Mt Marion
Fauna Assessment:
Hamptons Lease Area 53, L15/353, M15/999 and East E15/1599

Malleefowl mound recorded in Hamptons lease. Photo: Tim Gamblin

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Executive Summary

Introduction

Bamford Consulting Ecologists (BCE) were commissioned by Mineral Resource Limited (MRL) to conduct a Basic (formerly level 1) and Targeted (*sensu* EPA 2020) Fauna Assessment (desktop assessment and targeted survey for conservation significant species) around MRL's active Mt Marion Lithium Project located approximately 35 kilometres (km) south of Kalgoorlie, in the Coolgardie Bioregion and the Eastern Goldfields Subregion (COO03) of Western Australia. The Fauna Assessment focused specifically within Hamptons Lease Area 53, L15/353, M15/999, and East 15/1599. This involved:

- Identification of Vegetation and Substrate Associations (VSAs) (that provide fauna habitats);
- Targeted searches for significant fauna and an assessment of their likelihood of occurrence based on VSAs present; target species include:
    - Malleefowl – opportunistic records of mounds;
    - Chuditch – camera trap survey;
    - Arid Bronze Azure Butterfly (ABAB) – opportunistic searching for associated *Camponotus* ants in smooth-barked eucalypts;
    - Trapdoor Spiders – opportunistic searching for trapdoor spider burrows in suitable habitat.
- Continuous recording of bird species encountered; and
- Opportunistic fauna observations.

BCE use a 'values and impacts' assessment process with the following components:

- The identification of **fauna values**:
    - Assemblage characteristics: uniqueness, completeness and richness;
    - Species of conservation significance;
    - Recognition of ecotypes or vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
    - Patterns of biodiversity across the landscape; and
    - Ecological processes upon which the fauna depend.
- The review of **impacting processes** such as:
    - Habitat loss leading to population decline;
    - Habitat loss leading to population fragmentation;
    - Degradation of habitat due to weed invasion leading to population decline;
    - Ongoing mortality from operations;
    - Species interactions including feral and overabundant native species;
    - Hydrological change;
    - Altered fire regimes; and
    - Disturbance (dust, light, noise).
- The **recommendation** of actions to mitigate impacts (if requested).

The desktop assessment draws on the findings of extensive surveys which were conducted in the Mt Marion Project area and nearby areas between 2010 and 2020 (mostly by BCE), including a BCE review of these surveys 2019.

Description of project area

The Mt Marion Lithium Project ('the Project') is located approximately 35 kilometres (km) south of Kalgoorlie, in the Goldfields region of Western Australia. The project area consists of three leases located adjacent to the existing Project:

(1) Hamptons Lease Area 53 (hereafter "Hamptons" or Priority 1): 4326 hectares (ha); located just north of existing mining infrastructure;
(2) L15/353 and M15/999 (hereafter "L" and "M" respectively or Priority 2 combined): 67 ha and 50 ha respectively; located southeast and adjacent to existing mining infrastructure; and
(3) E15/1599 (hereafter "East" or Priority 3): 3379 ha; located southwest of existing mining infrastructure.

The Project area lies within the Coolgardie Bioregion and the Eastern Goldfields Subregion (COO03). The Coolgardie Bioregion falls within the Bioregion Group 3 (Northern Botanical Province) classification of the Environmental Protection Authority (EPA) where "native vegetation is largely contiguous but used for commercial grazing".

Key fauna values

Vegetation and Substrate Associations (VSAs) that provide habitat for fauna
Seven major Vegetation and Substrate Associations (VSAs) were identified in the project area:

1) Mixed Eucalypt woodland over sclerophyll shrubland on undulating hills (VSA 1);
2) Acacia shrubland on rocky rises (VSA 2);
3) Eucalypt woodland over mixed shrubs on red loam flats (VSA 3);
4) Mixed Eucalypt woodland over *Melaleuca sheathiana* on gravelly rises (VSA 4);
5) Dense Mallee and Eucalypt woodland associated with minor drainage lines (VSA 5);
6) Acacia shrubland on brown loam flats (VSA 6); and
7) Dense Acacia shrubland on exposed granite (VSA 7).

All VSAs are considered important for fauna. Large Salmon Gums (*Eucalyptus salmonophloia*) provide important nesting opportunities for fauna and dense vegetation provide cover and habitat for species such as the Golden Whistler, Western Yellow Robin and Malleefowl.

Fauna assemblage
The desktop study identified 288 vertebrate fauna species as potentially occurring in the project area: five frogs, 85 reptiles, 164 birds, 25 native and ten introduced mammals. The presence of at least 95 species (one frog, 12 reptiles, 66 bird species, ten native mammals and six introduced mammals) has been recorded from surveys thus far. The 2021 field investigations confirmed the presence of three reptiles, 34 birds, two native mammals and one introduced mammal. The expected fauna assemblage is typical of the Coolgardie region and Goldfields eucalypt woodlands, with some species occurring at

the edge of their range in the project area. The assemblage contains a high level of richness which is expected in such relatively undisturbed intact woodland vegetation and is mostly complete, with a portion of the mammal fauna considered locally extinct.

Species of conservation significance

Three broad levels of conservation significance are used in this report:

- Conservation Significance 1 (CS1) – species listed under State or Commonwealth Acts.
- Conservation Significance 2 (CS2) – species listed as Priority by DBCA but not listed under State or Commonwealth Acts.
- Conservation Significance 3 (CS3) – species not listed under Acts or in publications but considered of at least local significance because of their pattern of distribution.

There are 33 species of conservation significance expected to occur in the project area, comprising 10 CS1, two CS2 and 21 CS3 species. The majority of conservation significant species are expected as residents (13 species), following by vagrants (7 species), regular visitors (7 species) and irregular visitors (6 species). Ten conservation significant species have been recorded to date, comprising one CS1 and 9 CS3 species (one CS3 species was recorded in the 2021 field investigations).

Two Malleefowl mounds were recorded in Hamptons, with one of these being recent but inactive. They were located within a densely-vegetated area in the southern part of Hamptons and this area is considered likely to provide suitable habitat for Malleefowl. No Chuditch were recorded on camera traps. With the closest known population located 200 km southwest of the project, dispersing individuals may move through the area and the species is expected to occur in the project area as a vagrant or possibly an irregular visitor.

No *Camponotus* ants which are associated with the ABAB were recorded and it is considered unlikely for the butterfly to occur in the project area. Several Trapdoor Spider burrows were detected (all within Hamptons) and were identified as species of the genus *Idiosoma*, with the potential for these to be the CS2 species.

Patterns of biodiversity

The presence of a range of VSAs are factors in patterns of biodiversity; fauna that occur in eucalypt woodlands throughout the region are likely to utilise the project area, areas of dense thicket are important for species that prefer dense cover, areas with exposed granite may support a unique suite of species, with large, hollow-bearing trees in woodlands providing potential important nesting opportunities.

Key ecological processes

Key ecological processes affecting the fauna assemblage in the project area are hydrology, feral species and possibly over-abundant native species.

