutturalis* | Crested Bellbird | | | P4 | 1980 Ularring |

- ***Aspidites ramsayi* Woma**

  Family: Boidae

  Conservation Status: Schedule 4: Fauna that is in need of special protection under the WCA 1950.

  Distribution: The Woma was formerly abundant in the southwestern sandplains. They are now known from four disjunct populations: a southwestern population, isolated populations on Peron Peninsula, an arid northwestern population and a Central Australian population (Storr *et al.* 2002).

  Ecology: The Woma, also colloquially known as Ramsay's Python, grows up to 2.7 m long, although the average length is 1.5 m, and it is particularly placid. It has a grey, olive,

golden brown or rich red-brown back, ringed with darker bands. Unlike most other Australian pythons, the Woma has a narrow pointed head rather than a broad head distinct from its body. It does not have the characteristic python heat-sensory pits along the lips and front of the head. These features result in it being occasionally mistaken for a venomous snake, although like all pythons the Woma is harmless to humans.

Mating probably occurs between May to August. A clutch of 5–19 eggs are laid in September and October. Once the young snakes hatch, after about two months' incubation, the female probably leaves the maternal burrow and the juveniles are independent.

During the day the Woma shelters in hollow logs, old burrows or warrens or thick vegetation. It uses its head like a shovel to dig and enlarge its burrow. The Woma emerges at night to search for food, which includes reptiles including lizards or snakes, in addition to many species of venomous snakes, small mammals and birds. The snake wiggles the end of its tail to lure its prey close enough to strike, then kills its prey by squeezing it in the coils of its body, or by squashing it against the walls of its burrow or warren.

Likelihood of occurrence: The DEC Threatened and Priority Fauna Database lists one Woma recorded for 1966 ~70 km southeast of the survey area. Given this and the current distribution of this species, it is not likely that the Woma occurs within the survey area. Further, there does not appear to be preferred habitat for this species in the area surveyed at Mt Mason.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- **Malleefowl *Leipoa ocellata***

Family: Megapodidae

Conservation Status: Vulnerable under EPBC Act 1999 and Schedule 1: Rare and likely to become extinct under the WCA 1950

Distribution: The Malleefowl was once broadly distributed across the southern half of the Australian continent, but has undergone significant range reduction and now occupy semi-arid regions of southern Australia where mallee eucalypts form the dominant vegetation (Birds Australia 2012).

Ecology: The Malleefowl is a large, ground-dwelling bird that roosts in trees but rarely flies. The species is omnivorous and typically has a large home range in woodlands or shrublands that have a deep layer of leaf litter which is used in building nesting mounds. Mounds are up to one metre in height and 3m to 5 m in diameter. Breeding occurs from September to April and chicks emerge independently, approximately seven weeks after hatching.

Clearing of habitat, fox predation and the degradation of habitat by fire and overgrazing by feral livestock has reduced Malleefowl numbers considerably.

Likelihood of occurrence: During the survey period, seven old, inactive mounds were identified within the Mt Mason area with one active mound located 1.7 km south of the southern boundary of the Mt Mason tenement. The presence of this species is addressed in the recommendations.

Potential Impacts: Given the distribution of this species and the quality and quantity of preferred habitat in the region that will not be disturbed, it is unlikely that the overall conservation status of this species will be altered by the proposed mining activity.

- ***Apus pacificus* Fork-tailed Swift**

  Family: Apodidae

  Conservation Status: Migratory Marine under EPBC Act 1999.
  This species is also listed in the CAMBA, JAMBA and ROKAMBA agreements.

  Distribution: The Fork-tailed Swift breeds in northeast and mid-east Asia and winters in south New Guinea and Australia (Johnstone and Storr 1998). It is a visitor to most parts of Western Australia beginning to arrive in the Kimberley in late September, the Pilbara and Eucla in November and in the southwest in mid-December. It leaves in late April. While it is common in the Kimberley, it is uncommon near the northwest, west and southeast coasts and rare or scare elsewhere.

  Ecology: The Fork-tailed Swift does not breed in Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. They probably roost aerially, but are occasionally observed to land (Higgins 1999). The species food items within Australia are not well known, however, the species is known to be insectivorous. Studies have recorded the Swift eating small bees, wasps, termites and moths.

  Likelihood of occurrence: Given the ecology of this species, the swift may include the area within its aerial forays and migratory path.

  Potential Impacts: There are no significant threats to the Fork-tailed Swift in Australia. Potential threats include habitat destruction and predation by feral animals (Birdlife International 2012). Due to the wide range and ecology of this species, the conservation status is unlikely to be altered by the proposed mining activity at Mt Mason.

- **Great Egret *Ardea alba modesta***

  Family: Ardeidae

  Conservation Status: Migratory Species under the EPBC Act 1999

  Distribution: The Great Egret has been recorded across much of Western Australia but avoids the driest regions of the western and central deserts (McKilligan 2005).

  Ecology: The Great Egret, also known as the White Egret is common to very common in well-watered Kimberley flatlands and scarce to moderately common elsewhere. Preferred habitat includes shallow freshwaters and shallow saltwaters, and rarely dry pastures.

  Likelihood of occurrence: Given the preferred habitat of this species, it is not likely to occur within the survey area.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity at Mt Mason.

- ***Falco peregrinus* Peregrine Falcon**

  Family: Falconidae

  Conservation Status: Schedule 4: Fauna that is in need of special protection under the WCA 1950

  Distribution: The Peregrine Falcon is uncommon but widespread in distribution. It is moderately common within the higher aspects of the Stirling Ranges in the south of Western Australia but tends to be uncommon in the hilly northwest Kimberley (Johnstone and Storr 1998).

  Ecology: This species inhabits cliff faces such as those along the coast, near rivers and ranges. The Peregrine Falcon can also be seen around wooded watercourses and lakes. It nests on ledges in cliffs as well as granite outcrops and quarries and also makes use of mine pits. This Falcon feeds almost entirely on birds including sea birds and some parrot species (Johnstone and Storr 1998).

  Likelihood of occurrence: Two dated sightings of this species were recorded in 1978 and 1999 within 20 km of the Mt Mason Project area. It was not included in the results from Birds Australia Database or the Western Museum Database searches for the area. While it is not unreasonable for this species to be seen in flight in this area, the preferred habitat of this Falcon indicates that it is not likely to utilise the habitat within the area proposed for disturbance.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the Mt Mason area.

- ***Ardeotis australis* Australian Bustard**

  Family: Otitidae

  Conservation Status: Priority Four: Taxa in need of monitoring on DEC Threatened and Priority Fauna Database.

  Distribution: The Australian Bustard occurs over much of Western Australia, with the exception of the more heavily wooded southern portion of the State (Johnstone and Storr 1998). Its wider distribution includes eastern Australia and New Guinea.

  Ecology: The Australian Bustard is a large ground-dwelling bird known to occur in open or lightly wooded country. It is nomadic and ranges over very large areas, largely dependent on rainfall and hence food availability. Although not flightless, Bustards spend the greater proportion of time on the ground.

  Likelihood of occurrence: Sightings of the Bustard for this area include one in 1973 near Leonora and one in 1980 near Menzies. While some of the habitat may be considered suitable for this species, no recording of this bird has been made in the local area for ~30 years. It is therefore not likely to occur in the study area. Notwithstanding this, if it were present, given its range and mobility, the Bustard is likely to avoid disturbance and move to less disturbed areas.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the Mt Mason area.

- ***Charadrius rubricollis*** **Hooded Plover**

  Family: Charadriidae

  Conservation Status: Priority Four on DEC Threatened and Priority Fauna Database

  Distribution: In Western Australia, this small plover is found along the southern coast, west of Israelite Bay and north to Jurien Bay, and on off-shore islands (Johnstone and Storr 1998).

  Ecology: This species occurs along sandy and seaweedy beaches as well as along the margins of saltlakes, estuaries and dams where it feeds on invertebrates (Johnstone and Storr 1998).

  Likelihood of occurrence: The DEC Threatened and Priority Fauna Database list two sightings, one in 1980 at Ularring and a second in 1992 at Menzies. As there are no water bodies within the area surveyed, this species is not likely to occur in the study area.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- **Rainbow Bee-eater** ***Merops ornatus***

  Family: Meropidae

  Conservation Status: Migratory Species under the EPBC Act 1999

  Distribution: The Rainbow Bee-eater is distributed across much of mainland Australia, and is a common summer migrant to southern Australia. They range from scarce to common across their range depending on suitable habitat and breeding grounds.

  Ecology: Rainbow Bee-eaters are very social birds and when not breeding roost together in large groups in dense understorey or large trees. They generally migrate south at the beginning of spring and breed from November to January. They require open areas with loamy soft soils soft enough for nest tunneling yet firm enough to support the tunnel.

  Likelihood of occurrence: The Rainbow Bee-eater usually migrates south in late September early October and north from February to April (Johnstone and Storr 1998). It is therefore not surprising that the Bee-eater was neither seen nor heard during the Spring 2011 survey that was conducted at the end of August beginning of September, and that it was recorded during the Autumn 2012 survey that was conducted in March.

  Potential Impacts: Given the migratory status of the Rainbow Bee-eater and its ability to travel vast distances, the conservation status of this species is not likely to be altered by the proposed mining activity in the Mt Mason area.

- ***Acanthiza iredalei iredalei*** **Slender-billed Thornbill**

  Family: Acanthizidae

  Conservation Status: Vulnerable under the EPBC Act 1999

  Distribution: The Slender-billed Thornbill is sparsely distributed in disjunct populations across the southern arid and semi-arid portion of Western Australia and western South Australia.

  Ecology: The preferred habitat for this species includes chenopod shrublands, treeless or sparsely wooded flatlands and saline flats associated with salt lakes. The Thornbill forages mainly on the ground and in low vegetation, increasing its vulnerability to predation by cats and foxes.

  Likelihood of occurrence: Given the absence of preferred habitat for this species, it is not likely to be present in the area proposed for disturbance. None were identified during the comprehensive survey.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- ***Pomatostomus superciliosis ashbyi*** **White-browed Babbler (western wheatbelt)**

  Family: Pomatostomidae

  Conservation Status: Priority Four on the DEC Threatened and Priority Fauna Database

  Distribution: The White-browed Babbler is endemic to mainland Australia and occurs mainly in the arid and semi-arid zones south of the Tropic of Capricorn. Scattered populations are found in outback Northern Territory and Western Australia, particularly in the south-western corner of Western Australia.

  Ecology: The White-Browed Babbler is a gregarious bird that travels in flocks and has a strong community affinity. It is found in dry sclerophyll woodlands with a shrubby understorey, mulga, acacias, mallee, cypress pine scrubs, timber, scrub along watercourses and saltbush, and forages on or near the ground for insects and seeds.

  Likelihood of occurrence: The White-browed Babbler was recorded on the DEC Threatened and Priority Fauna Database in 1980 at Ularring. Three individual Babblers were recorded during the systematic sampling during the Spring 2011 survey and more were recorded opportunistically during both seasonal survey periods.

  Potential Impacts: Advice from the Office of the EPA indicates that the conservation status of this species refers to the western populations particularly in the agricultural zone where clearing and fragmentation of native vegetation has impacted on this species habitat. Given the location of the proposed activity and the large areas of intact, undisturbed, remnant vegetation regionally, the conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- ***Oreoica gutturalis gutturalis*** **Crested Bellbird (southern)**

  Family: Pachycephalidae

  Conservation Status: Priority Four on DEC Threatened and Priority Fauna Database

  Distribution: The distributional range of the Crested Bellbird extends across the greater part of the State but not the wetter regions (north and west Kimberley, Darling Range and deep South-West).

  Ecology: This sedentary and solitary species inhabits the drier mallee woodlands and heaths of the southern parts of Western Australia. It forages mainly on the ground, primarily for insects, and breeds from March through to December across the State.

  Likelihood of occurrence: The Crested Bellbird was recorded at all sites during the seasonal surveys and was also recorded opportunistically.

  Potential Impacts: The Crested Bellbird (southern) is listed as a Priority 4 species on the DEC Threatened and Priority Fauna database for the Goldfields, Midwest, Wheatbelt and South Coast. While the Mt Mason areas falls within the Goldfields region, the conservation classification refers principally to areas where the preferred habitat of the Crested Bellbird has been disturbed, particularly by clearing of native vegetation and resultant fragmentation. The area proposed to be impacted is relatively undisturbed and large tracts of undisturbed native vegetation are present and will remain intact adjacent to the mining operations. The large home range and mobility of the Crested Bellbird strongly suggests that its conservation classification will not be compromised by the proposed mining activities at Mt Mason.

### 7.2 Potential Impacts

The EPA objective for terrestrial fauna is to maintain the abundance, species diversity and geographical distribution of terrestrial fauna and protect specially protected (Threatened) fauna consistent with the provision of the WCA 1950.

Integral to the development of mining operations in the Mt Mason area, the clearing, removal and/or disturbance of substantial areas of BIF and adjacent areas of native vegetation is anticipated. It is inevitable that there will be some localised loss of fauna due to direct mortality arising from these activities associated with the mining operations. However, for those vertebrate taxa that cannot move away from any disturbances, and in relation to potential impacts implied in Section 7.1, it is unlikely that the loss of individuals associated with the direct mortalities and compromise of proximal habitat values would be sufficient to affect the overall conservation status of any of the species recorded from the survey area.

Similarly, the ongoing impacts from mining activities including vehicular movements, noise and associated dust generation and machinery noise are not likely to alter the conservation status of any species that may persist in adjacent areas. Any invasion and dispersal of weed species may cause deterioration of the condition of the remaining vegetation and the invasion and/or spread of non-native mammals pose a threat to indigenous species in terms of predation and resource limitation. Both elements should be managed to ensure and promote the sustainability of native fauna and their habitat locally.

## 7.3 Habitats of Significance to Fauna Indigenous to Western Australia

Development of mining operations and associated infrastructure will result in the loss of native vegetation, removal of faunal habitat, fragmentation of currently contiguous habitat and loss of areas for dispersal of native fauna.

The overall condition of the vegetation within the survey area can generally be described as "Very Good" to "Excellent" with almost all disturbances within the area directly related to recent exploration activity and associated tracks.

None of the vegetation groups identified have been recognised as TEC's as defined in the EPBC Act 1999. However, the area surveyed lies within the buffer zone of a PEC (Bulga Downs / Perinvale / Walling vegetation complex) that has not yet been described by the DEC on the list of PECs. However, it is inferred that the PEC relates to the vegetation specifically occurring on the BIF (NVS 2012). No DRF were identified in the survey area and only one Priority 3 species (*Calotis* sp. Perinvale Range) was recorded. The vegetation communities are generally described as Mulga over shrubland and are extensive locally. Cowan (2001) reports that most species within at least the East Murchison bioregion are wide ranging and usually occur in at least one, and often several, adjoining subregions.

Given the above, there appears to be no unique, restricted or fauna-specific habitat types for terrestrial vertebrate fauna within the Mt Mason or local area. Thus, while the removal of up to approximately 220 ha of this native vegetation will impact on indigenous fauna, the vegetation cannot be considered to be significant habitat in a regional context.

Additionally, as discussed elsewhere in this report, fauna of conservation significance that may use this habitat are unlikely to be compromised by the removal of the vegetation for the proposed mining activities.

Given the limited knowledge of invertebrate fauna and their habitat, particularly in a regional context, it is not possible to gauge a likely impact on SREs following the proposed mining activities at Mt Mason. Notwithstanding this, potential SRE habitat supported by the BIF ranges at Mt Mason is extensive and is not limited to the area of proposed impact.

## 7.4 Recommendations

The following general recommendations apply in the case of any major disturbance to large areas of native vegetation, as a consequence of the proposed development for the Mt Mason Project:

- Any clearing be minimised in extent given that the abundance and diversity of species lost will be proportional to the amount of habitat cleared;
- Where possible, all infrastructure associated with the development of the mining operation be aligned preferentially to areas of existing disturbance;
- Where possible, access routes be aligned to existing tracks and other barriers or follow the boundaries of broad-scale intact native vegetation;
- A rehabilitation plan is developed that progressively rehabilitates areas as soon as they are no longer required; and
- All members of the work force on site attend an environmental induction to ensure they are familiar with the value of native vegetation to fauna indigenous to Western Australia. This should include awareness of driving restrictions, ensuring that off-road driving is minimised, fire prevention is actively practised, and appropriate responses are followed in the event of an accident involving fauna.

In addition, specific recommendations are made in relation to the Malleefowl:

- A targeted Malleefowl survey should be undertaken by a suitably qualified team in the areas proposed for disturbance as soon as detailed boundaries of these areas have been confirmed.
- Given the evidence of Malleefowl within the zone of impact, a referral should be submitted to the Federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for approval in accordance with the EPBC Act 1999
- Pending the results of the targeted Malleefowl survey in the confirmed areas for disturbance and outcome of the DSEWPaC referral, a Malleefowl Management Plan should be developed and implemented immediately post approval.

# 8.0 REFERENCES

ANRA, (2012), *Australian Natural Resources Atlas,* Australian Government. Available online:
http://www.anra.gov.au/topics/vegetation/pubs/native_vegetation/nat_veg_wa.html#bioregions

Armstrong, K. and Konishi, Y. (2011). Bat call identification from near Menzies, WA. Unpublished Report, September 2011. Specialised Zoological, South Australia.

Armstrong, K. and Konishi, Y. (2012). Bat call identification from Mt Mason, Goldfields, WA. Unpublished Report, March, 2012. Specialised Zoological, South Australia.

Australasian Bat Society (2006). Recommendations of the Australasian Bat Society Inc for reporting standards for insectivorous bat surveys using bat detectors. *The Australasian Bat Society Newsletter* **27:** 6–9.

Beard, J.S. (1990). *Plant life of Western Australia.* Kangaroo Press, NSW.

Birds Australia (2012). Available online at
http://www.birdsaustralia.com.au/our-projects/atlas-birdata.html,
http://www.birdsaustralia.com.au/our-projects/important-bird-areas.html,

BirdLife International (2012). *Apus pacificus* In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.2. *Apus pacificus*. IUCN Red List.

Burbidge, A.A., Fuller, P.J. and McKenzie, N.L. (1995). *Vertebrate Fauna.* In: The Biological Survey of the Eastern Goldfields of Western Australia. Part 12. Barlee-Menzies Study Area. Eds. A.A. Burbidge, N.J. Hall, G.J. Keighery and N.L. Mckenzie. Records of the Western Australian Museum Supplement Number 49.

Burbidge, A.A., McKenzie, N.L. and Fuller, P.J. (2008). Long-tailed Dunnart *Sminthopsis longicaudata.* In: S. van Dyck and R. Strahan (Eds). *The Mammals of Australia*. Reed New Holland, Sydney.