Potential impacts upon fauna

Impacting processes included: habitat loss leading to population decline and population fragmentation, local hydrological change, degradation of habitat due to weed invasion, ongoing mortality from operations (i.e., roadkill of Malleefowl and Chuditch), impacts of feral and

overabundant native species, fire and disturbance (dust, noise and light). Potential impacts are considered negligible to minor as the project area is small, relative to the broad and largely intact landscape. Recommendations related to conservation significant species include: detailed targeted surveys for conservation significant species when a clearing footprint is available; protection of active Malleefowl nests; roadkill management; feral species management; conserving mature trees; avoiding overabundant native species. Recommendations related to key fauna values include: feral and overabundant native species management; minimise disturbance footprint; habitat preservation – retain important areas (such as large mature hollow-bearing trees); manage hydrology; and minimise disturbance to mature eucalypt trees and areas of dense understorey.

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Bamford Consulting Ecologists (BCE) was commissioned by Mineral Resource Limited (MRL) to conduct a Basic (formerly level 1) and Targeted (*sensu* EPA 2020) Fauna Assessment (desktop assessment and targeted survey for conservation significant species) around MRL's active Mt Marion Lithium Project located approximately 35 kilometres (km) south of Kalgoorlie, in the Coolgardie Bioregion and the Eastern Goldfields Subregion (COO03) of Western Australia. The Fauna Assessment focused specifically within Hamptons Lease Area 53, L15/353, M15/999, and East 15/1599. This report presents the results of that fauna desktop review and targeted survey.

1.1 General approach to fauna impact assessment

The purpose of impact assessment is to provide government agencies with the information they need to decide what significance the impacts of a proposed development will have, and to provide information to proponents which assist them to develop appropriate strategies for avoiding and minimising impacts from their activities. This relies on information regarding the fauna assemblage and its environment. Bamford Consulting Ecologists uses an approach with the following components:

- The identification of **fauna values**:
  - Assemblage characteristics: uniqueness, completeness and richness;
  - Species of conservation significance;
  - Recognition of ecotypes or vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
  - Patterns of biodiversity across the landscape; and
  - Ecological processes upon which the fauna depend.

- The review of **impacting processes** such as:
  - Habitat loss leading to population decline;
  - Habitat loss leading to population fragmentation;
  - Degradation of habitat due to weed invasion leading to population decline;
  - Ongoing mortality from operations;
  - Species interactions including feral and overabundant native species;
  - Hydrological change;
  - Altered fire regimes; and
  - Disturbance (dust, light, noise).

- The **recommendation** of actions to mitigate impacts (if requested).

Based on the impact assessment process above, the objectives of the study are therefore to:

1. Conduct a literature review and searches of Commonwealth and State fauna databases;
2. Review the list of fauna expected to occur on the site in the light of fauna habitats present, with a focus on investigating the likelihood of significant species being present;
3. Identify significant or fragile fauna habitats within the project area;
4. Identify any ecological processes in the project area upon which fauna may depend;
5. Identify general patterns of biodiversity within or adjacent to the project area; and

6. Identify potential impacts upon fauna and propose recommendations to minimise impacts.

Descriptions and background information on these values and processes can be found in **Appendices 1 to 4**. Based on this impact assessment process, the objectives of investigations are to: identify fauna values; review impacting processes with respect to these values and the proposed development; and provide recommendations to mitigate these impacts.

1.2 Description of project area and background environmental information

1.2.1 Project area

For spatial terminology (i.e. definitions of project, survey and study areas) see Section 2.1.1 below.

The Project is located approximately 35 kilometres (km) south of Kalgoorlie in the Goldfields region of Western Australia **(Figure 1-1)**. The project area is comprised of three leases located adjacent to the existing Project **(Figure 1-2)**. Bamford Consulting Ecologists was requested by MRL to conduct the Fauna Assessment at each lease by level of priority, as indicated below. The project area comprises the following leases:

1. Hamptons Lease Area 53 (hereafter "Hamptons" or Priority 1): 4326 hectares (ha); located just north of existing mining infrastructure;
2. L15/353 and M15/999 (hereafter "L" and "M" respectively or Priority 2 combined): 67 ha and 50 ha respectively; located southeast and adjacent to existing mining infrastructure; and
3. E15/1599 (hereafter "East" or Priority 3): 3379 ha; located southwest of existing mining infrastructure.

The field investigations in this environmental impact assessment were conducted within the project area only and, therefore, the 'survey area' and project area are treated as synonymous from hereon.

Figure 1-1. Regional location of the Mt Marion Lithium Project.

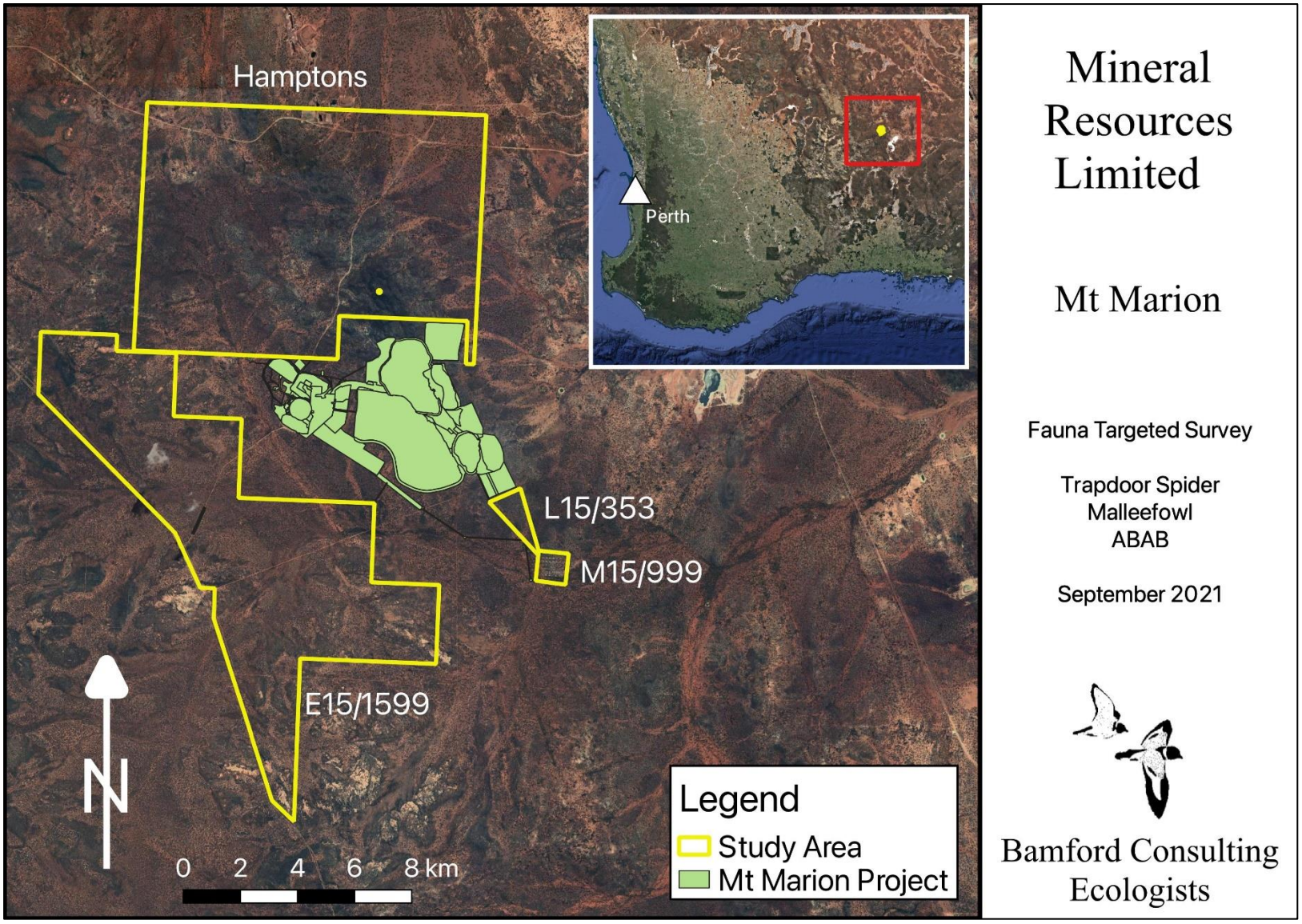


Figure 1-2. Location of project area and four leases.

1.2.2 Interim Biogeographic Regionalisation of Australia (IBRA) and landscape characteristics

The Interim Biogeographic Regionalisation of Australia (IBRA) has identified 26 bioregions in Western Australia which are further divided into subregions (DAWE 2021b). Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell 1995). IBRA Bioregions are affected by a range of different threatening processes and have varying levels of sensitivity to impact (EPA 2016c).

The Mt Marion project area lies within the Coolgardie Bioregion and the Eastern Goldfields Subregion (COO03) **(Figure 1-3)**. The Coolgardie Bioregion falls within the Bioregion Group 3 (Northern Botanical Province) classification of EPA (2016c) where "native vegetation is largely contiguous but used for commercial grazing". Cowan (2001) describes the Eastern Goldfields subregion as: "*The vegetation is of Mallees, Acacia thickets and shrub heaths on sandplains. Diverse Eucalyptus woodlands occur around salt lakes, on ranges, and in valleys. Salt lakes support dwarf shrublands of samphire. The area is rich in endemic Acacias. The climate is Arid to Semi-arid with 200-300 mm of rainfall, sometimes in summer but usually in winter. The subregional area is 5,102,428ha*."

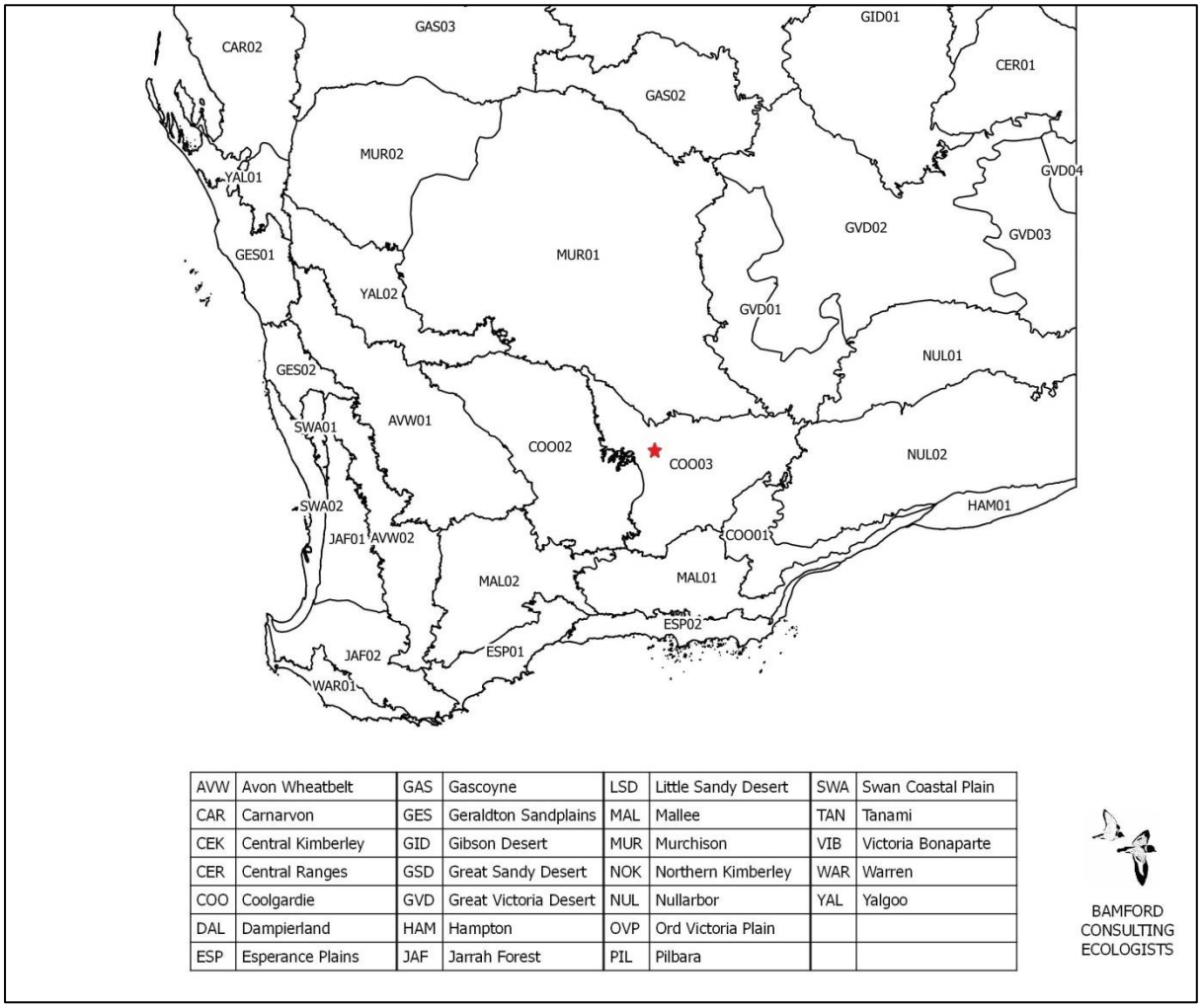
The dominant land use within the Eastern Goldfield subregion is grazing, with smaller areas of crown reserves, mining, freehold, and conservation. Only 4.35 % of the sub-region is vested within conservation reserves (Cowan, 2001). Cowan (2001) describes the Goldfields Woodlands as having an exceptionally high diversity of Eucalyptus species with as many as 170 species occurring in the bioregion. The project area lies within the Coolgardie Vegetation System. The region is characterised by woodlands of *Eucalyptus torquata*, *Eucalyptus lesouefii* and *Eucalyptus clelandii* with *Eremophila scoparia*, *Eremophila glabra* and *Eremophila oldfieldii* shrubs. All woodlands in the Coolgardie System have been logged in the past for mining timber and firewood and current vegetation is secondary growth regenerated from seed and coppice (Beard 1972). Beard (1972) describes the vegetation of the region as:

- Greenstone Ridges supporting a characteristic *Eucalyptus torquata – E. lesouefii* association. Both *E. torquata* and *E. lesouefii* are co-dominant, abundant and characteristic. Associated trees include *E. clelandii*, *E. campaspe*, *Casuarina pauper* and *Grevillea nematophylla*. There is an open shrub understorey, largely of *Eremophila* spp. ("Broombush"), *Dodenia lobulata*, *Senna cardiosperma* and *Acacia* species, interspersed with *Atriplex nummularia*. Two understorey types, "broombush" and "saltbush", occur on slopes, with broombush appearing on less alkaline soils;

- Eucalypt Woodlands of the lower slopes and flats consist typically of *Eucalyptus salmonophloia*, often with *E. salubris*, *E. torquata* and *E. longicornis*. *Melaleuca pauperiflora* (boree) occurs as a dominant understorey on heavy, periodically wet soils;

- Salt lakes and samphire flats. Distinct localised vegetation communities occur in saline or alkaline soils and fringed with open saltbush or bluebush, lightly wooded with *Casuarina pauper*, *Myoporum platycarpum* and some *Acacia* species; and

- Red sand dunes with scattered *Callitris columellaris*, *Pittosporum angustifolium*, *Acacia tetragonophylla*, *Eremophila miniata* and shrubs of *Grevillea sarissa* and *Acacia* species (Beard, 1972).