Burger, M.A., Castalanelli, M.A., Waldock, J., Car, C. and Harvey, M.S. (2012). *Arachnids and Myriapods from Mt Mason, Western Australia.* Unpublished Report, April 2012. Western Australian Museum, Welshpool, WA.

Bureau of Meteorology (2012). Climatic Averages Webpage. Available online at: http://www.bom.gov.au/climate/averages/tables/cw_012052.shtml

Christidis, L and Boles, W.E. (2008). *Systematics and Taxonomy of Australian Birds.*CSIRO Publishing, Victoria.

Cowan, M. (2001). Murchison 1 (*Mur1 – East Murchison subregion*). In; *A Biodiversity Audit of Western Australia.* Eds McKenzie, N.L., May, J.E. and McKenna, S. Department of Conservation and Land Management, Perth.

CAR (2009). *CAR Reserve Analysis.* Department of Environment and Conservation, WA.

DEC (2011). *Standard Operating Procedure: Remote operation of cameras. SOP No:5.2.* Department of Environment and Conservation WA

Department of the Environment, Water, Heritage and the Arts (2009). Available online at: http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/index.html

Doughty, P. and Maryan, B. (2010). Checklist of the Mammals of Western Australia. Unpublished list available from Western Australian Museum.

Environmental Protection Authority (2002). *Terrestrial Biological Surveys as an Element of Biodiversity Protection: Positions Statement No. 3.* Environmental Protection Authority, Perth, WA.

Environmental Protection Authority (2009). *Guidance for the Assessment of Environmental Factors No 20. Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia.* Environmental Protection Authority, Perth, WA.

Environmental Protection Authority (2004). *Guidance for the Assessment of Environmental Factors. Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia No. 56.* Environmental Protection Authority, Perth, WA.

Environmental Protection Authority and 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.

Garden, J.G., McAlpine, C.A. and Possingham, H.P. (2007). Using multiple survey methods to detect terrestrial reptiles and mammals: what are the most successful and cost-efficient combinations? *Wildlife Research* **34:** 218-227.

Harvey, M.S. (2002). Short-range endemism among the Australian fauna: some examples from non-marine environments. *Invertebrate Systematics* **16:** 555-570.

Higgins, P.J. (ed.) (1999). *Handbook of Australian, New Zealand and Antarctic Birds. Volume Four - Parrots to Dollarbird*. Melbourne: Oxford University Press.

How, R.A., Cooper, N.K. and Bannister, J.L. (2010). Checklist of the Mammals of Western Australia. Unpublished list available from Western Australian Museum.

IUCN. (2001). *IUCN Red List Categories and Criteria: Version 3.1.* IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK

Johnstone, R.E and Storr, G.M (1998). *Handbook of Western Australian Birds, Volume 1, Non-passerines (Emu to Dollarbird).* Western Australian Museum, Perth.

Judd, S. and Hosie, A.M. (2012). *Isopods from Mt Mason, Western Australia.* Unpublished Report, March 2012. Western Australian Museum, Welshpool, WA.

Keighery, B.J. (1994). *Bushland Plant Survey; A guide to plant community survey for the Community.* Wildflower Society of Western Australia (Inc.) Nedlands.

KLA (2011). *Macarthur Minerals Limited. Snark Project. Fauna Assessment.* Unpublished Report, August 2011. Keith Lindbeck and Associates, Perth WA.

KLA (2012 *in prep). Jupiter Mines Limited. Central Yilgarn Iron Project (CYIP) Mt Ida. Fauna Assessment.* Unpublished Report, 2012. Keith Lindbeck and Associates, Perth WA.

Mace, G.M. and Stuart. S.N. (1994) *Draft IUCN Red List Categories, Version 2.2. Species* 21-22:13-24.

McKilligan, N. (2005). *Herons, Egrets and Bitterns. Their Biology and Conservation in Australia*. CSIRO Publishing, Victoria.

Meissner, R. and Owen, G. (2010). Flora and vegetation of banded iron formations of the Yilgarn Craton: Mt Ida Greenstone Belt and Mt Hope. Conservation Science Western Australia **7 (3):** 583-592.

Menkhorst, P. and Knight, F. (2011). *A Field Guide to the Mammals of Australia. Third Edition.* Oxford University Press, Victoria.

NVS (2012). *Jupiter Mines Limited. Mt Mason Project. Level 2 Flora and Vegetation Survey. Part 1 – October 2011 & Part 2 – March 2012.* Unpublished Report, May 2012. Native Vegetation Solutions, Kalgoorlie.

OES (2007). *Mt Mason Project Desktop Study.* Unpublished report. Outback Ecology Services, Jolimont, WA.

OES (2010). *Jupiter Mines Limited Mt Mason. Level 2 Flora and Vegetation Survey*. Unpublished report, September 2010. Outback Ecology Services, Jolimont, WA.

OES (2011). *Jupiter Mines Limited Central Yilgarn Iron Project. Terrestrail Short-ramge Endemic Invertebrate Survey.* Unpublished report, March 2011. Outback Ecology Services, Jolimont, WA.

Paul Armstrong and Associates (2008). *Vegetation Survey and Rare Flora Search of the Mt Mason and Mt Ida Exploration Project*. Unpublished Report, January 2008. Paul Armstrong and Associates, Perth, WA.

Storr, GM. Smith, LA and Johnstone, R.E. (2002). *Snakes of Western Australia.* Western Australian Museum, Perth.

Terrestrial Ecosystems (2011a). *Level 2 Fauna Risk Assessment for the Granny Deeps Project Area.* Unpublished Report, February 2011. Terrestrial Ecosystems, Mt Claremont, WA.

Terrestrial Ecosystems (2011b). *Targeted Fauna Survey for Long-tailed Dunnarts for the Granny Deeps Project Area.* Unpublished Report, June 2011. Terrestrial Ecosystems, Mt Claremont, WA.

Volschenk, E.S. (2012). *Mount Mason Scorpion Identification Report.* Unpublished Report, March 2012. ScorpionID, Innaloo, WA.

Whisson, C. (2012). *Land snails from Mt Mason, Western Australia.* Unpublished Report, April 2012. Western Australian Museum, Welshpool, WA.

# APPENDIX A
# Keighery, B.J. (1994) Vegetation Condition Scales

**Pristine (1).** Pristine or nearly so, no obvious signs of disturbance.

**Excellent (2).** Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

**Very Good (3).** Vegetation structure altered, obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

**Good (4).** Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Retains basic vegetation structure or ability to regenerate it.
For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

**Degraded (5).** Basic vegetation structure severely impacted by disturbance.
Scope for regeneration but not to a state approaching good condition without intensive management.
For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

**Completely Degraded (6).** The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.
These areas are often described as ‘parkland cleared’ with the flora compromising weed or crop species with isolated trees or shrubs.

# APPENDIX B
## Species likely to occur in the area and species identified in the area

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| **AMPHIBIANS** | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| LIMNODYNASTIDAE | | | | | | | | | | | | | | | |
| *Neobatrachus* sp. | | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Neobatrachus sutor* | Shoemaker Frog | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Neobatrachus wilsmorei* | Plonking Frog | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| MYOBATRACHIDAE | | | | | | | | | | | | | | | |
| *Pseudophryne occidentalis* | Western Toadlet | - | - | - | - | + | + | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| **REPTILES** | | | | | | | | | | | | | | | |
| AGAMIDAE | | | | | | | | | | | | | | | |
| *Caimanops amphiboluroides* | | - | - | - | - | - | + | + | - | + | + | - | + | - | - |
| *Ctenophorus cristatus* | Bicycle Dragon | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Ctenophorus fordi* | Mallee Sand Dragon | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Ctenophorus isolepis* | Crested Dragon | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Ctenophorus isolepis* subsp. *gularis* | Central Military Dragon | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Ctenophorus ornatus* | Ornate Cervice Dragon | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Ctenophorus reticulatus* | Western Netted Dragon | - | - | - | - | + | + | + | - | - | - | - | - | - | - |
| *Ctenophorus salinarum* | Salt Pain Dragon | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Ctenophorus scutulatus* | | - | - | - | - | + | + | + | - | + | - | - | + | + | - |
| *Moloch horridus* | Thorny Devil | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Pogona minor* | | - | - | - | - | + | + | + | - | + | + | - | - | - | - |
| *Tympanocryptis cephalus* | Pebble Dragon | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| DIPLODACTYLIDAE | | | | | | | | | | | | | | | |
| *Diplodactylus granariensis* subsp. *granariensis* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Diplodactylus pulcher* | | - | - | - | - | + | + | + | - | + | - | - | - | - | - |
| *Lucasium stenodactylum* | | - | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Oedura reticulata* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Rhynchoedura ornata* | Beaked Gecko | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Strophurus assimilis* | Goldfields Spiny-tailed Gecko | - | - | - | - | + | - | - | - | + | - | - | - | - | - |
| *Strophurus elderi* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Strophurus intermedius* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| *Strophurus strophurus* | | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| CARPHODACTYLIDAE | | | | | | | | | | | | | | | |
| *Nephrurus levis* subsp. *levis* | | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Nephrurus vertebralis* | | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Underwoodisaurus milii* | Southern Barking Gecko | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| GEKKONIDAE | | | | | | | | | | | | | | | |
| *Gehyra purpurascens* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Gehyra variegata* | | - | - | - | - | + | - | + | - | - | - | - | + | - | - |
| *Heteronotia binoei* | Bynoe's Gecko | - | - | - | - | + | - | + | - | - | - | - | + | - | - |
| | | | | | | | | | | | | | | | |
| PYGOPODIDAE | | | | | | | | | | | | | | | |
| *Delma butleri* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Lialis burtonis* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| SCINCIDAE | | | | | | | | | | | | | | | |
| *Cryptoblepharus plagiocephalus* | | - | - | - | - | + | + | - | - | - | + | - | - | - | - |
| *Ctenotus* sp. | | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Ctenotus atlas* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Ctenotus grandis* | | - | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Ctenotus leonhardii* | | - | - | - | - | + | + | + | - | - | - | - | + | - | - |
| *Ctenotus mimetes* | | - | - | - | - | + | + | + | - | - | - | - | - | - | - |
| *Ctenotus schomburgkii* | | - | - | - | - | + | + | + | - | + | - | - | - | - | - |
| *Ctenotus uber* subsp. *uber* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Ctenotus xenopleura* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Cyclodomorphus branchialis* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Egernia depressa* | Pygmy Spiny-tailed Skink | - | - | - | - | + | - | + | - | + | + | - | + | - | - |
| *Egernia formosa* | | - | - | - | - | + | - | | - | - | - | - | - | - | - |
| *Eremiascincus richardsonii* | Broad-banded Sand Swimmer | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Hemiergis initialis* subsp. *initialis* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Hemiergis millewae* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Lerista macropisthopus* subsp. *macropisthopus* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Lerista muelleri* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Liopholis inornata* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| | | | | | | | | | | | | | | | |
| *Menetia greyii* | | - | - | - | - | + | + | + | - | + | + | - | + | - | - |
| *Morethia butleri* | | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| VARANIDAE | spp. | | | | | | | | | | + | | | + | |
| *Varanus caudolineatus* | | - | - | - | - | + | - | + | - | + | - | - | + | - | - |
| *Varanus gouldii* | Bungarra or Sand Monitor | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Varanus panoptes* | Yellow-spotted Monitor | - | - | - | - | - | - | + | - | + | + | - | + | + | - |
| *Varanus tristis* subsp. *tristis* | Racehorse Monitor | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| TYPHLOPIDAE | | | | | | | | | | | | | | | |
| *Ramphotyphlops bituberculatus* | | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Ramphotyphlops hamatus* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| BOIDAE | | | | | | | | | | | | | | | |
| *Antaresia stimsoni* | Stimson's Python | - | - | - | - | - | - | + | - | - | - | + | - | - | - |
| *Aspidites ramsayi* | Woma | - | + | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| ELAPIDAE | spp. | | | | | | | | | | + | | | | |
| *Demansia psammophis* | Yellow-faced Whipsnake | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Demansia psammophis* subsp. *psammophis* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Neelaps bimaculatus* | Black Naped Snake | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Parsuta monachus* | | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Pseudechis butleri* | Spotted Mulga Snake | - | - | - | - | - | - | + | - | - | + | - | - | - | - |
| *Pseudonaja modesta* | Ringed Brown Snake | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Pseudonaja nuchalis* | Gwardar; Northern Brown Snake | - | - | - | - | + | - | - | - | - | + | - | - | - | - |
| *Simoselaps bertholdi* | Jan's Banded Snake | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| **MAMMALS** | | | | | | | | | | | | | | | |
| TACHYGLOSSIDAE | | | | | | | | | | | | | | | |
| *Tachyglossus aculeatus* | Echidna | - | - | - | - | + | - | + | - | - | + | - | - | - | - |
| | | | | | | | | | | | | | | | |
| DASYURIDAE | | | | | | | | | | | | | | | |
| *Ningaui ridei* | Wongai Ningaui | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Ningaui yvonneae* | Southern Ningaui | - | - | - | - | + | - | - | - | - | - | - | - | - | - |

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| *Pseudantechinus macdonnellensis* | Fat-tailed Pseudantechinus | - | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Pseudantechinus woolleyae* | Woolley's Pseudantechinus | - | - | - | - | - | - | + | - | - | - | - | + | - | + |
| *Sminthopsis* sp. | | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Sminthopsis crassicaudata* | Fat-tailed Dunnart | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Sminthopsis dolichura* | Little long-tailed Dunnart | - | - | - | - | + | + | + | - | + | - | - | + | - | - |
| *Sminthopsis hirtipes* | Hairy-footed Dunnart | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Sminthopsis longicaudata* | Long-tailed Dunnart | - | - | - | - | - | - | + | - | + | - | - | + | - | - |
| | | | | | | | | | | | | | | | |
| MACROPODIDAE | | | | | | | | | | | | | | | |
| *Macropus fuliginosus* | Western Grey Kangaroo | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Macropus robustus erubescens* | Euro | - | - | - | - | + | + | + | - | - | - | + | - | - | - |
| *Macropus rufus* | Red Kangaroo | - | - | - | - | + | - | + | - | - | - | - | - | - | + |
| | | | | | | | | | | | | | | | |
| CHIROPTERA | | | | | | | | | | | | | | | |
| Chiroptera sp. | | - | - | - | - | - | - | + | - | - | - | + | - | - | + |
| VESPERTILIONIDAE | | | | | | | | | | | | | | | |
| *Chalinolobus gouldii* | Gould's Wattle Bat | - | - | - | - | + | + | + | - | + | - | - | + | - | - |
| *Chalinolobus morio* | Chocolate Wattled Bat | - | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Nyctophilus geoffroyi* | Lesser Long-eared Bat | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Nyctophilus major* | Greater Long-eared Bat | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Nyctophilus* sp. | | - | - | - | - | - | + | + | - | + | - | - | + | - | - |
| *Scotorepens balstoni* | Inland Broad-nosed Bat | - | - | - | - | + | - | + | - | + | - | - | + | - | - |
| *Vespadelus baverstocki* | Inland Forest Bat | - | - | - | - | + | + | - | - | - | - | - | - | - | - |
| *Vespadelus finlaysoni* | Finlayson's Cave Bat | - | - | - | - | - | - | + | - | + | - | - | + | - | - |
| *Vespadelus regulus* | Southern Forest Bat | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| MOLOSSIDAE | | | | | | | | | | | | | | | |
| *Mormopterus planiceps* | Southern Freetail-bat | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Mormopterus* sp. 3 | | - | - | - | - | - | + | - | - | + | - | - | + | - | - |
| *Mormopterus* sp. 3 / *Mormopterus* sp. 4 | | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Tadarida australis* | White-striped Freetailed-bat | - | - | - | - | + | + | + | - | + | - | - | + | - | - |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| MURIDAE | | | | | | | | | | | | | | | |
| *Mus musculus** | House Mouse | - | - | - | - | + | + | + | - | + | - | - | + | - | - |
| *Notomys alexis* | Spinifex Hopping-mouse | - | - | - | - | + | + | + | - | - | - | - | + | - | - |
| *Notomys mitchellii* | Mitchell's Hopping-mouse | - | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Pseudomys albocinereus* | Ash-grey Mouse | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Pseudomys bolami* | Bolam's Mouse | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Pseudomys hermannsburgensis* | Sandy Inland Mouse | - | - | - | - | + | + | + | - | - | - | - | + | - | - |
| LEPORIDAE | | | | | | | | | | | | | | | |
| Oryctolagus cuniculus* | Rabbit | + | - | - | - | + | - | + | - | - | + | - | - | + | + |
| | | | | | | | | | | | | | | | |
| CANIDAE | sp. | - | - | - | - | - | - | - | - | - | + | - | - | + | - |
| *Canis lupus dingo* | Dingo | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Canis lupus familiaris** | Dog | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Vulpes vulpes** | Red Fox | + | - | - | - | + | - | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| FELIDAE | | | | | | | | | | | | | | | |
| *Felis catus** | Cat | + | - | - | - | + | - | + | - | - | + | - | - | - | - |
| | | | | | | | | | | | | | | | |
| BOVIDAE | | | | | | | | | | | | | | | |
| *Bos taurus** | European Cattle | - | - | - | - | - | - | + | - | - | + | - | - | - | - |
| *Equus asinus** | Donkey | - | - | - | - | - | - | + | - | - | + | - | - | - | - |
| *Capra hircus** | Goat | + | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Ovis aries* | Sheep | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| **AVIFAUNA** | | | | | | | | | | | | | | | |
| CASUARIIDAE | | | | | | | | | | | | | | | |
| *Dromaius novaehollandiae* | Emu | - | - | - | + | + | - | + | - | - | + | - | - | + | - |
| | | | | | | | | | | | | | | | |
| MEGAPODIIDAE | | | | | | | | | | | | | | | |
| *Leipoa ocellata* | Malleefowl | - | + | - | + | + | - | + | - | - | + | - | - | + | - |
| | | | | | | | | | | | | | | | |
| ANATIDAE | | | | | | | | | | | | | | | |
| *Cygnus atratus* | Black Swan | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Tadorna tadornoides* | Australian Shelduck | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Chenonetta jubata* | Australian Wood Duck | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Malacorhynchus membranaceus* | Pink-eared Duck | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Anas gracilis* | Grey Teal | - | - | - | - | + | - | - | - | - | - | - | - | - | - |