AVW	Avon Wheatbelt	GAS	Gascoyne	LSD	Little Sandy Desert	SWA	Swan Coastal Plain
CAR	Carnarvon	GES	Geraldton Sandplains	MAL	Mallee	TAN	Tanami
CEK	Central Kimberley	GID	Gibson Desert	MUR	Murchison	VIB	Victoria Bonaparte
CER	Central Ranges	GSD	Great Sandy Desert	NOK	Northern Kimberley	WAR	Warren
COO	Coolgardie	GVD	Great Victoria Desert	NUL	Nullarbor	YAL	Yalgoo
DAL	Dampierland	HAM	Hampton	OVP	Ord Victoria Plain		
ESP	Esperance Plains	JAF	Jarrah Forest	PIL	Pilbara		

Figure 1-3. Project location within the Eastern Goldfield (COO03) subregion of Interim Biogeographic Regionalisation of Australia (IBRA) regions.

2 Methods

2.1 Overview

This approach to fauna impact assessment has been developed with reference to guidelines and recommendations set out by the Western Australian Environmental Protection Authority (EPA) on fauna surveys and environmental protection (EPA 2002, 2016b, 2016c, 2020), and Commonwealth biodiversity legislation (DotE 2013, DSEWPaC 2013). The EPA (2020) recommends three levels of investigation that differ in their approach for field investigations:

- Basic – a low-intensity survey, conducted at the local scale to gather broad fauna and habitat information (formerly referred to as 'Level 1'). The primary objectives are to verify the overall adequacy of the desktop study, and to map and describe habitats. A basic survey can also be used to identify future survey site locations and determine site logistics and access. The results from the basic survey are used to determine whether a detailed and/or targeted survey is required. During a basic survey, opportunistic fauna observations should be made and low-intensity sampling can be used to gather data on the general faunal assemblages present.

While referred to as 'basic', this level of survey is involved and powerful, and should be considered the primary level of assessment. Other levels of assessment (where deemed necessary) add information to inform this primary level.

- Detailed – a detailed survey to gather quantitative data on species, assemblages and habitats in an area (formerly referred to as 'Level 2'). A detailed survey requires comprehensive survey design and should include at least two survey phases appropriate to the biogeographic region (bioregion). Surveys should be undertaken during the seasons of maximum activity of the relevant fauna and techniques should be selected to maximise the likelihood that the survey will detect most of the species that occur, and to provide data to enable some community analyses to be carried out.
- Targeted – to gather information on significant fauna and/or habitats, or to collect data where a desktop study or field survey has identified knowledge gaps. Because impacts must be placed into context, targeted surveys are not necessarily confined to potential impact areas. A targeted survey usually requires one or more site visits to detect and record significant fauna and habitats. For areas with multiple significant species there may not be a single time of year suitable to detect all species. In these cases, multiple visits, each targeting different species or groups, should be conducted.

The level of assessment recommended by the EPA (2020) is determined by geographic position, with a generic statement that detailed surveys are expected across all of the state except the south-west, but also recommending that site and project characteristics be considered, such as the survey objectives, existing available data, information required, the scale and nature of the potential impacts of the proposal and the sensitivity of the surrounding environment in which the disturbance is planned. These aspects should be considered in the context of the information acquired by the desktop study. When determining the type of survey required, the EPA (2020) suggested that the following be considered:

- Level of existing regional knowledge;
- Type and comprehensiveness of recent local surveys;
- Degree of existing disturbance or fragmentation at the regional scale;
- Extent, distribution and significance of habitats;
- Significance of species likely to be present;
- Sensitivity of the environment to the proposed activities; and
- Scale and nature of impact.

Guidance for field investigations methods is provided by the EPA (2016c, 2020) and by Bamford *et al.* (2013).

A 'basic' level survey (desktop review, fauna habitat identification and a site inspection) is considered appropriate for the project area. This is based upon the in-depth level of existing knowledge (see Section 2.3 below), the stage in the approvals process, and the extent, distribution and significance of habitats (widespread) likely to be present.

The approach and methods utilised in this report are divided into three groupings that relate to the stages and the objectives of impact assessment:

- **Desktop assessment.** The purpose of the desktop review is to produce a species list that represents the vertebrate fauna assemblage of the project area, based on unpublished and published data using a precautionary approach.
- **Field investigations.** The purpose of the field investigations carried out for a Basic assessment is to gather information on the vegetation and soil associations ('habitats') supporting the fauna assemblage. Additionally, it places the list generated by the desktop review into the context of the project areas surrounding environment. Targeted surveys allow for assessing the likelihood of conservation significant species to occur in the project area, which may trigger further detailed study. The brief field investigations that form part of a Basic assessment also allow fauna observations to be made. This assists the consultant to develop further understanding of the ecological processes that may be occurring in the project area.
- **Impact assessment.** Determines how the fauna assemblage may be affected by the proposed development; this is based on the interaction of the project with a suite of ecological and threatening processes.

2.1.1 Spatial terminology

A range of terms are used through the report to refer to the spatial environment around the proposed project, and these are defined below:

- Development footprint – the expected extent of land clearing and/or development. Usually a subset of the project area but in some cases this will be equivalent to project area (where the entire project area is proposed to be developed).
- Project area – the outermost boundary within which the proposed project will be located (the maximum envelope in which development could occur). This will usually be a lease area or land over which the proponent has some tenure. In this report, the project area comprises the three leases as described in Section 1.2.1.
- Survey area – the outermost boundary of the environmental impact assessment (including the area to which the results of the desktop analysis are directed and/or the area where field investigations are conducted). While the minimum survey area boundary is equivalent to project area, often this boundary will exceed that of the project area where reference, contextual or regional information is sourced (including field investigations outside of the project area; i.e. outside the land over which the proponent has tenure). Note that while the term 'survey area' is used throughout the guidance provided by EPA (2020), it does not appear to be explicitly defined and, therefore, the above definition has been developed with interpretation of both the guidance and BCE report structure.
- Study area – the outermost boundary of the desktop assessment that is almost always a specified buffer distance (see Section 2.3.1 below) around the project area, or the project area centroid. This is generally the area from which databases are sourced.

2.2 Identification of Vegetation and Substrate Associations (VSAs)

Vegetation and Substrate Associations (VSAs) combine vegetation types, the soils or other substrate they are associated with, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna.

BCE deliberately makes the distinction between 'habitat' (a species-specific term that may encompass the whole or part of one or more VSAs and is the physical subset of an ecosystem that a given species, or species group, utilises) and 'VSA' (a general, discrete and mutually exclusive spatial division of a target area, based on soil, vegetation and topography). It is recognised, however, that, within the broader EIA literature/guidance, the former term is used more or less synonymously to indicate the latter (e.g.' habitat assessment' used by EPA 2020). Further discussion is provided in **Appendix 1.**

For the current assessment, VSAs were identified based on extensive previous surveys by BCE (which included identification of VSAs) in the Mt Marion area and on observations made during the field investigations.

2.3 Desktop assessment of expected species

2.3.1 Sources of information

As per the recommendations of EPA (2020), information on the fauna assemblage of the project area was drawn from a range of sources including databases (as listed in **Table 2-1**). In addition, extensive surveys have been conducted by BCE in the region and on MRL leases, some of which overlap the leases surveyed in this report; these reports were consulted as part of the desktop assessment (as listed in **Table 2-2**). Information from these sources was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns are listed in **Table 2-3**. As extensive surveys have been conducted across the Mt Marion area and the project area is located within search boundaries, the database search conducted in 2019 as part of the review was considered sufficient for the present desktop assessment.

Table 2-1. Databases searched for the desktop review, accessed May 2019.

Source	Type of records	Year/Area searched
Atlas of Living Australia	Records of biodiversity data from multiple sources across Australia.	Project area centre point plus 20 km buffer. Searched 8/5/2019.
NatureMap (DBCA 2019)	Records in the WAM and DBCA databases. Includes historical data and records on Threatened and Priority species in WA.	Project area centre point plus 20 km buffer. Searched 8/5/2019.
BirdLife Australia Atlas Database (Birdlife Australia 2019)	Records of bird observations in Australia, 1998-2019.	One-degree cell containing project area Searched 8/5/2019.
EPBC Protected Matters (DEE 2019)	Records on matters of national environmental significance protected under the EPBC Act.	Project area centre point plus 20 km buffer. Searched 8/5/2019.

Table 2-2. Literature sources for the desktop review.

Source	Type of records	Year/Area searched
Mt Marion Lithium Project Malleefowl Survey, January 2020	Systematic targeted survey for Malleefowl mounds conducted by BCE.	Mt Marion Project Area, 2020.
Review of Fauna Assessments within the Mt Marion Lithium Project area	Review of all surveys conducted in and around MRL leases, conducted by BCE.	Mt Marion Project Area, 2019.
Fauna Assessment of a proposed borefield pipeline corridor (Woolibar borefield Stage 2)	Level 1 Fauna Survey conducted by BCE in 2018.	Borefield area, Mt Marion Project Area 2018.
Fauna Assessment of a proposed borefield pipeline corridor (Woolibar borefield Stage 1)	Level 1 Fauna Survey conducted by BCE in 2017.	Borefield area, Mt Marion Project Area, 2017.
Fauna Assessment of M15/717 lease area, part of the Mt Marion Lithium Project.	Level 1 Fauna Survey conducted by BCE in 2017.	M15/717 lease area, Mt Marion Project Area, 2017.
Fauna Assessment of the Mt Marion Study Area.	Level 2 Fauna Survey conducted by BCE in 2016.	Mt Marion Project Area, 2016.
Fauna Assessment of the Gunga West Project.	Level 1 Fauna Survey conducted by BCE in 2016.	Gunga West Project, 2016.
Fauna Assessment of the Cannon Project.	Level 1 Fauna Survey conducted by BCE in 2015.	Cannon Project, 2015.
Fauna Assessment of the Southern Gold Bulong Project.	Level 1 Survey conducted by BCE in 2012.	Bulong, 2012.
Fauna Assessment of the Mt Marion Mining Lease Area.	Level 1 Survey conducted by BCE in 2012.	Mount Marion, 2012.
Fauna Assessment of the South Kalgoorlie TSF.	Level 1 Survey conducted by BCE in 2012.	South Kalgoorlie, 2012.
Fauna Assessment of the South Kalgoorlie Pipeline.	Level 1 Survey conducted by BCE in 2012.	South Kalgoorlie, 2012.
Fauna Assessment of the Bardoc Mining Lease Area.	Level 1 Survey conducted by BCE in 2012.	Bardoc, 2012.
Fauna Assessment of the St Ives Mining Area.	Level 2 Survey conducted by BCE in 2010.	Lake Lefroy, 2010.
Fauna Assessment of the St Ives Pistol Club Mining Area.	Level 1 Fauna Survey conducted in 2015.	Kambalda, 2015.
Rapallo Level 1 Fauna Survey of Mount Marion	Level 1 Fauna Survey conducted by Rapallo in 2010.	Mount Marion, 2010.
Fauna Assessment of the Kangaroo Hills and Calooli Nature Reserves	Level 2 report by M. Bamford and S. Davies.	Kangaroo Hills and Calooli 1990.

Table 2-3. Sources of information used for general patterns of fauna distribution.

Taxa	Sources
Frogs	Tyler and Doughty (2009), Anstis (2017).
Reptiles	Storr *et al*. (1983, 1990, 1999, 2002), Bush and Maryan (2011), Wilson and Swan (2021).
Birds	Johnstone and Storr (1998, 2004), Menkhorst *et al*. (2017).
Mammals	Van Dyck and Strahan (2008), Churchill (2009), Menkhorst and Knight (2011).

2.3.2 Previous fauna surveys

In 2019, BCE conducted a review of fauna assessments within the vicinity of the project area (Metcalf and Bamford 2019). The review was based primarily on the findings from previous fauna assessments within the Mt Marion Lithium Project Area, but also drew on the findings from surveys outside the project area, but within the greater Goldfields region (e.g., BCE 2010, BCE 2012c, BCE 2012d, BCE 2012e, BCE 2015, BCE 2016a). Multiple Level 1 and Level 2 fauna assessments, including targeted Malleefowl assessments, have been conducted in the area covering parts of the project area (Rapallo 2010, BCE 2012a, BCE 2012b, BCE 2016b, Metcalf and Bamford 2017a, Metcalf and Bamford 2017b, Bancroft and Bamford 2020); see **Table 2-4** for a list of lease areas and relevant fauna assessments.

Table 2-4. Fauna Assessments covering Mt Marion lease areas.

Lease Area	Relevant Fauna Assessment/s
M15/717	BCE 2012a, BCE 2012b, BCE 2016b, Metcalf and Bamford 2017a
All leases previously surveyed	Metcalf and Bamford 2019
Scattered around Mt Marion site	Bancroft and Bamford 2020
M15/1000	Rapallo 2010, BCE 2016b
M15/999	Bamford, 2016b
L15/353	Bamford 2016b, Metcalf and Bamford 2017b (lease area was updated from L15/321).
L15/220	Bamford 2016b
L15/360	Bamford 2016b
L15/392	Metcalf and Bamford 2018
Hamptons Area 53	Bamford 2016b

A number of fauna assessments, both Level 1 and Level 2, have also been conducted by BCE in the greater area, including near Coolgardie, Kambalda, Bulong and Kalgoorlie (see Table 2-2). The reports provide data on conservation significant species recorded in VSAs in some cases similar to those found across the Project area. VSAs observed at the project area are presented in Section 3.1.

2.3.3 Nomenclature and taxonomy

As per the recommendations of the EPA (2020), the nomenclature and taxonomic order presented in this report are generally based on the Western Australian Museum's (WAM) Checklist of the Fauna of Western Australia 2020. The authorities used for each vertebrate group were: frogs (Doughty 2020a), reptiles (Doughty 2020b), birds (BirdLife Australia 2019, Gill *et al.* 2021), and mammals (Travouillon 2020). In some cases, more widely-recognised names and naming conventions have been followed, particularly for birds where there are national and international naming conventions in place (e.g. the BirdLife Australia working list of names for Australian Birds, and the International Ornithological Congress' 'World Bird List'). English common names of species, where available, are used throughout the text; Latin names are presented with corresponding English names in tables in the appendices. The use of subspecies is limited to situations where there is an important (and relevant) geographically distinct population, or where the taxonomic distinction has direct relevance to the conservation status or listing of a taxon.