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| *Anas superciliosa* | Pacific Black Duck | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Aythya australis* | Hardhead | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| PODICIPEDIDAE | | | | | | | | | | | | | | | |
| *Poliocephalus poliocephalus* | Hoary-headed Grebe | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| COLUMBIDAE | | | | | | | | | | | | | | | |
| *Phaps chalcoptera* | Common Bronzewing | - | - | - | + | + | - | + | + | - | + | - | + | + | + |
| *Ocyphaps lophotes* | Crested Pigeon | - | - | - | + | + | - | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| PODARGIDAE | | | | | | | | | | | | | | | |
| *Podargus strigoides* | Tawny Frogmouth | - | - | - | - | + | - | + | - | - | - | - | - | + | + |
| | | | | | | | | | | | | | | | |
| EUROSTOPODIDAE | | | | | | | | | | | | | | | |
| *Eurostopodus argus* | Spotted Nightjar | - | - | - | + | + | - | + | - | - | - | + | - | - | - |
| | | | | | | | | | | | | | | | |
| AEGOTHELIDAE | | | | | | | | | | | | | | | |
| *Aegotheles cristatus* | Australian Owlet-nightjar | - | - | - | - | + | - | + | - | - | - | - | + | + | + |
| | | | | | | | | | | | | | | | |
| APODIDAE | | | | | | | | | | | | | | | |
| *Apus pacificus* | Fork-tailed Swift | + | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| ARDEIDAE | | | | | | | | | | | | | | | |
| *Ardea pacifica* | White-necked Heron | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Ardea modesta alba* | Western Great Egret | + | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Egretta novaehollandiae* | White-faced Heron | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| ACCIPITRIDAE | | | | | | | | | | | | | | | |
| *Lophoictinia isura* | Square-tailed Kite | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Hamirostra melanosternon* | Black-breasted Buzzard | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Haliastur sphenurus* | Whistling Kite | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Accipiter fasciatus* | Brown Goshawk | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Accipiter cirrocephalus* | Collared Sparrowhawk | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Circus assimilis* | Spotted Harrier | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Aquila audax* | Wedge-tailed Eagle | - | - | - | + | + | - | + | - | - | + | - | - | - | - |
| *Hieraaetus morphnoides* | Little Eagle | - | - | - | - | + | - | - | - | - | - | - | - | - | - |

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| FALCONIDAE | | | | | | | | | | | | | | | |
| *Falco cenchroides* | Australian Kestrel | - | - | - | + | + | - | + | + | - | - | - | - | - | - |
| *Falco berigora* | Brown Falcon | - | - | - | - | + | - | + | + | - | - | - | - | - | - |
| *Falco longipennis* | Australian Hobby | - | - | - | + | + | - | - | - | - | - | - | - | - | - |
| *Falco peregrinus* | Peregrine Falcon | - | + | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| RALLIDAE | | | | | | | | | | | | | | | |
| *Fulica atra* | Eurasian Coot | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| OTIDIDAE | | | | | | | | | | | | | | | |
| *Ardeotis australis* | Australian Bustard | - | + | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| RECURVIROSTRIDAE | | | | | | | | | | | | | | | |
| *Himantopus himantopus* | Black-winged Stilt | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Recurvirostra novaehollandiae* | Red-necked Avocet | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Cladorhynchus leucocephalus* | Banded Stilt | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| CHARADRIIDAE | | | | | | | | | | | | | | | |
| *Charadrius ruficapillus* | Red-capped Plover | - | - | - | + | + | - | - | - | - | - | - | - | - | - |
| *Elseyornis melanops* | Black-fronted Dotterel | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Thinornis rubricollis* | Hooded Plover | - | + | - | - | + | - | - | - | - | - | - | - | - | - |
| *Erythrogonys cinctus* | Red-kneed Dotterel | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Vanellus tricolor* | Banded Lapwing | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| TURNICIDAE | | | | | | | | | | | | | | | |
| *Turnix velox* | Little Button-quail | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| LARIDAE | | | | | | | | | | | | | | | |
| *Chroicocephalus novaehollandiae* | Silver Gull | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| CACATUIDAE | | | | | | | | | | | | | | | |
| *Eolophus roseicapillus* | Galah | - | - | - | + | + | - | + | + | + | + | - | - | - | - |
| *Nymphicus hollandicus* | Cockatiel | - | - | - | - | + | - | + | - | + | + | - | - | - | - |
| | | | | | | | | | | | | | | | |
| PSITTACIFORMES | | | | | | | | | | | | | | | |
| *Barnardius zonarius* | Australian Ringneck | - | - | - | + | + | + | + | + | + | + | - | + | + | - |
| *Psephotus varius* | Mulga Parrot | - | - | - | - | + | + | + | - | - | - | - | - | + | - |

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| *Melopsittacus undulatus* | Budgerigar | - | - | - | - | + | - | + | - | + | + | - | - | - | - |
| *Neopsephotus bourkii* | Bourke's Parrot | - | - | - | - | + | - | - | - | + | - | - | - | - | - |
| *Polytelis anthopeplus* | Elegant Parrot | - | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Neophema splendida* | Scarlet-chested Parrot | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| CULCULIDAE | | | | | | | | | | | | | | | |
| *Chalcites basalis* | Horsfield's Bronze Cuckoo | - | - | - | + | + | - | + | - | + | - | - | - | - | - |
| *Chalcites osculans* | Black-eared Cuckoo | - | - | - | + | - | - | + | - | + | - | - | - | - | - |
| *Cacomantis pallidus* | Pallid Cuckoo | - | - | - | - | + | + | + | - | + | - | - | - | - | - |
| STRIGIDAE | | | | | | | | | | | | | | | |
| *Ninox novaeseelandiae* | Southern Boobook Owl | - | - | - | + | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| HALCYONIDAE | | | | | | | | | | | | | | | |
| *Todiramphus pyrrhopygius* | Red-backed Kingfisher | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| MEROPIDAE | | | | | | | | | | | | | | | |
| *Merops ornatus* | Rainbow Bee-eater | + | - | - | - | + | - | + | - | - | - | - | - | + | - |
| | | | | | | | | | | | | | | | |
| CLIMACTERIDAE | | | | | | | | | | | | | | | |
| *Climacteris affinis* | White-browed Treecreeper | - | - | - | - | + | + | + | - | - | - | - | - | - | - |
| *Climacteris rufa* | Rufous Treecreeper | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| PTILONORHYNCHIDAE | | | | | | | | | | | | | | | |
| *Ptilonorhynchus guttatus* | Western Bowerbird | - | - | - | - | - | - | + | - | + | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| MALURIDAE | | | | | | | | | | | | | | | |
| *Malurus splendens* | Splendid Fairy-wren | - | - | - | + | + | + | + | - | + | + | - | + | + | - |
| *Malurus leucopterus* | White-winged Fairy-wren | - | - | - | + | + | - | - | - | - | - | - | - | - | - |
| *Malurus lamberti* | Variegated Fairy-wren | - | - | - | - | + | + | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| ACANTHIZIDAE | | | | | | | | | | | | | | | |
| *Calamanthus campestris* | Rufous Fieldwren | - | - | - | - | - | - | - | - | + | - | - | - | - | - |
| *Pyrrholaemus brunneus* | Redthroat | - | - | - | + | + | + | + | - | + | - | - | - | - | - |
| *Smicrornis brevirostris* | Weebill | - | - | - | + | + | + | + | + | + | - | - | + | - | - |
| *Gerygone fusca* | Western Gerygone | - | - | - | - | + | + | - | - | - | - | - | - | - | - |
| *Acanthiza* sp. | | - | - | - | - | - | - | + | - | - | - | - | - | - | - |

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| *Acanthiza robustirostris* | Slaty-backed Thornbill | - | - | - | + | - | - | + | - | + | - | - | + | + | - |
| *Acanthiza chrysorrhoa* | Yellow-rumped Thornbill | - | - | - | + | + | + | + | - | + | - | - | - | - | - |
| *Acanthiza uropygialis* | Chestnut-rumped Thornbill | - | - | - | + | + | + | + | - | - | - | - | - | - | - |
| *Acanthiza iredalei iredalei* | Slender-billed Thornbill | + | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Acanthiza apicalis* | Inland Thornbill | - | - | - | + | + | + | + | - | + | - | - | + | + | + |
| *Aphelocephala leucopsis* | Southern Whiteface | - | - | - | + | + | + | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| PARDALOTIDAE | | | | | | | | | | | | | | | |
| *Pardalotus striatus* | Striated Pardalote | - | - | - | - | + | + | + | - | - | - | - | - | - | - |
| MELIPHAGIDAE | sp. | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Certhionyx variegatus* | Pied Honeyeater | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Lichenostomus virescens* | Singing Honeyeater | - | - | - | + | + | + | + | - | + | - | - | + | + | - |
| *Lichenostomus leucotis* | White-eared Honeyeater | - | - | - | - | + | + | + | - | - | - | - | - | - | - |
| *Lichenostomus ornatus* | Yellow-plumed Honeyeater | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Lichenostomus plumulus* | Grey-fronted Honeyeater | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Purnella albifrons* | White-fronted Honeyeater | - | - | - | + | + | - | + | - | - | - | - | - | - | - |
| *Manorina flavigula* | Yellow-throated Miner | - | - | - | + | + | - | + | - | + | + | - | - | + | - |
| *Acanthagenys rufogularis* | Spiny-cheeked Honeyeater | - | - | - | + | + | + | + | - | + | + | - | + | + | - |
| *Anthochaera carunculata* | Red Wattlebird | - | - | - | + | + | - | + | - | + | + | - | - | - | - |
| *Epthianura tricolor* | Crimson Chat | - | - | - | - | + | - | - | - | + | - | - | - | - | - |
| *Epthianura albifrons* | White-fronted Chat | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Sugomel niger* | Black Honeyeater | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Lichmera indistincta* | Brown Honeyeater | - | - | - | - | + | + | - | - | - | - | - | - | - | - |
| *Melithreptus brevirostris* | Brown-headed Honeyeater | - | - | - | + | + | - | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| POMATOSTOMIDAE | | | | | | | | | | | | | | | |
| *Pomatostomus superciliosus* | White-browed Babbler | - | + | - | - | + | + | + | - | + | + | - | - | + | - |
| | | | | | | | | | | | | | | | |
| PSOPHODIDAE | | | | | | | | | | | | | | | |
| *Cinclosoma castanotus* | Chestnut Quail-thrush | - | - | - | - | + | + | - | - | - | - | - | - | - | - |
| *Cinclosoma castaneothorax* | Chestnut-breasted Quail-thrush | - | - | - | + | - | - | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| NEOSITTIDAE | | | | | | | | | | | | | | | |
| *Daphoenositta chrysoptera* | Varied Sittella | - | - | - | - | + | + | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| CAMPEPHAGIDAE | | | | | | | | | | | | | | | |
| *Coracina maxima* | Ground Cuckoo-shrike | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Coracina novaehollandiae* | Black-faced Cuckoo-shrike | - | - | - | + | + | + | + | + | + | - | - | - | + | - |
| *Lalage sueurii* | White-winged Triller | - | - | - | - | + | + | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| PACHYCEPHALIDAE | | | | | | | | | | | | | | | |
| *Pachycephala inornata* | Gilbert's Whistler | - | - | - | - | + | + | - | - | - | - | - | - | - | - |
| *Pachycephala rufiventris* | Rufous Whistler | - | - | - | + | + | + | + | - | + | - | - | + | + | + |
| *Colluricincla harmonica* | Grey Shrike-thrush | - | - | - | + | + | + | + | - | + | + | - | + | - | - |
| *Oreoica gutturalis* | Crested Bellbird | - | + | - | + | + | + | + | - | + | + | - | + | + | - |
| ARTAMIDAE | | | | | | | | | | | | | | | |
| *Artamus* sp. | | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Artamus personatus* | Masked Woodswallow | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Artamus cinereus* | Black-faced Woodswallow | - | - | - | + | + | - | + | - | - | - | - | - | - | - |
| *Artamus cyanopterus* | Dusky Woodswallow | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Artamus minor* | Little Woodswallow | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Cracticus torquatus* | Grey Butcherbird | - | - | - | + | + | + | + | - | - | - | - | - | - | - |
| *Cracticus nigrogularis* | Pied Butcherbird | - | - | - | + | + | - | + | - | + | - | - | + | - | - |
| *Cracticus tibicen* | Australian Magpie | - | - | + | + | + | - | + | - | - | - | - | - | - | - |
| *Strepera versicolor* | Grey Currawong | - | - | - | + | + | + | + | - | + | + | - | + | - | - |
| | | | | | | | | | | | | | | | |
| RHIPIDURIDAE | | | | | | | | | | | | | | | |
| *Rhipidura albiscapa* | Grey Fantail | - | - | - | + | + | + | + | - | - | - | - | + | + | - |
| *Rhipidura leucophrys* | Willie Wagtail | - | - | - | + | + | - | + | - | - | - | - | - | + | - |
| | | | | | | | | | | | | | | | |
| CORVIDAE | | | | | | | | | | | | | | | |
| *Corvus coronoides* | Australian Raven | - | - | - | + | - | - | - | - | - | - | - | - | - | - |
| *Corvus bennetti* | Little Crow | - | - | - | + | + | + | + | - | + | + | - | - | - | - |
| *Corvus orru* | Torresian Crow | - | - | - | - | - | - | + | - | - | - | - | + | + | - |
| | | | | | | | | | | | | | | | |
| MONARCHIDAE | | | | | | | | | | | | | | | |
| *Grallina cyanoleuca* | Magpie-lark | - | - | - | + | + | - | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |

| | | EPBC Search | DEC data search | WAM data search | Birds Australia data search | Previous studies in and around the study area | | | KLA reconnaissance survey 2011 | Spring Survey 2011 | | | Autumn Survey 2012 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Burbidge *et al.* 1995 | KLA 2011 | KLA 2012 | | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting | Systematic Sampling | Opportunistic sightings and evidence | Spotlighting |
| PETROICIDAE | | | | | | | | | | | | | | | |
| *Microeca fascinans* | Jacky Winter | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Petroica boodang* | Scarlet Robin | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Petroica goodenovii* | Red-capped Robin | - | - | - | + | + | + | + | - | - | + | - | + | + | + |
| *Melanodryas cucullata* | Hooded Robin | - | - | - | + | + | + | + | - | - | - | - | - | + | - |
| | | | | | | | | | | | | | | | |
| HIRUNDINIDAE | | | | | | | | | | | | | | | |
| *Cheramoeca leucosternus* | White-backed Swallow | - | - | - | + | - | - | + | - | - | - | - | - | - | - |
| *Hirundo neoxena* | Welcome Swallow | - | - | - | + | + | - | + | - | - | - | - | - | - | - |
| *Petrochelidon ariel* | Fairy Martin | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Petrochelidon nigricans* | Tree Martin | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| MEGALURIDAE | | | | | | | | | | | | | | | |
| *Cincloramphus mathewsi* | Rufous Songlark | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Cincloramphus cruralis* | Brown Songlark | - | - | - | - | + | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| NECTARINIIDAE | | | | | | | | | | | | | | | |
| *Dicaeum hirundinaceum* | Mistletoebird | - | - | - | - | + | - | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| ESTRILDIDAE | | | | | | | | | | | | | | | |
| *Taeniopygia guttata* | Zebra Finch | - | - | - | + | + | + | + | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | |
| MOTACILLIDAE | | | | | | | | | | | | | | | |
| *Anthus novaseelandiae* | Australian Pipit | - | - | - | + | + | - | + | - | - | - | - | - | - | - |

# APPENDIX C
# Categories used in the assessment of conservation status

# IUCN (2001) Red List Categories

**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 (CR)**

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered*, 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*, 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*, 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.

**LEAST CONCERN (LC)**

A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

**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**.**

**NOT EVALUATED (NE)**

A taxon is Not Evaluated when it is has not yet been evaluated against the criteria

- Refer to http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf for criteria

**Schedules used in the WA Wildlife Conservation Act 1950.**

**Schedule 1.** Rare and Likely to become Extinct.

**Schedule 2.** Extinct.

**Schedule 3.** Migratory species listed under international treaties.

**Schedule 4.** Other Specially Protected Fauna.

**Department of Environment and Conservation Priority Species**

(species not listed under the Conservation Act, but for which there is some concern)

**Priority 1.** Taxa with few, poorly known population on threatened lands.

**Priority 2.** Taxa with few, poorly known populations on threatened lands, or taxa with several, poorly known populations not on conservation lands.

**Priority 3.** Taxa with several, poorly known populations, some on conservation lands.

**Priority 4.** 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.

**Priority 5.** Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

**JAMBA** The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6.

**CAMBA** The agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22.

**ROKAMBA** The agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24.

# APPENDIX D
# Department of Environment and Conservation Regulation 17 Permits

**DEPARTMENT OF ENVIRONMENT AND CONSERVATION**

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242

Correspondence: Locked Bag 30
Bentley Delivery Centre WA 6983

PAGE 2
NO. SF008183
PERSON NO. 78973

**DATE OF ISSUE** 18/08/2011
**VALID FROM** 18/08/2011
**DATE OF EXPIRY** 31/10/2011

**LICENSING OFFICER**

(VI)

**LICENSEE:** DR V SAFFER
**ADDRESS** SENIOR BIOLOGIST
KEITH LINDBECK & ASSOCIATES
P.O. BOX 144
BULLCREEK
W.A. 6149

AMENDED
6.9.2011 Date
OPS Initial

**DEPARTMENT OF ENVIRONMENT AND CONSERVATION**

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242

Correspondence: **Locked Bag 30**
**Bentley Delivery Centre WA 6983**

**PAGE** 1
**NO.** SF008183
**PERSON NO.** 78973

**RECEIPT NO.** **AMOUNT** $0.00

**WILDLIFE CONSERVATION ACT 1950**
**REGULATION 17**

## LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES

**THE UNDERMENTIONED PERSON MAY TAKE FAUNA FOR RESEARCH OR OTHER SCIENTIFIC PURPOSES AND WHERE AUTHORISED, KEEP IT IN CAPTIVITY, SUBJECT TO THE FOLLOWING AND ATTACHED CONDITIONS, WHICH MAY BE ADDED TO, SUSPENDED OR OTHERWISE VARIED AS CONSIDERED FIT.**

**DIRECTOR GENERAL**

### CONDITIONS

1 THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE WILDLIFE CONSERVATION ACT AND REGULATIONS AND ANY NOTICES IN FORCE UNDER THIS ACT AND REGULATIONS.

2 UNLESS SPECIFICALLY AUTHORISED IN THE CONDITIONS OF THIS LICENCE OR OTHERWISE IN WRITING BY THE DIRECTOR GENERAL, SPECIES OF FAUNA DECLARED AS LIKELY TO BECOME EXTINCT, RARE OR OTHERWISE IN NEED OF SPECIAL PROTECTION SHALL NOT BE CAPTURED OR OTHERWISE TAKEN.

3 NO FAUNA SHALL BE TAKEN FROM ANY NATURE RESERVE, WILDLIFE SANCTUARY, NATIONAL PARK, MARINE PARK, TIMBER RESERVE OR STATE FOREST WITHOUT PRIOR WRITTEN APPROVAL OF THE DIRECTOR GENERAL. NO FAUNA SHALL BE TAKEN FROM ANY OTHER PUBLIC LAND WITHOUT THE WRITTEN APPROVAL OF THE GOVERNMENT AUTHORITY MANAGING THAT LAND.