2.3.4 Interpretation of species lists

2.3.4.1 Expected occurrence

Species lists generated from the review of sources are generous as they include records drawn from a large region (the study area, see **Figure 1-2**) and possibly from environments not represented in the project area. Therefore, some species that were returned by one or more of the database and literature searches have been excluded. This is because their ecology, or the environment within the project area, determine that it is highly unlikely that these species will be present. Such species can include, for example, seabirds that might occur as extremely rare vagrants at a terrestrial, inland site, but for which the site is of no importance. Species returned from the databases and not excluded on the basis of ecology or environment are therefore considered. They are potentially present or expected to be present in the project area at least occasionally, whether they were recorded during field surveys or not, and whether or not the project area is likely to be important for them. This list of expected species is therefore subject to interpretation by assigning each a predicted status, the expected occurrence, in the project area. The status categories used are:

- **Resident:** species with a population permanently present in the project area;
- **Regular migrant or visitor:** species that occur within the project area regularly in at least moderate numbers, such as part of an annual cycle;
- **Irregular visitor:** species that occur within the project area irregularly such as nomadic and irruptive species. The length of time between visitations could be decades but when the species is present, it uses the project area in at least moderate numbers and for some time;
- **Vagrant:** species that occur within the project area unpredictably, in small numbers and/or for very brief periods. Therefore, the project area is unlikely to be of importance for the species; and
- **Locally extinct:** species that would have been present but has not been recently recorded in the local area and therefore is almost certainly no longer present in the project area.

These status categories make it possible to distinguish between vagrant species, which may be recorded at any time but for which the site is not important in a conservation sense, and species which use the site in other ways but for which the site is important at least occasionally. This is particularly

useful for birds that may naturally be migratory or nomadic, and for some mammals that can also be mobile or irruptive, and further recognises that even the most detailed field survey can fail to record species which will be present at times. The status categories are assigned conservatively based on the precautionary principle. For example, a lizard known from the general area is assumed to be a resident unless there is very good evidence the site will not support it, and even then, it may be classed as a vagrant rather than assumed to be absent if the site might support dispersing individuals. It must be stressed that these status categories are predictions only and that often very intensive sampling would be required to confirm a species' status.

The results of the database searches were reviewed and interpreted, and obvious errors and out of date taxonomic names were removed.

2.3.4.2 Conservation significance

All expected species were assessed for conservation significance as detailed in **Appendix 1.** Three broad levels of conservation significance are used in this report:

- Conservation Significance 1 (CS1) – species listed under State or Commonwealth Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act);
- Conservation Significance 2 (CS2) – species listed as Priority by DBCA but not listed under State or Commonwealth Acts; and
- Conservation Significance 3 (CS3) – species not listed under Acts or in publications but considered of at least local significance because of their pattern of distribution.

See **Appendix 1** for an expanded discussion of these categories and **Appendix 2** for a description of the categories used in the legislation (EPBC and BC Acts) and by the DBCA.

2.4 Field investigations

2.4.1 Overview

A survey of the project area was conducted (10-14 September 2021) to familiarise the consultants with the leases and to search for specific conservation significant species. This involved inspecting as much of the project area as possible, including walking through areas that did not have direct vehicle access. This enabled:

- identification of VSAs (that provide fauna habitats);
- targeted searches for significant fauna and an assessment of their likelihood of occurrence based on VSAs present; target species include Malleefowl, Chuditch, ABAB and Trapdoor Spiders;
- continuous recording of bird species encountered; and
- opportunistic fauna observations.

2.4.2 Malleefowl

2.4.2.1 Overview

The project area was assessed for habitat which may have the potential to support Malleefowl, i.e., dense woodland and Acacia on stony or sandy substrates. This involved traversing the area and

assessing suitability of vegetation and substrate to support Malleefowl and its breeding efforts. Suitable areas were searched for Malleefowl nest mounds. Note that this was not a targeted Malleefowl survey (which involves systematic transects to search for mounds).

Results of previous Malleefowl surveys conducted in 2019 and 2020 by BCE were consulted and summarised.

2.4.2.2 Malleefowl nest mounds

Opportunistic records of Malleefowl mounds were made at all times of the field investigations. Mounds were recorded, measured (diameter across mound in metres, height of mound in centimetres and depth of crater in centimetres) and scored for mound profile and age, as described below:

Mound Profile

The profile of a Malleefowl mound changes with breeding activity and age (erosion and vegetation growth). A number of profile stages are classified according to age (NHT 2007):

- Profile 1: Typical crater with raised rims. This is the typical shape of an inactive nest. However, this is also the profile of a mound being worked early in the breeding season;
- Profile 2: Nest fully dug out. The characteristic of this profile is that the crater slopes down steeply and at the base the sides drop vertically to form a box- like structure with side usually 20 to 30 cm deep. Often, litter will have been raked into windrows, and may have started to enter the nest;
- Profile 3: Nest with litter. This is the next stage after profile 2. Litter will have been raked into the nest by Malleefowl, and thick layers of litter are evident on the surface. There may or may not be sand mixed with the litter at this stage;
- Profile 4: Nest mounded up (no crater). This is the typical profile of an active but unopened Malleefowl nest. The active mound is closed and dome shaped;
- Profile 5: Nest a crater with peak in centre. This is a typical profile of an active nest which is in the process of being closed by Malleefowl; and
- Profile 6: Nest low and flat without peak or crater. This mound has not been used for some time and weathering and erosion have 'flattened" the original mound.

Mound Age

- Active: Fresh scratching, Malleefowl scats, loose soil, mound may be dug out in preparation for the breeding season or mounded for breeding;
- Recently used: (1-5 years): Mound contains signs of recent activity (e.g., eggshell fragments) and mound may still contain large amounts of leaf litter if not excavated. Soil surface compacted, mound structure intact with well-defined central depression. No vegetation colonising mound;
- Moderately old: (5-20 years): No recent activity, mound compacted. Surface of mound showing some weathering and some minor plant colonisation possibly present. Mound profile raised; central depression defined;
- Old: (20-100 years): Mound moderately to very weathered, often with a veneer of gravel on the slopes because of removal of fine materials from the surface. Extensive plant colonisation. Mound profile raised; no or minimal central depression; and

- Very old: (100+ years): Mound very weathered, with a low profile. Bushes and even small trees growing on mound. No central depression.

2.4.2.3 Malleefowl critical habitat

Only a brief general definition of 'critical habitat' is provided under section 207B of the *EPBC Act*: "habitat identified … as being critical to the survival of a listed threatened species or listed threatened ecological community" (DEH 2000). Critical habitat specifically for Malleefowl is not presently defined (DoE 2020a) and, therefore, it is not currently listed on the Federal (*EPBC Act*) Register of Critical Habitat (DoE 2020b).

In the assessment of "Habitat critical for survival" for the *National Recovery Plan for Malleefowl*, Benshemesh (2007) noted that, at a national level at least, critical habitat is "not well understood". Habitat studies available at that time were not of sufficient scope to adequately describe the habitat features that are important for Malleefowl across their range (Benshemesh 2007). Benshemesh (2007) also noted that, at the time of publication, no particular populations or general areas can be described as being of greater importance for the long-term survival of Malleefowl.

In the absence of direct guidance at the national scale, for the purposes of this survey, we define critical habitat at the regional scale with the purpose of protecting a buffer zone around any active nest mound such that there is minimal disruption to the breeding success of that mound. There are no data available to guide the establishment of buffer widths, however, it is noted that active Malleefowl mounds have been observed in close proximity to disturbance areas (e.g. along the edges of active tracks or drill-lines; M. Bamford and W. Bancroft, pers. obs.). It is vital to preserve any connectivity of the active mound area to broadscale areas of native vegetation to facilitate movement through the natural landscape for parents (e.g. for foraging, while tending the mound) and offspring (for dispersal).

Suitable *potential* nesting habitat is not a limiting factor in the region (soils suited to mound construction, including loam-sand to gravel but not clay, with sufficient surrounding vegetation to provide leaf litter), additionally the Malleefowl is a mobile species that has the ability to transit to other areas without assistance. Therefore, the loss of inactive mounds at the local scale is highly unlikely to affect the long term survival of local individuals and will not affect the regional survival of the species. Suitable potential nesting habitat could be considered to be critical habitat if it supported active mounds (i.e. supported a breeding population of the species).

In the absence of a clear definition of critical habitat for Malleefowl, we concluded that this should be decided on a case by case basis where an active mound is found.

2.4.3 Chuditch

Motion-sensitive cameras are commonly used to detect mammals which may be otherwise difficult to detect, such as Chuditch. A total of ten camera traps was installed in areas containing suitable Chuditch habitat, i.e., rocky areas (**Figure 2-1**). They were left operational for a period of 33 to 36 nights with the first date of deployment being 10th September 2021 (**Table 2-5**). A non-reward lure was used to attract fauna to the camera in the form of bait tubes filled with universal bait (peanut butter, oats and sardines). Bait tubes were placed into the camera frame and attached to a solid

object to immobilise the tubes. Cameras were positioned in areas selected to maximise fauna detection such as along a trail and near suitable microhabitat such as hollow logs. Details of camera traps, including GPS coordinates, are given in **Table 2-5**.

Table 2-5. Details of camera traps deployed across project area (Zone 51J).

CT No.	Easting	Northing	Date Deployed	Date Collected	Priority Area	Duration (days)
BCE05	356195	6556763	10/9/21	16/10/21	2	36
BCE04	355794	6557667	10/9/21	16/10/21	2	36
BCE11	351453	6563419	11/9/21	17/10/21	1	36
BCE06	353192	6566439	11/9/21	17/10/21	1	36
BCE13	348878	6566791	11/9/21	17/10/21	1	36
BCE33	351037	6563964	12/9/21	17/10/21	1	35
BCE32	346713	6566556	12/9/21	17/10/21	1	35
BCE34	349686	6556571	13/9/21	16/10/21	3	33
BCE30	348792	6555276	13/9/21	16/10/21	3	33
BCE31	350373	6564123	13/9/21	17/10/21	1	34

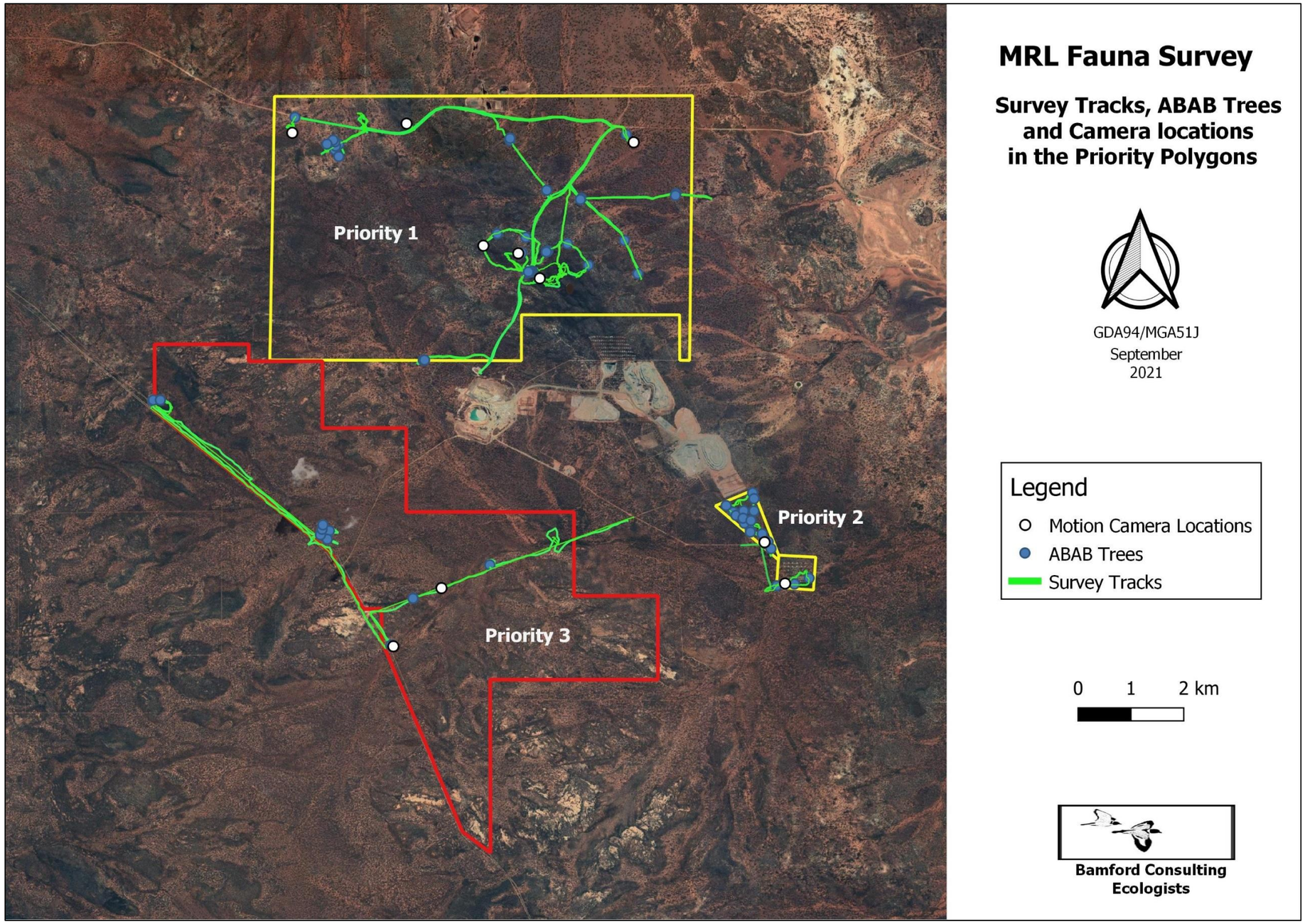


Figure 2-1. Map showing survey tracks, locations of camera traps and locations of ABAB trees. Fauna assessment priority levels for each lease as requested by MRL are indicated.