4 NO ENTRY OR COLLECTION OF FAUNA TO BE UNDERTAKEN ON ANY PRIVATE PROPERTY OR PASTORAL LEASE WITHOUT THE CONSENT IN WRITING OF THE OWNER OR OCCUPIER, OR FROM ANY ABORIGINAL RESERVE WITHOUT THE WRITTEN APPROVAL OF THE DEPARTMENT OF INDIGENOUS AFFAIRS.

5 NO FAUNA OR THEIR PROGENY SHALL BE RELEASED IN ANY AREA WHERE IT DOES NOT NATURALLY OCCUR, NOR BE HANDED OVER TO ANY OTHER PERSON OR AUTHORITY UNLESS APPROVED BY THE DIRECTOR GENERAL, NOR SHALL THE REMAINS OF SUCH FAUNA BE DISPOSED OF IN SUCH MANNER AS TO CONFUSE THE NATURAL OR PRESENT DAY DISTRIBUTION OF THE SPECIES.

6 THIS LICENCE AND THE WRITTEN PERMISSION REFERRED TO AT CONDITIONS 3 & 4 MUST BE CARRIED BY THE LICENSEE OR AUTHORISED AGENT AT ALL TIMES FOR THE PURPOSE OF PROVING THEIR AUTHORITY TO TAKE FAUNA WHEN QUESTIONED AS TO THEIR RIGHT TO DO SO BY A WILDLIFE OFFICER, ANY OTHER STATE OR LOCAL GOVERNMENT EMPLOYEE OR ANY MEMBER OF THE PUBLIC.

7 **********ANY INTERACTION INVOLVING GAZETTED THREATENED FAUNA THAT MAY BE HARMFUL AND/OR INVASIVE MAY REQUIRE APPROVAL FROM THE COMMONWEALTH DEPT OF THE ENVIRONMENT AND WATER RESOURCES, PHONE 02 6274 1900. INTERACTION WITH SUCH SPECIES IS CONTROLLED BY THE COMMONWEALTH GOVERNMENT'S "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999" & "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION REGULATIONS 2000" AS WELL AS DEC'S WILDLIFE CONSERVATION ACT & REGULATIONS.**********

8 NO BIOPROSPECTING INVOLVING THE REMOVAL OF SAMPLE AQUATIC AND TERRESTRIAL ORGANISMS (BOTH FLORA AND FAUNA) FOR CHEMICAL EXTRACTION AND BIOACTIVITY SCREENING IS PERMITTED TO BE CONDUCTED WITHOUT SPECIFIC WRITTEN APPROVAL BY THE DIRECTOR GENERAL OF DEC.

9 FURTHER CONDITIONS (NUMBERED 1 TO 7 ) ARE ATTACHED.

**PURPOSE** LEVEL 2 FAUNA SURVEY USING A GRID DESIGN AT MT MASON AND MT IDA NEAR MENZIES IN THE GOLDFIELDS FOR JUPITER MINES LIMITED. FAUNA CAPTURE WILL BE VIA ASSISTED DRY PITFALL, FUNNEL, ELLIOTT AND CAGE TRAPS. FAUNA SPECIES WILL BE IDENTIFIED AND THEN RELEASED AT POINT OF CAPTURE SOME INVERTEBRATE SPECIMENS MAY BE TAKEN FOR IDENTIFICATION.

**AUTHORISED PERSONS** MS ERICA MACINTYRE
MS MERRI BARTLETT
MR HAMISH BURNETT

## WILDLIFE CONSERVATION REGULATIONS 1970

**Regulation 17:- Licence to Take Fauna for Scientific Purposes**

FURTHER CONDITIONS (OF LICENCE NUMBER SF008183)

1. The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.

2. Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers etc and signs erected by the licensee and all traps shall be removed, all pitfalls shall be refilled or capped and the study area returned to the condition it was in prior to the research/capture program. During any break in research, cage traps should be removed and pitfalls either removed, capped or filled with sand.

3. No collecting is to be undertaken in areas where it would impinge on pre-existing scientific research programs.

4. Any form of colour marking of birds or bats shall only be undertaken in accordance with the requirements of the Australian Bird and Bat Banding Scheme.

5. Any inadvertently captured specimen of fauna which is declared as likely to become extinct, rare or otherwise in need of special protection is to be released immediately at the point of capture. Where such a specimen is injured or deceased, the licensee shall contact Department of Environment and Conservation licensing staff at Kensington (08 9423 2434) for advice on disposal. Records are to be kept of any fauna so captured and details included in the report required under further condition 6 below.

6. Within one month of the expiration of this licence, the holder shall submit an electronic return detailing the locality, site, geocode, date and number of each species captured, sighted or vouchered during the currency of the licence, into the Department of Environment and Conservation Fauna Survey Database (DECFSD). A copy of any paper, report or thesis resulting from the research shall on completion be lodged with the Director General. If a renewal of this licence is required, the licensee shall submit a written progress report for activities undertaken during this licence period prior to the expiry of this licence.

7. Not more than ten specimens of any one protected species shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take large series in order to obtain adequate statistical data the collector will proceed with circumspection and justify their actions to the Director General in advance.

8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected which represents a significant extension of geographic range shall be donated on request to the Western Australian Museum.

9. To prevent any unnecessary collecting in this State, all specimens and material collected under the authority of this license shall, on request, be loaned to the Western Australian Museum. Also, the unused portion or portions of any specimen collected under the authority of this license shall be offered for donation to the Western Australian Museum or made available to other scientific workers if so required.

**DEPARTMENT OF ENVIRONMENT AND CONSERVATION**

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242

Correspondence: **Locked Bag 30**
**Bentley Delivery Centre WA 6983**

**PAGE** 2
**NO.** SF008484
**PERSON NO.** 78973

**DATE OF ISSUE** 24/02/2012
**VALID FROM** 24/02/2012
**DATE OF EXPIRY** 09/04/2012

**LICENSING OFFICER**

**LICENSEE:** DR V SAFFER
**ADDRESS** SENIOR BIOLOGIST
KEITH LINDBECK & ASSOCIATES
P.O. BOX 144
BULLCREEK
W.A. 6149

(VI)

**DEPARTMENT OF ENVIRONMENT AND CONSERVATION**

Enquiries. 17 DICK PERRY AVE. KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242

Correspondence: **Locked Bag 30**
**Bentley Delivery Centre WA 6983**

**PAGE NO.** 1
SF008484
**PERSON NO.** 78973

**RECEIPT NO.** **AMOUNT** $0.00

**WILDLIFE CONSERVATION ACT 1950**
**REGULATION 17**

# LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES

**THE UNDERMENTIONED PERSON MAY TAKE FAUNA FOR RESEARCH OR OTHER SCIENTIFIC PURPOSES AND WHERE AUTHORISED, KEEP IT IN CAPTIVITY, SUBJECT TO THE FOLLOWING AND ATTACHED CONDITIONS, WHICH MAY BE ADDED TO, SUSPENDED OR OTHERWISE VARIED AS CONSIDERED FIT.**

**DIRECTOR GENERAL**

## CONDITIONS

1 THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE WILDLIFE CONSERVATION ACT AND REGULATIONS AND ANY NOTICES IN FORCE UNDER THIS ACT AND REGULATIONS.

2 UNLESS SPECIFICALLY AUTHORISED IN THE CONDITIONS OF THIS LICENCE OR OTHERWISE IN WRITING BY THE DIRECTOR GENERAL, SPECIES OF FAUNA DECLARED AS LIKELY TO BECOME EXTINCT, RARE OR OTHERWISE IN NEED OF SPECIAL PROTECTION SHALL NOT BE CAPTURED OR OTHERWISE TAKEN.

3 NO FAUNA SHALL BE TAKEN FROM ANY NATURE RESERVE, WILDLIFE SANCTUARY, NATIONAL PARK, MARINE PARK, TIMBER RESERVE OR STATE FOREST WITHOUT PRIOR WRITTEN APPROVAL OF THE DIRECTOR GENERAL. NO FAUNA SHALL BE TAKEN FROM ANY OTHER PUBLIC LAND WITHOUT THE WRITTEN APPROVAL OF THE GOVERNMENT AUTHORITY MANAGING THAT LAND.

4 NO ENTRY OR COLLECTION OF FAUNA TO BE UNDERTAKEN ON ANY PRIVATE PROPERTY OR PASTORAL LEASE WITHOUT THE CONSENT IN WRITING OF THE OWNER OR OCCUPIER, OR FROM ANY ABORIGINAL RESERVE WITHOUT THE WRITTEN APPROVAL OF THE DEPARTMENT OF INDIGENOUS AFFAIRS.

5 NO FAUNA OR THEIR PROGENY SHALL BE RELEASED IN ANY AREA WHERE IT DOES NOT NATURALLY OCCUR, NOR BE HANDED OVER TO ANY OTHER PERSON OR AUTHORITY UNLESS APPROVED BY THE DIRECTOR GENERAL, NOR SHALL THE REMAINS OF SUCH FAUNA BE DISPOSED OF IN SUCH MANNER AS TO CONFUSE THE NATURAL OR PRESENT DAY DISTRIBUTION OF THE SPECIES.

6 THIS LICENCE AND THE WRITTEN PERMISSION REFERRED TO AT CONDITIONS 3 & 4 MUST BE CARRIED BY THE LICENSEE OR AUTHORISED AGENT AT ALL TIMES FOR THE PURPOSE OF PROVING THEIR AUTHORITY TO TAKE FAUNA WHEN QUESTIONED AS TO THEIR RIGHT TO DO SO BY A WILDLIFE OFFICER, ANY OTHER STATE OR LOCAL GOVERNMENT EMPLOYEE OR ANY MEMBER OF THE PUBLIC.

7 **********ANY INTERACTION INVOLVING GAZETTED THREATENED FAUNA THAT MAY BE HARMFUL AND/OR INVASIVE MAY REQUIRE APPROVAL FROM THE COMMONWEALTH DEPT OF THE ENVIRONMENT AND WATER RESOURCES, PHONE 02 6274 1900. INTERACTION WITH SUCH SPECIES IS CONTROLLED BY THE COMMONWEALTH GOVERNMENT'S "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999" & "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION REGULATIONS 2000" AS WELL AS DEC'S WILDLIFE CONSERVATION ACT & REGULATIONS.**********

8 NO BIOPROSPECTING INVOLVING THE REMOVAL OF SAMPLE AQUATIC AND TERRESTRIAL ORGANISMS (BOTH FLORA AND FAUNA) FOR CHEMICAL EXTRACTION AND BIOACTIVITY SCREENING IS PERMITTED TO BE CONDUCTED WITHOUT SPECIFIC WRITTEN APPROVAL BY THE DIRECTOR GENERAL OF DEC.

9 FURTHER CONDITIONS (NUMBERED ( TO 9 ) ARE ATTACHED.

**PURPOSE** LEVEL 2 FAUNA SURVEY USING CAGE TRAPS, ELLIOTT TRAPS, DRY PIT TRAPS AND FUNNEL TRAPS AT MT MASON AND MT IDA, CENTRAL YILGARN IRON PROJECT AREA (CYIP) FOR JUPITER MINES LIMITED.

**AUTHORISED PERSONS**
MS ERICA MACINTYRE
DR RONALD SNOOK
DR WESLEY BANCROFT

# WILDLIFE CONSERVATION REGULATIONS 1970

## Regulation 17:- Licence to Take Fauna for Scientific Purposes

FURTHER CONDITIONS (OF LICENCE NUMBER SF008484)

1. The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.

2. Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers etc and signs erected by the licensee and all traps shall be removed, all pitfalls shall be refilled or capped and the study area returned to the condition it was in prior to the research/capture program. During any break in research, cage traps should be removed and pitfalls either removed, capped or filled with sand.

3. No collecting is to be undertaken in areas where it would impinge on pre-existing scientific research programs.

4. Any form of colour marking of birds or bats shall only be undertaken in accordance with the requirements of the Australian Bird and Bat Banding Scheme.

5. Any inadvertently captured specimen of fauna which is declared as likely to become extinct, rare or otherwise in need of special protection is to be released immediately at the point of capture. Where such a specimen is injured or deceased, the licensee shall contact Department of Environment and Conservation licensing staff at Kensington (08 9423 2434) for advice on disposal. Records are to be kept of any fauna so captured and details included in the report required under further condition 6 below.

6. Within one month of the expiration of this licence, the holder shall submit an electronic return detailing the locality, site, geocode, date and number of each species captured, sighted or vouchered during the currency of the licence, into the Department of Environment and Conservation Fauna Survey Database (DECFSD). A copy of any paper, report or thesis resulting from the research shall on completion be lodged with the Director General. If a renewal of this licence is required, the licensee shall submit a written progress report for activities undertaken during this licence period prior to the expiry of this licence.

7. Not more than ten specimens of any one protected species shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take large series in order to obtain adequate statistical data the collector will proceed with circumspection and justify their actions to the Director General in advance.

8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected which represents a significant extension of geographic range shall be donated on request to the Western Australian Museum.

9. To prevent any unnecessary collecting in this State, all specimens and material collected under the authority of this license shall, on request, be loaned to the Western Australian Museum. Also, the unused portion or portions of any specimen collected under the authority of this license shall be offered for donation to the Western Australian Museum or made available to other scientific workers if so required.

Keith Lindbeck and Associates
Environmental Management Consultants
ABN 36 150 274 469

Jupiter Mines Limited

# CENTRAL YILGARN IRON PROJECT

## *MT MASON PROJECT AND PROPOSED HAUL ROAD*

# TARGETED EPBC FAUNA SURVEY

Report Prepared for: ***Jupiter Mines Limited***

Report Prepared by: Keith Lindbeck and Associates
PO Box 144
BULLCREEK WA 6149
Telephone: 08 93320671
Facsimile: 08 93320672
Mobile: 0412 419 468
E-mail: keith@keithlindbeck.com.au
ABN: 36 140 274 469

**March 2013**

## TABLE OF CONTENTS

**PAGE NO.**

**TABLES**



**FIGURES**



**APPENDIX**

# 1.0 INTRODUCTION

## 1.1 BACKGROUND

Jupiter Mines Limited (Jupiter) is engaged in the exploration and development of mineral resources at its Central Yilgarn Iron Project (CYIP) area. The CYIP area is located approximately 530 km northeast of Perth and 110 km northwest of Menzies and consists of three project areas: Mt Alfred, Mt Mason and Mt Ida (Figure 1). All three projects are 100% owned by Jupiter. The Mt Alfred project lies within the northern portion of the Illaara Greenstone Belt some 59km northwest of the Mt Mason and Mt Ida projects. The Mt Mason and Mt Ida projects lie within the northern portion of the Mount Ida Greenstone Belt which is located along the eastern boundary of the Southern Cross Granite-Greenstone Terrane.

High-grade hematite mineralisation at Mt Mason project represents a potential low cost DSO project which upon completion would lead to mining at the Mount Ida magnetite deposit. The Mt Mason DSO project will require a haul road from the Mt Mason project area to the port of Esperance via the Menzies-Sandstone Road.

The Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) Protected Matters Search Tool provides results of protected matters, including fauna species listed under the Federal *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*. The results of the searches for the CYIP area are presented below (Table 1):

**Table 1 - EPBC Protected Matters Search Tool Results for Fauna in CYIP area**

| Scientific Name | Common Name | Status* |
|---|---|---|
| *Leipoa ocellata* | Malleefowl | Vulnerable |
| *Apus pacificus* | Fork-tailed Swift | Migratory |
| *Ardea alba* | Great Egret | Migratory |
| *Merops ornatus* | Rainbow Bee-eater | Migratory |
| *Acanthiza iredalei iredalei* | Slender-billed Thornbill | Vulnerable |

* Status defined in Appendix 1.

Jupiter commissioned Keith Lindbeck and Associates (KLA) to undertake a targeted EPBC fauna survey of Mt Mason's disturbance footprint and the associated Haul Road (Figure 2).

## 1.2 PURPOSE AND SCOPE

The objective of the targeted EPBC fauna survey was to ground truth the vegetation within the Mt Mason disturbance footprint and the proposed Haul Road and identify suitable habitat for the listed species.

The purpose of this report is to document the methodology and results of the targeted EPBC fauna survey conducted by KLA in March and April 2012.

The scope of work was to:

- conduct a targeted EPBC fauna survey in all uncleared areas within the footprint of proposed disturbance at Mt Mason and the associated Haul Road,
- determine areas of habitat suitable for all species listed in Table 1 in these areas,
- provide an impact risk assessment for selected targeted vertebrate fauna species, and
- provide recommendations, including the management of selected fauna of conservation significance and their habitats.

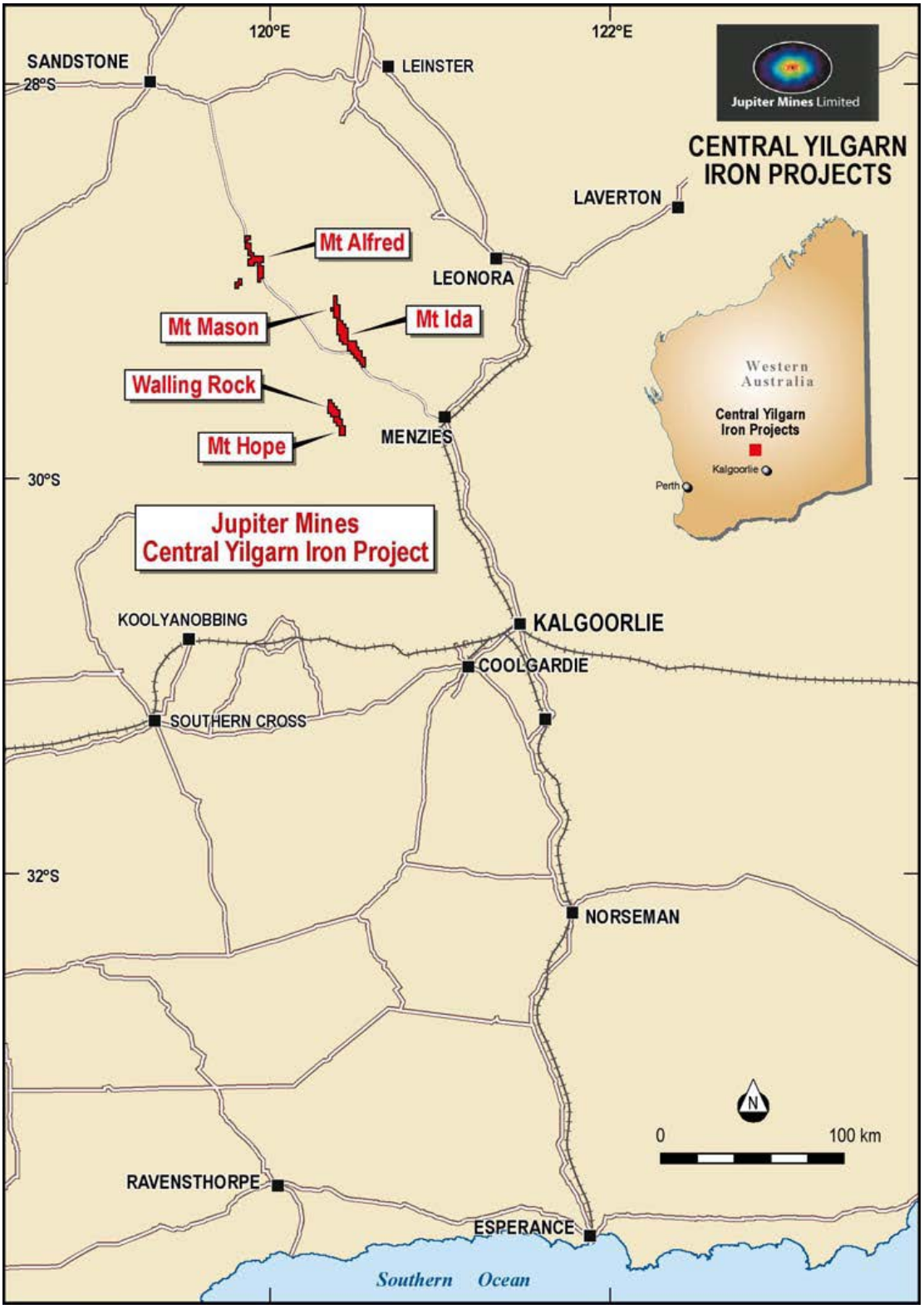



**Figure 1 - Location of Jupiter's CYIP**

# 2.0 DESCRIPTION OF THE SPECIES

## 2.1 MALLEEFOWL *Leipoa ocellata*

Malleefowl (*Leipoa ocellata,* Gould, 1840) are large ground dwelling birds belonging to the Megapodiidae family. This species belongs to a small group of mound builders where the mound is used as an external heat source to incubate their eggs (Clark 1964). The Malleefowl is a long-lived sedentary species with an average lifespan of roughly 15 years. Reaching approximately 60cm in height and 1.5 - 2kg in weight, they are roughly the size of a small turkey (Benshemesh 2007). They have a unique appearance with a distinctly barred upper body of grey, white, black, buff and pale chestnut feathers, with a crest extending from the front of the crown to the nape which is raised when the bird is alarmed (Pizzey and Knight 1999) (Figure 2).

**Figure 2 - Adult Malleefowl *Leipoa ocellata***

### 2.1.1 General Ecology

The Malleefowl occupies semi-arid to arid regions of Western Australia, inhabiting dense shrublands and thickets of Mallee (*Eucalyptus spp*.), Boree (*Melaleuca lanceolata*), Bowgada (*Acacia linophylla*), or areas which form dense leaf litter (Johnstone and Storr 1998). Malleefowl prefer habitat that is long unburnt for breeding and shelter (Benshemesh 2007). However Malleefowl will feed in recently burnt areas (Benshemesh 1992, Marchant and Higgins 1993).

The Malleefowl builds mounds that utilise heat from the sun and composting vegetation to incubate their eggs (Figure 3). Most heat is generated from the fermentation of vegetative material used to create the mound, along with solar energy used later in the season as the leaf litter dries out (Johnstone and Storr 1998). The size of Malleefowl mounds vary. However, an average mound spans 5m in diameter and can be up to 1m high (Benshemesh 2007)

**Figure 3 - Malleefowl Mound**

Malleefowl are usually solitary and occupy a home range of between 0.5 and 4.6 $km^2$ (Benshemesh 1992). Individuals are known to move distances of 15 km or greater over a matter of weeks (Sims 2000, cited in Parsons *et al.* 2009). Established monogamous breeding pairs usually inhabit a similar area throughout the year and come together for breeding. While both sexes build the mound, once the female has laid the eggs, the male usually maintains the mound on his own. Birds generally breed annually (Marchant and Higgins 1993) with the breeding season lasting 11 months. Following mound preparation, eggs are laid from mid-August to late January and hatchlings appear from November (Johnstone and Storr 1998). The precocial chicks are independent from hatching having no contact with either their parents or siblings (van der Waag 2007). While 50% to 85% of eggs hatch (Frith 1959), generally more than 80% of chicks die within the first few weeks of life from predation and 'metabolic stress' (Priddel and Wheeler 1994).

Malleefowl feed opportunistically and will often feed on whatever food sources are abundant in the area (van der Waag 2007). Their omnivorous diet can consist of seeds, native herbs, flower buds, fruits and foliage of different plant species, as well as invertebrates. Malleefowl will drink water but can easily survive during summer when surface water is unavailable (DEC 2012).

### 2.1.2 Distribution of the Malleefowl

Originally, Malleefowl were widespread and common across the southern arid and semiarid zone. However the species has now become patchily distributed due to the effects of habitat clearing and fox predation (Johnstone and Storr 1998). Unlike other megapods that prefer damp forest, the Malleefowl does not inhabit the higher rainfall area of the Swan Coastal Plain and the wetter parts of the south coast of Western Australia (Figure 4).

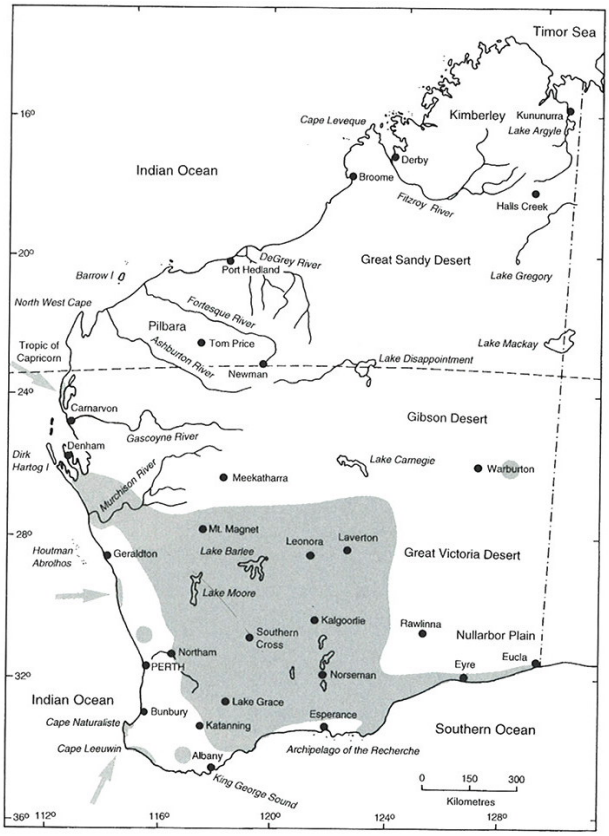



**Figure 4 - Distribution of Malleefowl**

### 2.1.3 Malleefowl Conservation Status

The Malleefowl is protected under Federal and State legislation: it is classified as Vulnerable: "Taxa facing a high risk of extinction in the wild in the medium-term future" under the EPBC Act 1999 and is also listed as Schedule 1: "Rare and likely to become extinct" under the WCA 1950. The DSEWPaC administers the EPBC Act 1999 and the Department of Environment and Conservation (DEC) administers the WCA 1950.

The Malleefowl is also listed as Vulnerable on the 2011 IUCN Red List of Threatened Species.

### 2.1.1 Known Presence in the CYIP Area

Numerous sightings and evidence of Malleefowl have been recorded in Jupiter's CYIP area. A list of potential mounds was provided to the zoological team and these were audited before and during the survey.

Malleefowl and evidence of their presence have been recorded regionally elsewhere (Burbidge *et al.* 1995, Chapman and Pronk 1997, Ninox 2009, Biota 2011, KLA 2011).

## 2.2 FORK-TAILED SWIFT *Apus pacificus*

The Fork-tailed Swift is a medium to large member of the Apodidae Family. It has a length of 18–21 cm is blackish with a pale throat, white rump and long, thin, deeply forked tail when fanned (Figure 5).

**Figure 5 – Fork-tailed Swift *Apus pacificus***

### 2.2.1 General Ecology

The Fork-tailed Swift does not breed in Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. They probably roost aerially, but are occasionally observed to land (Higgins 1999). The species food items within Australia are not well known, however, the species is known to be insectivorous. Studies have recorded the Swift eating small bees, wasps, termites and moths (Johnstone and Storr 1998).

### 2.2.2 Distribution of the Fork-Tailed Swift

The Fork-tailed Swift breeds in northeast and mid-east Asia and spends the northern winters in south New Guinea and most of Australia expect for a small arid inland area (Figure 6) (Johnstone and Storr 1998). It is a visitor to most parts of Western Australia (except the small arid interior extending south) beginning to arrive in the Kimberley in late September, the Pilbara and Eucla in November and in the southwest in mid-December. It leaves in late April. While it is common in the Kimberley, it is uncommon near the northwest, west and southeast coasts and rare or scare elsewhere.

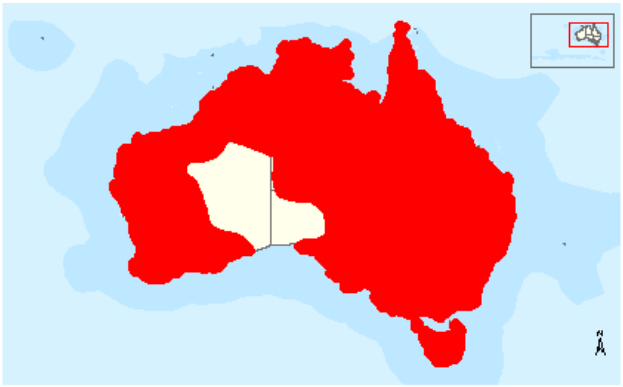


**Figure 6 - Distribution of Fork-tailed Swift**

### 2.2.3 Fork-Tailed Swift Conservation Status

The Fork-tailed Swift is listed as Migratory and Marine under the EPBC Act 1999.

It is also in international agreements between the Government of Australia and:

- the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6 (JAMBA),
- the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22 (CAMBA), and
- the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24 (ROKAMBA).

The Fork-tailed Swift is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

### 2.2.4 Known Presence in the CYIP Area

No sightings of the Fork-tailed swift were made during the recent Level 2 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas and the species has not been recorded during other surveys conducted in the regional area (Burbidge *et al.* 1995, Chapman and Pronk 1997, Ninox 2009, Terrestrial Ecosystems 2011, Biota 2011, KLA 2011).

## 2.3 GREAT EGRET *Ardea alba modesta*

The Great Egret is a moderately large bird (83–103 cm in length, 700–1200 g in weight) with white plumage, a black or yellow bill and long reddish and black legs (DSWEPaC 2012) (Figure 7).

**Figure 7 – Great Egret *Ardea modesta***

### 2.3.1 General Ecology

Great Egrets often occur solitarily, or in small groups when feeding. They roost in large flocks that may consist of hundreds of birds. The species usually nest in

colonies and rarely in solitary pairs. Colonies may be mono-specific or commonly mixed with other egrets, herons, ibises, spoonbills and/or cormorants.

The Great Egret usually frequents shallow waters and has been reported in a wide range of wetland type habitats. The Great Egret may retreat to permanent wetlands or coastal areas when other wetlands are dry. This may occur annually in some regions with regular wet and dry seasons or erratically where the availability of wetland habitat is also erratic.

In Australia, the breeding season of the Great Egret is variable, depending to some extent on rainfall but generally extends from November to April with pairs at southern latitudes breeding in spring and summer (particularly November and December), and pairs at more northerly latitudes breeding in summer and autumn (DSEWPaC 2012).

Breeding sites are usually located in wooded and shrubby swamps including mangrove forests in the Top End, Melaleuca swamps on the eastern coast of Australia and south-western Western Australia and mixed eucalypt/acacia/lignum swamps in the Channel Country and Murray-Darling Basin (DSEWPaC 2012).

Pairs construct a shallow platform-like nest of loosely woven sticks in the upper strata of trees or shrubs standing in or near water or sometimes in inundated reed beds. Females lay two to six, but usually three to five, pale blue or pale green eggs. The eggs are incubated by both parents, but mostly by the female, for a period of 23–29 days. Nestlings are fed and brooded by both parents. The young begin to clamber from the nest at 25–37 days of age. Fledged young make their final departure from the nest or colony at 55–88 days of age (DSEWPaC 2012).

The Great Egret has a diverse diet that includes fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammals.

### 2.3.2 Distribution of the Great Egret

In Australia, the distribution of Great Egrets is widespread (Figure 8). They occur in all states/territories of mainland Australia and in Tasmania. The Great Egret is also known as the White Egret, and distinguished from the Eastern Great Egret, the subspecies in Western Australia is referred to as *Ardea alba modesta*.

**Figure 8 - Distribution of Great Egret**

### 2.3.3 Great Egret Conservation Status

The Great Egret is listed as Migratory Wetland and Marine under the EPBC Act 1999.

It is also listed under the JAMBA and CAMBA Migratory Bird agreements.

The Great Egret is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

### 2.3.4 Known Presence in the CYIP Area

No sightings of the Great Egret were made during the recent Level 2 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas, and the species has not been recorded during other previous survey in the regional area (Burbidge *et al.* 1995, Chapman and Pronk 1997, Ninox 2009, Terrestrial Ecosystems 2011, Biota 2011, KLA 2011).

## 2.4 RAINBOW BEE-EATER *Merops ornatus*

The Rainbow Bee-eater is a medium-sized bird and the only species of bee-eater in Australia (Figure 9).

**Figure 9 – Rainbow Bee-eater *Merops ornatus***

### 2.4.1 General Ecology

The Rainbow Bee-eater is a migratory species whose movement patterns across Australia are not fully understood (DSEWPaC 2012). Generally, the Rainbow Bee-eater migrates north and spends the non-breeding period in northern Australia, Papua New Guinea and eastern Indonesia. In Western Australia, passage north occurs mostly from March to May and generally birds start moving south again late August and into September. In the far north some birds may be present all year.

Populations of the Rainbow Bee-eater gather together and assemble into flocks before migration. The migrating flocks, which can consist of tens to hundreds or thousands of birds often fly high above the ground when on passage.

Habitat for this species is also varied and includes open forests and woodlands, shrublands, various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches. The Bee-eater usually nests in loose colonies that may contain up to about 50 pairs, but some pairs nest solitarily. They nest in burrows with entrances located on the ground or in banks or sandy slopes.

### 2.4.2 Distribution of the Rainbow Bee-Eater

The Rainbow Bee-eater is widely distributed throughout Australia and eastern Indonesia. It is distributed across much of mainland Australia, and occurs on several near-shore islands. It is not found in Tasmania, and is thinly distributed in the most arid regions of central and Western Australia.

**Figure 10 - Distribution of Rainbow Bee-eater**

### 2.4.3 Rainbow Bee-Eater Conservation Status

The Rainbow Bee-eater is listed as Migratory Terrestrial and Marine under the EPBC Act 1999.

It is also listed under the JAMBA Migratory Bird agreement.

The Rainbow Bee-eater is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

### 2.4.4 Known Presence in the CYIP Area

Being a migratory species, the presence of the Rainbow Bee-eater is dependent on the timing of surveys. Interestingly, the Rainbow Bee-eater was not recorded during the recent Spring 2011 or Autumn 2012 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas of Jupiter's CYIP.

While the Rainbow Bee-eater has been recorded during some regional surveys (Burbidge *et al.* 1995, Chapman and Pronk 1997 and Biota 2011), it has not been recorded in others (Ninox 2009, Terrestrial Ecosystems 2011 and KLA 2011).

## 2.5 SLENDER-BILLED THORNBILL *Acanthiza iredalei iredalei*

The Slender-billed Thornbill (western) is a small passerine measuring approximately 10 cm in length (Figure 11).

**Figure 11 – Slender-billed Thornbill *Acanthiza iredalei iredalei***

### 2.5.1 General Ecology

The Slender-billed Thornbill (western) usually occurs in pairs, or in small flocks of up to ten birds (DSEWPaC 2012). It may congregate into larger flocks from time to time, given that flocks of up to 20 and, rarely, up to 60 birds have been recorded in other subspecies of the Slender-billed Thornbill. The Slender-billed Thornbill (western) sometimes associates with other birds, such as Chestnut-rumped Thornbills *Acanthiza uropygialis*, Southern Whitefaces *Aphelocephala leucopsis* and Orange Chats *Epthianura aurifrons*. However, it breeds in solitary pairs.

The Slender-billed Thornbill (western) usually occurs in chenopod shrublands that are dominated by samphires or *Maireana* and *Atriplex* associations. It occasionally occurs in acacia shrublands and mangroves adjacent to more preferred habitat. It feeds on insects including caterpillars, grasshoppers, beetles, bees and ants and it also spiders and, occasionally, centipedes.

### 2.5.2 Distribution of the Slender-Billed Thornbill

The Slender-billed Thornbill (western) is a resident or sedentary subspecies that is not known to undertake any long-distance movements. The Slender-billed Thornbill (western) occurs in arid and semi-arid regions of southern Western Australia and south-western South Australia (Figure 12). Its known distribution extends from near Carnarvon in Western Australia, east though central Western Australia, and across the Nullarbor Plain to Whyalla, Port Augusta and Port Davis in South Australia.

There have not been any recent, major changes in the extent of occurrence, but the extent of occurrence does appear to have declined in the past. The distribution of the Slender-billed Thornbill (western) formerly extended to near Mullewa in south-western Western Australia a cattle station in the south of the Northern Territory, Moorilyanna Soak and Wantapella Swamp in northern South Australia, and Leigh Creek in eastern South Australia but there have been no recent records of the subspecies from any of these locations.

The Slender-billed Thornbill (western) is estimated to occur in seven subpopulations (Matthew 2006, pers. comm.) with three occurring in Western Australia. The seven subpopulations are located in the following areas:

- Carnarvon-Shark Bay region of Western Australia,
- central-southern Western Australia,
- Nullarbor Plain.

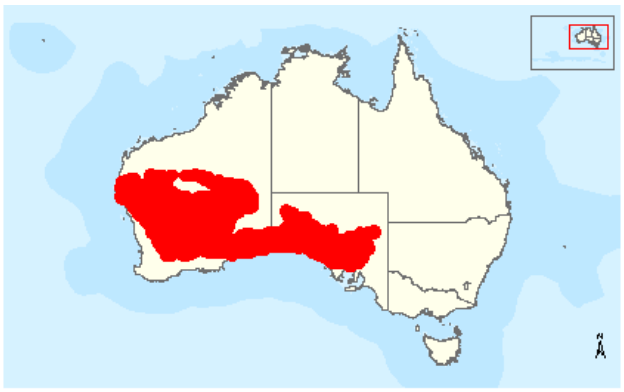


**Figure 12 - Distribution of Slender-billed Thornbill**

### 2.5.3 Slender-Billed Thornbill Conservation Status

The Slender-billed Thornbill is classified as Vulnerable: "Taxa facing a high risk of extinction in the wild in the medium-term future" under the EPBC Act 1999.

The Slender-billed Thornbill is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

### 2.5.4 Known Presence in the CYIP Area

No sightings of the Slender-billed Thornbill were made during the recent Level 2 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas. This species has been recorded during at least one regional survey (Burbidge *et al.* 1995) and not in others (Chapman and Pronk 1997, Ninox 2009, Terrestrial Ecosystems 2011, Biota 2011, KLA 2011).

## 2.6 BIOPHYSICAL ENVIRONMENT

### 2.6.1 Location

The CYIP area lies approximately 30 km northwest of Lake Ballard (an ephemeral salt lake), 65 km east of Lake Barlee (an intermittent salt lake) and 110 km northwest of Menzies in the Goldfields district of Western Australia (Figure 13). The CYIP tenements cover an area of approximately 27,500 ha and are located within three different pastoral leases, Perrinvale Station to the north, Walling Rock Station to the west and Riverina Station to the east (Figure 14).

Within the CYIP, the Mt Mason tenement is located in the southern portion, although north of Mt Ida (Figure 1) and the proposed haul road extends from the eastern boundary of Mt Mason west of Mt Ida and continues south to join the existing Sandstone-Menzies Road.

### 2.6.2 Regional setting

The Interim Biogeographic Regionalisation for Australia (IBRA) divides the Australian continent into 85 bioregions and 403 subregions (Department of the Environment, Water, Heritage and the Arts 2009). The CYIP area is located within the Murchison IBRA region and (MUR1) East Murchison subregion (Cowan 2001).

The East Murchison bioregion which totals over seven million hectares is characterised by Mulga Woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and *Halosarcia* shrubland (Cowan 2001). The area is characterised by:

- internal drainage,
- extensive areas of elevated red desert sandplains with minimal dune development,
- salt lake systems that are associated with the occluded Palaeodrainage system, and
- broad plains of red-brown soils and breakaway complexes as well as red sandplains (Cowan 2001).

### 2.6.3 Vegetation and Flora

The CYIP is located within the Austin District of the Eremaean Botanical Province characterised by predominantly mulga low woodland on plains, and scrub on hills, with tree steppe of *Eucalyptus* spp. and *Triodia basedowii* on sand plains. (Beard 1990).

Numerous flora and vegetation mapping surveys have previously been undertaken in the area (Paul Armstrong and Associates 2008, Meissner and Owen 2010, Outback Ecology 2010).

Vegetation and flora surveys of the Mt Mason project area have been undertaken by Native Vegetation Solutions (NVS) and have included:

- Level 2 vegetation survey of the Mt Mason project area on 3-7 October 2011 (NVS 2012a).
- Level 1 flora survey of the proposed haul road from Mt Mason to the Sandstone-Menzies public road from 29-31 May 2012 (NVS 2012b).

These surveys were undertaken in accordance with EPA Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002)

and EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004).

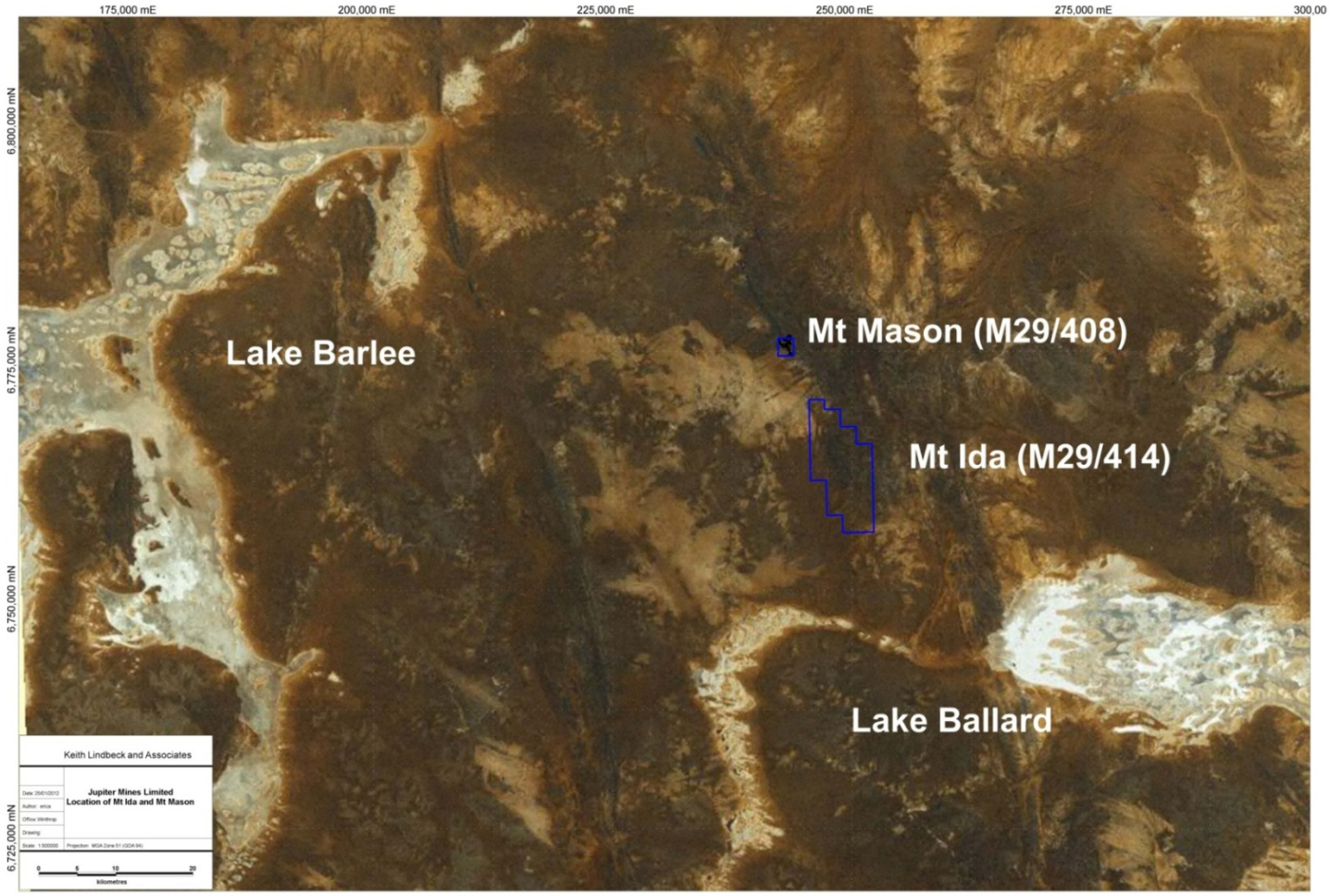



**Figure 13 - Location of Mt Mason and Mt Ida Tenements**

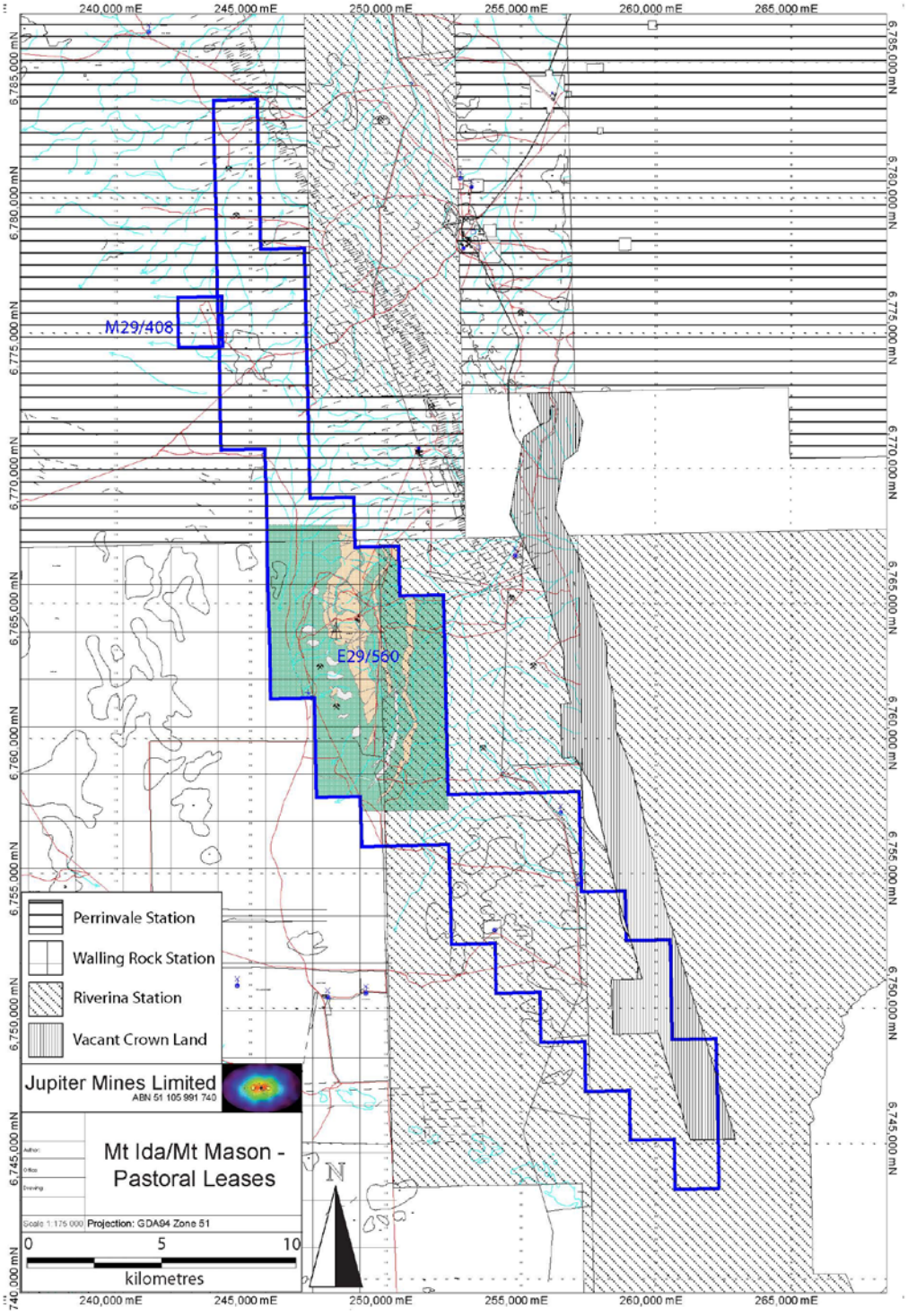



**Figure 14 - Mt Mason and Mt Ida Pastoral Leases**

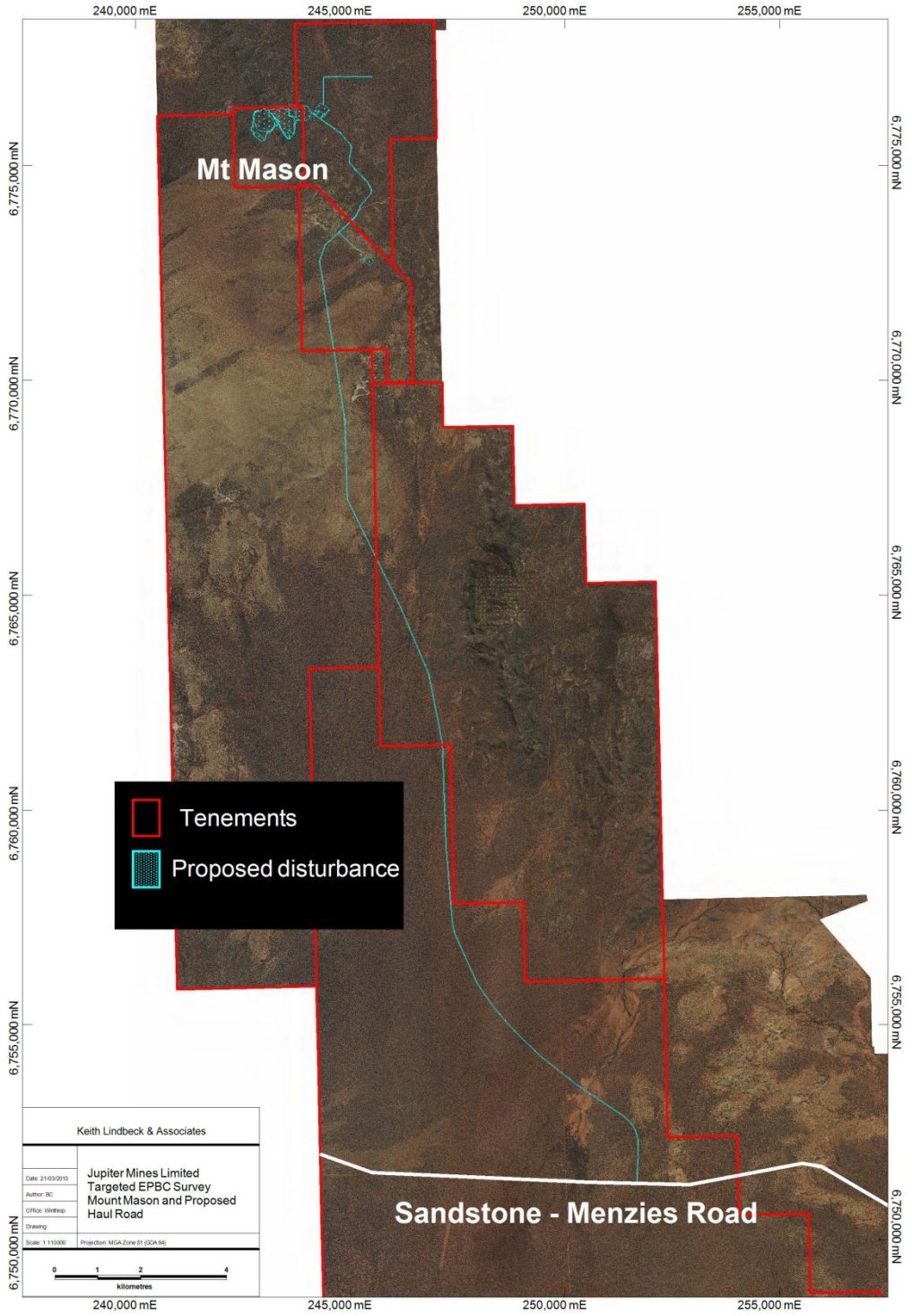



**Figure 15 - Location of Mt Mason and proposed Haul Road**

# 3.0 METHODOLOGY

## 3.1 TARGETED FAUNA SURVEY

Surveys were conducted in March (2, 3, 4, 5 and 8) and April (2 and 3) 2012 to:

- ground truth the vegetation communities along the survey route,
- inspect the fauna habitats along the survey route,
- determine the potential within these habitats for the targeted species to utilise these areas,
- extend these searches outside of the proposed haul road route to determine if the habitats are limited to the survey or are present elsewhere, and
- identify targeted species present at the time through direct observation and hearing of bird calls, and indirect evidence including mounds, hollows, tracks, scats, and feathers etc.

In the case of the identification of a Malleefowl mound, the following was recorded:

- GPS location
- photograph taken,
- determination of status of the mound and if inactive, approximately when last it was used, and
- approximate size (diameter in metres).

### 3.1.1 Targeted EPBC fauna species

Jupiter provided KLA with outlines of the areas to be surveyed.

#### 3.1.1.1 Mt Mason footprint of disturbance

A line survey approach was adopted for the proposed footprint of disturbance at Mt Mason (Figure 16). Between two and three personnel walked in parallel lines across the areas proposed for disturbance. The distance between lines was dictated by the landform and density of vegetation inasmuch as lines were as close as 10 m apart in areas of dense vegetation and others were further apart in areas of sparse understorey and areas of Banded Iron Formation (BIF) which are not suitable habitat for any of the EPBC listed species.

#### 3.1.1.2 Proposed Haul Road

A line survey approach was also adopted for the proposed haul road that ensured all parts of the route were surveyed (Figure 17). While the proposed haul road will only extend to approximately 20m in width, an area of 100 m was surveyed to allow for flexibility in design. Up to five qualified personnel walked in parallel straight lines approximately 20 m apart from the northern end of the proposed haul road to the southern end. GPS units were used by the personnel on the eastern and western extents of the proposed route to trace the exact route and the remaining three personnel maintained equal distances from other members of the team.

## 3.2 PERSONNEL AND REPORTING

The following personnel were involved in the surveys:

- Dr Vi Saffer *BSc (Biol.) Hons (Biol.) PhD (Biol.)*: Senior Zoologist, KLA,
- Ms Erica MacIntyre *BSc (Conservation and Wildlife Biol. and Env. Sci.) Hons (*in prep.): Project Ecologist, KLA
- Dr Ronald Snook *BSc BVMS*
- Ms Katherine Edwards *BSc (Conservation and Wildlife Biol.) Hons (Biol)*

- Mr Hamish Burnett, Field Assistant, TAFE Certificate II Conservation and Land Management
- Ms Polly Hammond, Environmental Coordinator (Approval) Jupiter Mines Limited.

- Mr Keith Lindbeck *BA, WDA, Dip Environ Studies;* Principal, KLA, reviewed the report.

### 3.3 LICENCE AND PERMITS

A license was not required for the targeted EPBC fauna survey.

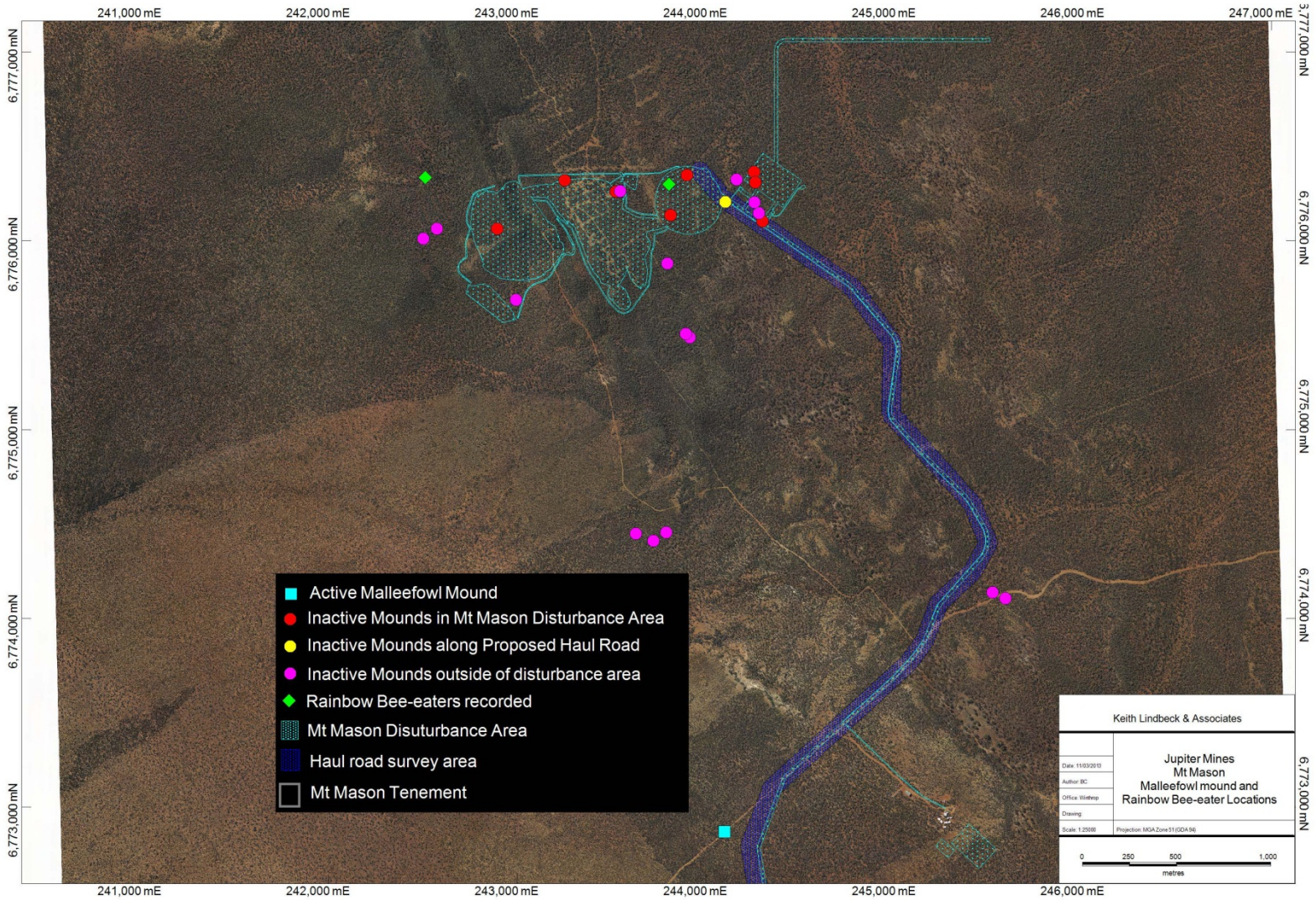



**Figure 16 - Mt Mason Disturbance Area with Malleefowl Mound Locations and Rainbow Bee-eater Recordings**

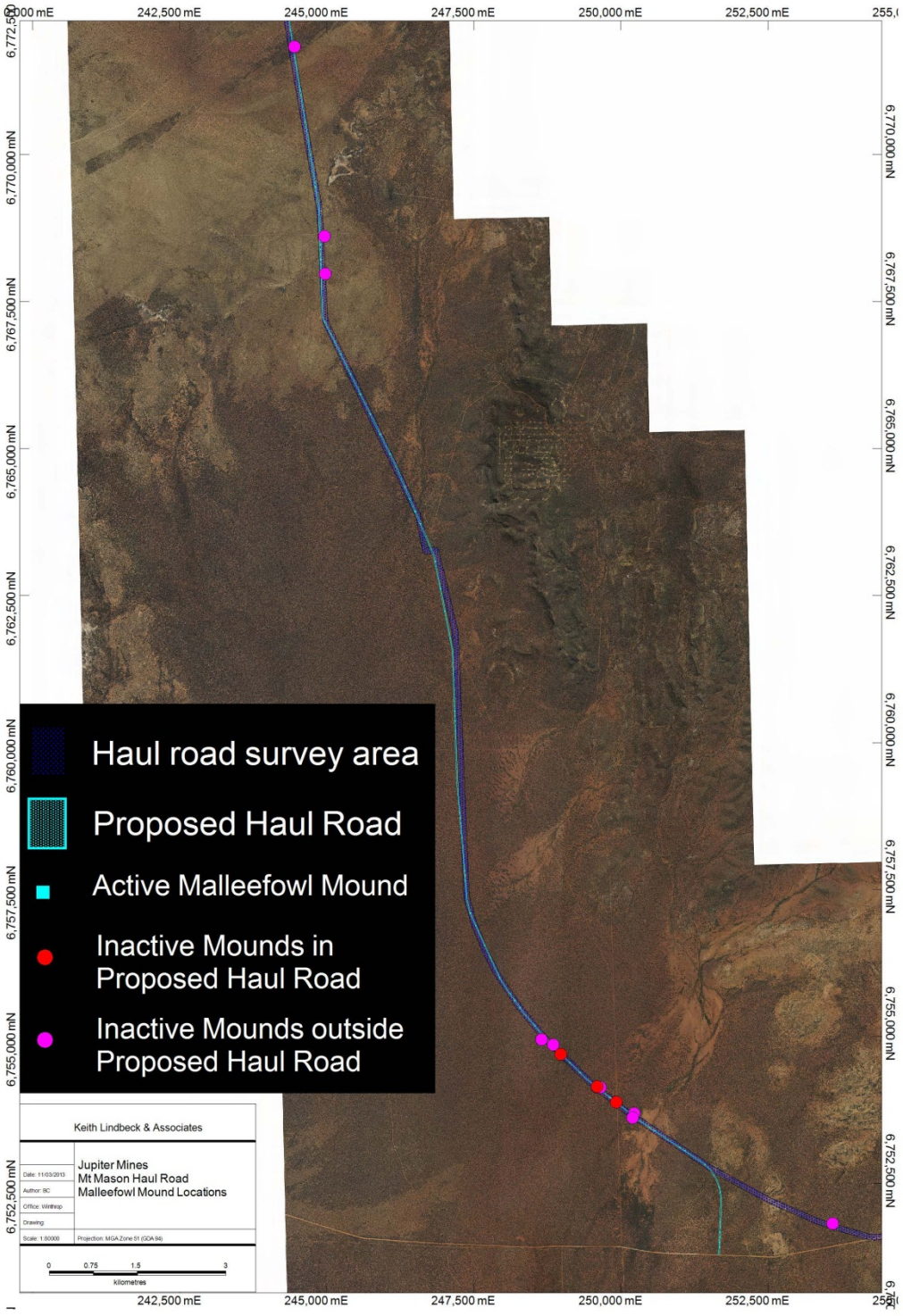



**Figure 17 - Haul Road with Malleefowl Mound Locations**

# 4.0 RESULTS AND DISCUSSION

Just under 40 person hours were spent traversing the disturbance footprint for Mt Mason (and associated infrastructure) and approximately 77 person hours were spent inspecting the area proposed for the haul road.

## 4.1 POTENTIAL FAUNA HABITAT

Nine vegetation groups were described in the proposed Mt Mason disturbance area during the flora survey area (NVS 2012a):

- *Thryptomene* Shrubland
- Open Mulga woodland over Laterite
- *Allocasuarina* over *Calytrix* shrubland
- Mulga over *Eremophila forrestii susbsp forrestii* on hills and ridges
- Mulga over *Prostanthera althoferi subsp althoferi* on hills and ridges
- Mulga over *Philotheca brucei subsp brucei* on hills and ridges
- *Mulga over Eremophila forrestii subsp forrestii* on flats
- *Acacia burkittii* shrubland within drainage lines
- *Acacia cockertoniana* over *Eremophila oldfieldii* and *Eremophila pantonii* on flats.

Results from the flora survey of the proposed haul road identified 12 vegetation groups (NVS 2012b).

- Mulga Shrubland with occasional Eucalypts (1a)
- Mulga woodland-floodplain (1b)
- Mulga shrubland with Philotheca brucei subsp brucei (1g)
- Mulga open shrubland-drainage (1k)
- Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or *Prostanthera althoferi* subsp. *althoferi* and/or *Eremophila forrestii* subsp. *forrestii* low shrubland (1n)
- Mulga over mixed shrubland (1o)
- *Acacia quadrimarginea*/*A. cockertoniana* open shrubland (2g)
- *Acacia effusifolia*/*Eucalyptus* mallee and other mixed shrublands burnt sandplain (3b)
- *Acacia effusifolia* Shrubland- transitional (3c)
- *Callitris* with scattered Eucalypt woodland- sandplain (4)
- *Eucalyptus lesouefii* open woodland (9a)
- *Eucalyptus salubris* woodland (9b).

### 4.1.1 Habitat for Malleefowl

Of the habitat identified during the flora surveys, the majority of the vegetation groups identified at the project comprise potential malleefowl breeding or foraging habitat. The majority of the inactive malleefowl mounds recorded were located on:

- Mulga over *Eremophila*
- Mulga over *Eremophila forrestii* (on flats and undulating hills)
- Mulga shrubland with occasional Eucalypts
- *A.effusiola*/*Eucalyptus* mallee and other mixed shrublands burnt sandplain
- *Callitris* with *Eucalyptus* woodland – sandplain.

There are extensive areas of habitat suitable for Malleefowl in and adjacent to the Mt Mason project area.

### 4.1.2 Discussion

The habitats (vegetation groups) identified are not restricted to the project area. While the survey of the Mt Mason mining area was limited predominantly to the areas proposed for disturbance, the survey of the proposed haul road involved assessment of a larger area than that proposed for disturbance (Table 2).

**Table 2 - Vegetation groups recorded on Mt Mason haul road**

| HAUL ROAD | Area to be disturbed (ha) | Area surveyed – no disturbance (ha) |
|---|---|---|
| Mulga Shrubland with occasional Eucalypts (1a) | 14.83 | 133.46 |
| Mulga woodland- floodplain (1b) | 14.36 | 129.22 |
| Mulga shrubland with *Philotheca brucei subsp brucei* (1g) | 0.47 | 4.26 |
| Mulga open shrubland- drainage (1k) | 0.61 | 5.47 |
| Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or *Prostanthera althoferi* subsp. *althoferi* and/or *Eremophila forrestii* subsp. *forrestii* low shrubland (1n) | 21.97 | 197.77 |
| Mulga over mixed shrubland (1o) | 0.38 | 3.38 |
| *Acacia quadrimarginea*/*A. cockertoniana* open shrubland (2g) | 2.43 | 21.85 |
| *Acacia effusifolia*/*Eucalyptus* mallee and other mixed shrublands burnt sandplain (3b) | 12.78 | 115.05 |
| *Acacia effusifolia* Shrubland- transitional (3c) | 0.74 | 6.67 |
| *Callitris* with scattered Eucalypt woodland- sandplain (4) | 1.03 | 9.24 |
| *Eucalyptus lesouefii* open woodland (9a) | 0.69 | 6.20 |
| *Eucalyptus salubris* woodland (9b) | 0.49 | 4.43 |
| **TOTAL** | **70.78** | **636.99** |

At a regional scale the proposed disturbance for the project represents >0.01% of the vegetation groups present (Table 3).

**Table 3 - Impact of project on vegetation at a regional scale**

| Veg Assoc | Description | Mount Mason proposed clearing (ha) | Current extent, WA (ha) | Pre-European Extent, WA (ha) | Remaining (%) | % of Current Extent (WA) |
|---|---|---|---|---|---|---|
| **484** | Shrublands; jam thicket | 0.52 | 70235 | 70,235 | 100 | 0.0007% |
| **202** | Shrublands; mulga & *Acacia quadrimarginea* scrub | 63.13 | 365,344 | 365,344 | 100 | 0.0173% |
| **483** | Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex; red mallee & mixed sparse dwarf shrubs over *Triodia basedowii* | 3.06 | 395,106 | 395,106 | 100 | 0.0008% |
| **18** | Low woodland; mulga (*Acacia aneura*) | 47.93 | 22,029,557 | 22,029,557 | 100 | 0.0002% |
| | **Total:** | 114.64 | 22,860,242 | 22,860,242 | | |

## 4.2 MALLEEFOWL

### 4.2.1 Mt Mason footprint of disturbance

Up to 8 Malleefowl mounds were recorded with the proposed disturbance footprint in the Mt Mason area (Table 4, Figure 16). All of these mounds were identified as inactive. A subjective estimation of the number of years since the mound was last used was made and is provided in Table 4.

**Table 4 - Locations of Malleefowl Mounds within the Mt Mason disturbance area**

| Number | Location | | | Size (metres) | Approximate Age (years) |
|---|---|---|---|---|---|
| | Zone | Easting | Northing | | |
| 1 | 51 | 243523 | 6776262 | 6 x 6 | >30 |
| 2 | 51 | 244256 | 6776365 | - | >100 |
| 3 | 51 | 243901 | 6776349 | 10 x 10 | >100 |
| 4 | 51 | 243814 | 6776136 | - | >150 |
| 5 | 51 | 244263 | 6776312 | 7 x 7 | >50 |
| 6 | 51 | 244300 | 6776106 | 5 x 5 | >150 |
| 7 | 51 | 243252 | 6776321 | 4 x 4 | >50 |
| 8 | 51 | 242895 | 6776065 | 6 x 6 | >50 |

### 4.2.2 Proposed Haul Road

A total of 3 Malleefowl mounds were recorded within the area proposed for the haul road (Table 5, Figure 17). All of these mounds were identified as inactive. A subjective estimation of the number of years since the mound was last used was made.

**Table 5 - Locations of Malleefowl Mounds within the proposed haul road area**

| Number | Location | | | Size (metres) | Approximate Age (years) |
|---|---|---|---|---|---|
| | Zone | Easting | Northing | | |
| 1 | 51 | 248977 | 6754701 | 10 x 10 | >100 |
| 2 | 51 | 249599 | 6754145 | 10 x 10 | >100 |
| 3 | 51 | 249923 | 6753883 | 10 x 10 | >100 |

### 4.2.3 Areas outside of Mt Mason disturbance footprint and proposed haul road

**A total of 26 Malleefowl mounds were recorded outside of the proposed disturbance footprint in the Mt Mason area and the proposed haul road area (**

Table 6, Figure 16 and Figure 17). Of these, one was determined to be active (Figure 18 and Figure 19) and the remainder inactive. A subjective estimation of the number of years since the mound was last used was made.

**Table 6 - Locations of Malleefowl Mounds outside of the proposed areas of disturbance**

| Number | Location | | | Size (metres) | Approximate Age (years) |
|---|---|---|---|---|---|
| | Zone | Easting | Northing | | |
| **ACTIVE MOUND** | | | | | |
| 1A | 51 | 244100 | 6772869 | 2.5 x 2.5 | 1 |
| **INACTIVE MOUNDS** | | | | | |
| 1 | 51 | 243917 | 6775489 | 7 x 7 | >100 |
| 2 | 51 | 245522 | 6774136 | 4 x 4 | >10 |
| 3 | 51 | 245590 | 6774104 | 3 x 3 | ? |
| 4 | 51 | 243631 | 6774448 | 10 x 10 | >100 |
| 5 | 51 | 243723 | 6774411 | 4 x 4 | >100 |
| 6 | 51 | 243791 | 6774455 | 5 x 5 | >100 |
| 7 | 51 | 243895 | 6775506 | 4 x 4 | >100 |
| 8 | 51 | 244164 | 6776326 | - | >100 |
| 9 | 51 | 243546 | 6776265 | 3 x 3 | >100 |
| 10 | 51 | 244258 | 6776205 | 6 x 6 | >150 |
| 11 | 51 | 244282 | 6776147 | 10 x 10 | >150 |
| 12 | 51 | 243796 | 6775882 | 6 x 6 | >150 |
| 13 | 51 | 242575 | 6776064 | 6 x 6 | >50 |
| 14 | 51 | 242994 | 6775688 | 2 x 2 | >150 |
| 15 | 51 | 242503 | 6776012 | 3 x 3 | >100 |
| 16 | 51 | 244107 | 6776207 | 5 x 5 | >100 |
| 17 | 51 | 244454 | 6771833 | 3 x 3 | ~1yr <5 |
| 18 | 51 | 244958 | 6768612 | 4 x 4 | >50 |
| 19 | 51 | 244977 | 6767975 | 3 x 3 | >50 |
| 20 | 51 | 248656 | 6754952 | 7 x 7 | >50 |
| 21 | 51 | 248852 | 6754862 | 5 x 5 | >100 |
| 22 | 51 | 249655 | 6754132 | 5 x 5 | >100 |
| 23 | 51 | 250227 | 6753693 | 6 x 6 | >100 |
| 24 | 51 | 250204 | 6753620 | 6 x 6 | >100 |
| 25 | 51 | 253603 | 6751822 | 12 x 12 | >100 |

**Figure 18 - Active Malleefowl mound**

**Figure 19 - Malleefowl working active mound**

### 4.2.1 Discussion

Malleefowl favour dense shrublands, Eucalypt Mallee thickets and areas that contain sufficient leaf litter for mound building. Inspection of many areas proposed for disturbance supported habitat suitable for Malleefowl mound building, as evidenced by the number of Malleefowl mounds. Malleefowl are present in the Mount Mason area and it is probable that the general area supports a breeding population.

However, only one known active Malleefowl mound was recorded during the survey. In March 2011, the Shire of Menzies graded a publically gazetted road (Metzke Road) that runs in a northeast-southwest direction south of the Mt Mason tenement. Soon after these road works were completed a pair of Malleefowl (Figure 19) established a mound (Figure 18) that is located less than 5m away from the Metzke Road and approximately 1.6 km from the south eastern corner of the tenement (Figure 16 and Figure 17). The proposed haul road runs approximately 137 m from this active mound. Jupiter has looked at the option of an alternate route to provide a larger buffer from the active mound but assessment of this route identified active mounds. The current proposed route is considered the best option to reduce the potential impacts to this species.

Albeit by subjective estimation, the majority of inactive mounds appeared to have been used a number of years ago (generally >50 years) with only two that appeared to have been used within the past five years. This suggests that Malleefowl have been in the area for many years. However, it is not possible to estimate the population that may have been present locally and historically. Any clearing of land or disturbance associated with developing the project could have an impact on individual Malleefowl. The proposed disturbance associated with the project may shift a small number of individuals into adjacent areas but it is not anticipated to have a significant impact on the population.

Threats to Malleefowl include clearing of habitat, road deaths, fire, predation and grazing and starvation. While local populations may have been subject to the effects of fire, predation and grazing and starvation, the proposed disturbance is likely to exacerbate these effects and will include the threats of clearing of native vegetation and road deaths. Further recommendations to reduce the potential impact of the proposed disturbance on the Malleefowl are addressed in Section 5.

Interestingly, a total of 11 of the 36 mounds recorded during the survey were determined to be ‘megamounds’. Megamounds appear to be extremely large Malleefowl mounds (~10 m x 10m) the origins of which remain unknown. While both megamounds and regular mounds may be re-used by Malleefowl, many of the older mounds have been and were currently being used by other fauna including varanids (Varanus spp.) and rabbits (*Oryctolagus cuniculus*).

## 4.3 FORK-TAILED SWIFT

No Fork-tailed Swifts were seen or heard during the survey.

Given the ecology of this species inasmuch as they are classified as Marine and Migratory, that they do not breed in Australia and they are almost exclusively aerial, it is unlikely that this species would utilise the habitat proposed for disturbance for the Mt Mason DSO Project or the associated haul road. The conservation status of this species is unlikely to be altered by the proposed mining activity in the area.

## 4.4 GREAT EGRET

No Great Egrets where seen or heard during the surveys and no evidence of their presence was identified.

The preferred habitat of the Great Egret is shallow waters, wetlands and swamps. As there are no such habitats within the area proposed for disturbance for the Mt Mason DSO project and associated haul road, it is not likely that this species would utilise this area. Further, the Great Egret is classified as a Migratory Wetland and Marine species.

The proposed mining operation at Mt Mason and the associated haul road therefore are unlikely to alter the conservation status of the Great Egret.

## 4.5 RAINBOW BEE-EATER

Rainbow Bee-eaters were heard and a total of seven individuals were seen in the Mt Mason area (Figure 16). None were seen or heard during the survey of the proposed haul road.

Rainbow Bee-eaters usually begin their northerly migration in March which is consistent with the timing of the survey. That they were recorded in the northern portion of the survey and not in the southern section exemplifies their migratory nature as they move across the Western Australia landscape, season-dependent.

Rainbow Bee-eaters usually make their breeding burrows in soft sandy banks, a feature not common in the CYIP landscape. Therefore, while the CYIP may be used within their migratory route, it is not likely to provide significant habitat for this species. The conservation status of this species, therefore, is not likely to be altered by the proposed operation at Mt Mason or the associated haul road.

## 4.6 SLENDER-BILLED THORNBILL

No Slender-billed Thornbills where seen or heard during the surveys and no evidence of their presence was identified.

The preferred habitat for the Slender-billed Thornbill is chenopod shrublands that are dominated by Samphire and occasionally adjacent shrublands and mangroves. Given the lack of this habitat in the Mt Mason area or associated hail road, it is unlikely that this species of Thornbill would be present.

Preferred habitat for this species is located approximately 30 km northwest at Lake Ballard and 65 km east at Lake Barlee. While movement of the Slender-billed Thornbill is likely along the edges of these large lakes in search of resources, they are not likely to move such a vast distance across the Mt Mason tenement between lakes (R. Johnstone *pers. comm.*).

The conservation status of this species is therefore not likely to be altered by the proposed mining activity in Jupiter's CYIP area.

# 5.0 RECOMMENDATIONS

Of the five species of fauna listed under the EPBC Act 1999 for the area, the habitat of only the Malleefowl is likely to be impacted by the proposed mining activity.

Given the presence of Malleefowl in the area, it is recommended that a Malleefowl Management Plan be developed and submitted to DSEWPaC for approval and that the approved plan be implemented immediately following approval.

Recommendations include but are not limited to the following:

- Conduct a targeted Malleefowl survey in any areas not surveyed but proposed for disturbance following realignment of the haul road;
- Clearing boundaries are to be well marked and no unnecessary clearing of native vegetation is to occur;
- Signage to be erected to alert drivers of (possible) presence of Malleefowl;
- Annual monitoring of all known mounds in the vicinity of the operational areas and haul road;
- Maintain management that reduces risk of fire;
- Implement a feral animal trapping program in consultation with DEC in the vicinity of operational areas;
- Ensure that all personnel attend inductions prior to going on site or at site and that these inductions include information about the Malleefowl, its legal status, ecology and habitat requirements;
- Encourage all personnel to report any signs of Malleefowl in the CYIP area
- All vehicles are to remain on designated tracks and speed restrictions appropriate to operational areas to be monitored.

# 6.0 REFERENCES

Beard, J.S. (1990). *Plant Life of Western Australia*, Kangaroo Press Pty Ltd, NSW.

Benshemesh, J. (1992). The conservation ecology of Malleefowl (*Leipoa ocellata* rosinae) No. 2 *South Aust. Ornith.* **3:** 78-91.

Benshemesh, J. (2007). *National Recovery Plan for Malleefowl*. Department for Environment and Heritage, South Australia

Biota (2011). *Deception Deposit Vertebrate Fauna Survey.* Unpublished Report, March 2011. Biota Environmental Sciences, Perth.

Burbidge, A.A., Fuller, P.J. and McKenzie, N.L. (1995). *Vertebrate Fauna.* In: The Biological Survey of the Eastern Goldfields of Western Australia. Part 12. Barlee-Menzies Study Area. Eds. A.A. Burbidge, N.J. Hall, G.J. Keighery and N.L. McKenzie. Records of the Western Australian Museum Supplement No. 49.

Chapman, A. and Pronk, G. (1997). Part 3 Vertebrate Fauna In: Lyons, M.N. & Chapman, A. (eds.) (1997). *A Biological Survey of the Helena and Aurora Range, Eastern Goldfields Western Australia*. Unpublished Report for Environment Australia, Canberra

Clark, G.A.J. (1964). Life History and the evolution of megapods. *Living Bird* **3**:149-167.

Cowan, M. (2001). Murchison 1 (*Mur1 – East Murchison subregion*). In; *A Biodiversity Audit of Western Australia.* Eds McKenzie, N.L., May, J.E. and McKenna, S. Department of Conservation and Land Management, Perth.

DEC (2012). *Malleefowl.* Department of Environment and Conservation. Available online at http://www.dec.wa.gov.au/content/view/3074/1499?cx=010068804368539907742%3Aq7d67n5eaz8&cof=FORID%3A10&ie=UTF-8&q=Malleefowl&siteurl=www.dec.wa.gov.au%2F#1008

Department of the Environment, Water, Heritage and the Arts (2009). Available online at: http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/index.html

DSEWPaC (2012). *Species Profile and Threats Database*. Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available online at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Environmental Protection Authority (2002). *Terrestrial Biological Surveys as an Element of Biodiversity Protection: Position Statement No. 3.* Environmental Protection Authority, Perth, WA.

Environmental Protection Authority (2004). *Guidance for the Assessment of Environmental Factors No. 56. Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.* Environmental Protection Authority, Perth, WA.

Frith, H. J. 1959. *Breeding of the Mallee Fowl, Leipoa ocellata Gould (Megapodiidae)*. CSIRO Wildlife Research **4**:31-60.

Higgins, P.J. (ed.) (1999). *Handbook of Australian, New Zealand and Antarctic Birds. Volume Four - Parrots to Dollarbird*. Melbourne: Oxford University Press.

Johnstone, R.E. and Storr, G.M. (1998). *Handbook of Western Australian Birds. Volume I – Nonpasserines (Emu to Dollarbird).* Western Australian Museum, Perth WA.

KLA (2011). *Macarthur Minerals Limited. Snark Project. Fauna Assessment.* Unpublished Report, August 2011. Keith Lindbeck and Associates, Perth.

KLA (2012a *in prep*). *Jupiter Mines Limited. Central Yilgarn Iron Project (CYIP) Mt Mason. Fauna Assessment.* Unpublished Report, 2012. Keith Lindbeck and Associates, Perth.

KLA (2012b *in prep*). *Jupiter Mines Limited. Central Yilgarn Iron Project (CYIP) Mt Ida. Fauna Assessment.* Unpublished Report, 2012. Keith Lindbeck and Associates, Perth.

Mace, G.M. and Stuart. S.N. (1994) *Draft IUCN Red List Categories, Version 2.2. Species* 21-22:13-24.

Marchant, S. and Higgins, P.J. (Eds) (1993). *Handbook of Australian, New Zealand and Antarctic Birds. Volume Two – Raptors to Lapwings*. Oxford University Press, Melbourne.

Meissner, R. and Owen, G. (2010). Flora and vegetation of banded iron formations of the Yilgarn Craton: Mt Ida Greenstone Belt and Mt Hope. Conservation Science Western Australia **7 (3):** 583-592.

Ninox (2009). *A Fauna Survey of the Carina Prospect – Yilgarn Iron Ore Project*. Unpublished report for Polaris Metals, July 2009. Ninox Wildlife Consulting, Perth.

NVS (2012a). *Jupiter Mines Limited. Mt Mason Project. Level 2 Flora and Vegetation Survey. Part 1 – October 2011 & Part 2 – March 2012.* Unpublished Report, May 2012. Native Vegetation Solutions, Kalgoorlie.

NVS (2012b). *Jupiter Mines Limited. Flora and Vegetation Survey of the Proposed Mt Mason Haul Road.* Unpublished Report, January 2013. Native Vegetation Solutions, Kalgoorlie.

Outback Ecology (2010). *Jupiter Mines Limited Mt Mason. Level 2 Flora and Vegetation Survey*. Unpublished report, September 2010. Outback Ecology Services, Jolimont, WA.

Parsons, B., Short, J. and Roberts, J.D. (2009). Using community observations to predict the occurrence of Malleefowl (*Leipoa ocellata*) in the Western Australian wheatbelt. *Biological Conservation* **142:** 364-374.

Paul Armstrong and Associates (2008). *Vegetation Survey and Rare Flora Search of the Mt Mason and Mt Ida Exploration Project*. Unpublished Report, January

2008. Paul Armstrong and Associates, Perth, WA.

Pizzey, G. and Knight, F. (1999). *Field guide to the birds of Australia*. Harper Collins, Sydney.

Priddel, D. and Wheeler, R. (1994). Mortality in captive-raised Malleefowl, *Leipoa ocellata*, release into a mallee remnant within the wheat-belt of New South Wales. In *Department of Environment, Water, Heritage and the Arts – Species Profile and Threats Database.* Canberra, Government of Australia.

Terrestrial Ecosystems (2011). *Targeted Fauna Survey for Long-tailed Dunnarts for the Granny Deeps Project Area.* Unpublished Report, June 2011. Terrestrial Ecosystems, Mt Claremont, WA.

Van der Waag, J (2007). *Side by Side. A Landowner's Guide to Malleefowl in Western Australia.* Unpublished Report. Perth, Western Australia.

Woolley, P. A. (2008). *Brush-tailed mulgara* *Dasycercus blythi*. In 'The Mammals of Australia'. 3rd Edition. Eds S. van Dyck and R. Strahan. Reed New Holland: Sydney.

# APPENDIX A
# Categories used in the assessment of conservation status

**IUCN categories (based on review by Mace and Stuart 1994) as used for the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999.**

**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 (CR)**
A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered*, 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*, 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*, 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.

**LEAST CONCERN (LC)**
A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

**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**.**

**NOT EVALUATED (NE)**
A taxon is Not Evaluated when it is has not yet been evaluated against the criteria

- Refer to http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf for criteria

**Schedules used in the WA Wildlife Conservation Act 1950.**

**Schedule 1.** Rare and Likely to become Extinct.

**Schedule 2.** Extinct.

**Schedule 3.** Migratory species listed under international treaties.

**Schedule 4.** Other Specially Protected Fauna.

**Department of Environment and Conservation Priority Species**

(species not listed under the Conservation Act, but for which there is some concern)

**Priority 1.** Taxa with few, poorly known population on threatened lands.

**Priority 2.** Taxa with few, poorly known populations on threatened lands, or taxa with several, poorly known populations not on conservation lands.

**Priority 3.** Taxa with several, poorly known populations, some on conservation lands.

**Priority 4.** 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.

**Priority 5.** Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

**JAMBA** The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6.

**CAMBA** The agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22.

**ROKAMBA** The agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24.

# Appendix E: Assessment Notification from DSEWPaC

EPBC Ref: 2013/6870

Mr Greg Kaeding
Environmental Manager
Jupiter Mines Ltd
PO Box Z5117
PERTH WA 6000

Dear Mr Kaeding

**Decision on referral**
**Mt Mason Direct Shipping Ore Hematite Project, 110 km north-west of Menzies, Western Australia (EPBC 2013/6870).**

Thank you for submitting a referral under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). This is to advise you of my decision regarding the proposed action to clear native vegetation for the construction of a Hematite mine, associated infrastructure and roads for the Mt Mason Direct Shipping Ore Hematite Project, 110 km north-west of Menzies, Western Australia.

**As a delegate of the Minister for Sustainability, Environment, Water, Population and Communities, I have decided that the proposed action is not a controlled action, provided it is taken in accordance with the manner described in the enclosed decision document. This means that, provided that the action is undertaken in that way, it does not require further assessment and approval under the EPBC Act before it can proceed.**

A copy of the document recording this decision is enclosed. This document will be published on the department's website.

Please note that this decision relates only to the specific matters protected under Chapter 2 of the EPBC Act.

This decision does not affect any requirement for separate state or local government environment assessment and approvals of the proposed action.

Please notify this department immediately if you are unable to undertake the proposed action in accordance with the measures described. Penalty provisions may apply if the referred action is undertaken in a different way to the manner specified.

Otherwise we would appreciate receiving your written advice:

- within three months of the date of this letter - reporting on your progress in implementing the measures.

The department has an active audit program for proposals that have been referred under the EPBC Act. The audit program aims to ensure that there is a high degree of compliance with decisions made in relation to those proposals. Please note that your project may be selected for

**Notification of**
**REFERRAL DECISION – not controlled action if undertaken in a particular manner**

**Mt Mason Direct Shipping Ore Hematite Project, 110 km north-west of Menzies, Western Australia (EPBC 2013/6870).**

**This decision is made under sections 75 and 77A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).**

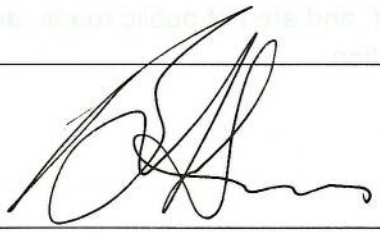
**Proposed action**

| | |
|---|---|
| **person named in the referral** | Jupiter Mines Limited<br><br>ACN 105 991 740 |
| **proposed action** | To clear native vegetation for the construction of a Hematite mine, associated infrastructure and roads for the Mt Mason Direct Shipping Ore Hematite Project, 110 km north-west of Menzies, Western Australia. [See EPBC Act referral 2013/6870]. |

**Referral decision: Not a controlled action if undertaken in a particular manner**

| | |
|---|---|
| **status of proposed action** | The proposed action is not a controlled action provided it is undertaken in the manner set out in this decision. |

**Person authorised to make decision**

| | |
|---|---|
| **Name and position** | Barbara Jones<br>Assistant Secretary<br>North, West & Offshore Assessment Branch |
| **Signature** |  |
| **date of decision** | 24 June 2013 |

| | |
|---|---|
| **manner in which proposed action must be taken** | The following measures must be taken to avoid significant impacts on:<br>• Listed threatened species and communities (sections 18 & 18A)<br>• Listed migratory species (sections 20 & 20A)<br>o Malleefowl (*Leipoa ocellata*) – Vulnerable<br>1. Clearing must not exceed 115 ha as outlined in section 1.4 of the referral at page 7.<br>2. **Construction** activities must not be undertaken within a 250 m buffer radius of active Malleefowl mounds (with the exception of MFM001 being 185 m) as shown in Attachment A and Attachment B.<br>3. Inactive Malleefowl mounds outside the **development footprint** to be retained must have a 50 m buffer radius as shown in Attachment A and Attachment B.<br>4. Prior to **construction** the **development footprint** must contain fire trails for the safe transit of fire fighting vehicles to mitigate the effects of advancing fires.<br>5. Prior to **construction** 'Malleefowl Ahead' warning signs and advisory speed limit signs, must be installed along **main access roads** within the **development footprint**. |

Definitions

**Construction** - includes any preparatory works required to be undertaken including clearing vegetation, the erection of any onsite temporary structures and the use of heavy duty equipment for the purpose of breaking the ground for buildings or infrastructure relating to the mine.

**Development footprint** – means areas outlined as development footprint in Attachment A and Attachment B.

**Main access roads -** Any roads that are located within the development footprint, and are not public roads, and are used for the purpose of the action.

audit by the department at any time and all related records and documents may be subject to scrutiny. Information about the department's compliance monitoring and auditing program is enclosed.

I have written separately to the Hon Gary Grey AO MP, Minister for Resources and Energy advising him of this decision.

If you have any questions about the referral process or this decision, please contact the project manager, Justin Williams, by email to justin.williams@environment.gov.au, or telephone 02 6275 9492 and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Barbara Jones
Assistant Secretary
North, West & Offshore Assessment Branch
24 June 2013

240000

250000

6770000

6760000

N

W

E

S

G29/23

M29/408-I

MFM010

MFM001

See Attachment B
for detail of this area

L29/100

MFM002

SEE INSET 1
FOR DETAIL

INSET 1: Detail of inactive mounds adjacent to haul road, with buffers

0 250 500 750 1,000 m

MFM007

G29/22

M29/414-I

MFM045

MFM043

MFM044

MFM047

SEE INSET 2
FOR DETAIL

L29/79

L29/121

INSET 2: Detail of inactive mounds adjacent to haul road, with buffers

0 250 500 750 1,000 m

240000

250000

**Malleefowl mounds - status (Total:50)**

- Active, to be retained (6)
- Inactive <20yrs, to be retained (2) with a 50m buffer
- Inactive >20yrs, to be retained (26) with a 50m buffer
- Inactive >20yrs, to be cleared (16)

**Buffers**

- 250 m
- 185 m
- Development Footprint
- Proposed Haul/internal road
- Other proposed infrastructure
- Menzies-Sandstone Rd (existing)

# Attachment A: Malleefowl mounds - overview

0 1 2 3 4 5 km

1:75,000

Jupiter Mines Limited

*Coordinates are GDA94 MGA zone 51.*
*Produced 20/06/2013.*


*2013-153a - email version*

242000
244000
246000
6776000
6774000
6772000

Explosives magazine
Pit, waste dump, process plant & ROM
Mining operation centre
Haul road & pipeline
MFM010
MFM001
Camp expansion
MFM002

G29/23
M29/408-I
G29/22
L29/100

**Malleefowl mounds - status (Total:50)**

- Active, to be retained (6)
- Inactive <20yrs, to be retained (2) with a 50m buffer
- Inactive >20yrs, to be retained (26) with a 50m buffer
- Inactive >20yrs, to be cleared (16)

**Buffers**

- 250 m
- 185 m
- Haul/internal road
- Other proposed infrastructure
- Development Footprint

# Attachment B: Malleefowl mounds-main project area

0 250 500 750 1,000 m

1:20,000

Jupiter Mines Limited

*Coordinates are GDA94 MGA zone 51.*
*Produced 20/06/2013.*


*2013-153b*