2.4.4 Arid Bronze Azure Butterfly

The Arid Bronze Azure Butterfly (ABAB) *Ogyris subterrestris petrina* has an obligate association with a sugar ant *Camponotus* sp. nr. *terebrans*, with the most critical factor for ABAB being the presence of these large host ant colonies. The sugar ants build nests at the base of smooth-barked eucalypts. Therefore, surveys for potential ABAB habitat involves searching for (i) smooth-barked eucalypts; and (ii) nests of these sugar ants. DBCA (2020) recommends a direct survey for ABAB being conducted only if large colonies of these ants are present.

The field investigations involved searching for ants around smooth-barked eucalypts when such trees were encountered. This involved disturbing the ground at the base of a tree (of DBH > 100 mm) to a depth of 10 cm and observing emerging ants. Locations of trees where this searching took place are indicated on **Figure 2-1**. Any ants of similar morphology to the sugar ant were collected (as per guidelines in DBCA 2020).

2.4.5 Trapdoor Spiders

Field investigations involved opportunistic searches for Trapdoor Spider burrows when suitable habitat was encountered (generally areas with leaf litter). Burrows have a camouflaged leaf litter door at the ground surface with leaves and/or twigs fanning out from the burrow rim. This distinctive leaf litter arrangement makes it possible to identify these burrows in the field. Species of interest are *Idiosoma sp.* as they are of conservation significance and considered likely to occur in the project area, but all spider burrows observed were recorded. Several specimens of the Shield-backed Trapdoor Spider were collected and sent to Volker W. Framenau of Murdoch University for identification.

2.4.6 Dates and Personnel

The project area was visited on the 10th to 14th September 2021. Personnel involved in the field investigations and report preparation (including desktop review) are listed in **Table 2-6**.

Table 2-6. Personnel involved in the field investigations and report preparation.

Personnel	Experience	Field Investigations	Report Preparation
Mr Tim Gamblin *B.Sc. (Zoology), Cert. Env. Mngmt.*	11 years	+	
Dr Jamie Wadey *BSc (Zoology/Ecology), Hons (Ecology), PhD (Movement Ecology)*	7 years	+	+
Ms Natalia Huang *BSc (Environmental Science/Zoology), Hons (Conservation Biology), MBA*	15 years		+
Dr Mike Bamford *BSc (Biology), Hons (Biology), PhD (Biology)*	40 years		+

2.5 Survey limitations

The EPA Guidance Statement 56 (EPA 2004) and the EPA (2020) outline a number of limitations that may arise during field investigations for Environmental Impact Assessment. These survey limitations are discussed in the context of the BCE investigation of the project area in **Table 2-7**. No limitations were identified.

The lack of detailed survey (i.e. intensive sampling of the fauna assemblage) is not considered a limitation as this assemblage is well-understood in the area due to multiple previous field investigations. Furthermore, EPA guidance does not consider limitations related to the effectiveness of field sampling for fauna but appears to make an assumption that the purpose of such sampling is to confirm the fauna assemblage. This is implicit in the EPA (2020) technical guidance that does provide suggestions for sampling techniques, but the level of field investigations suggested cannot confirm the presence of an entire assemblage, or confirm the absence of a species. This requires far more work than is possible (or recommended) for studies contributing to the EIA process because fauna assemblages vary seasonally and annually, and often have high levels of variation even over short distances (Beta diversity). For example, in an intensive trapping study, How and Dell (1990) recorded in any one year only about 70% of the vertebrate species found over three years. In a study spanning over two decades, Bamford *et al.* (2010) found that the vertebrate assemblage varies over time and space, meaning that even complete sampling at a set of sites only defines the assemblage of those sites at the time of sampling. The limited effectiveness of short periods of fauna sampling is not a limitation for impact assessment *per se*, as long as database information is interpreted effectively and field investigations are targeted appropriately. That is the approach taken by BCE.

Table 2-7. Survey limitations as outlined by EPA (2020).

EPA Survey Limitations	BCE Comment with regard to 2021 field investigations
Availability of data and information	Extensive information from databases and previous studies (see Section 2.3.1). Not a limitation.
Competency/experience of the survey team, including experience in the bioregion surveyed	The ecologists have had extensive experience in conducting desktop reviews, and basic and targeted surveys for environmental impact assessment fauna studies and have undertaken many studies within the region. Not a limitation.
Scope of the survey (e.g. were faunal groups were excluded from the survey)	The survey focused on terrestrial vertebrate fauna and fauna values. Not a limitation.
Timing, weather and season	Timing is not of great importance for Basic level field investigations in this region. Not a limitation.
Disturbance that may have affected results	None. Not a limitation.
The proportion of fauna identified, recorded or collected	All fauna observed were identified. Not a limitation.
Adequacy of the survey intensity and proportion of survey achieved (e.g. the extent to which the area was surveyed)	The site was adequately surveyed to the level appropriate for a Basic level assessment. Fauna database searches covered a 25 km radius beyond the centroid of the project area. The Basic level assessment was completed. Not a limitation.
Access problems	There were no access problems encountered. Not a limitation.
Problems with data and analysis, including sampling biases	There were no data problems. Not a limitation.

2.6 Presentation of results for Impact Assessment

While some impacts are unavoidable during development, the concerns are long-term, deleterious impacts upon biodiversity. This is reflected in documents such as the Significant Impact Guidelines provided by DSEWPaC (2013) (see **Appendix 4**). Significant impacts may occur if:

- There is direct impact upon a VSA and the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna;
- There is direct impact upon conservation significant fauna; or
- Ecological processes are altered and this affects large numbers of species or large proportions of populations, including significant species.

The impact assessment process therefore involves reviewing the fauna values identified through the desktop assessment and field investigations, with respect to the project and impacting processes. The severity of impacts on the fauna assemblage and conservation significant fauna can then be quantified on the basis of predicted population change. The presentation of this assessment follows the general

approach to impact assessment as given in Section 1.1, but modified to suit the characteristics of the site. Key components to the general approach to impact assessment are addressed as follows:

Fauna values

This section presents the results of the desktop and field investigations in terms of key fauna values (described in detail in **Appendix 1**) and includes:

- Recognition of ecotypes or vegetation/substrate associations (VSAs);
- Assemblage characteristics (uniqueness, completeness and richness);
- Species of conservation significance;
- Patterns of biodiversity across the landscape; and
- Ecological processes upon which the fauna depend.

Impact assessment

This section reviews impacting processes (as described in detail in **Appendix 3**) with respect to the proposed development and examines the potential effect these impacts may have on the faunal biodiversity of the project area. It thus expands upon Section 1.1 and discusses the contribution of the project to impacting processes, and the consequences of this with respect to biodiversity. A major component of impact assessment is consideration of threats to species of conservation significance, as these are a major and sensitive element of biodiversity. Therefore, the impact assessment section includes the following:

- Review of impacting processes; will the proposal result in:
    - Habitat loss leading to population decline, especially for significant species;
    - Habitat loss leading to population fragmentation, especially for significant species;
    - Weed invasion that leads to habitat degradation;
    - Ongoing mortality;
    - Species interactions that adversely affect native fauna, particularly significant species;
    - Hydrological change;
    - Altered fire regimes; or
    - Disturbance (dust, light, noise).
- Summary of impacts upon significant species, and other fauna values.

The impact assessment concludes with recommendations for impact mitigation, based upon predicted impacts. Note that the terms direct and indirect impacts are not used in this report; for further explanation see **Appendix 2**.

2.6.1 Criteria for impact assessment

Impact assessment criteria are based on the severity of impacts on the fauna assemblage and conservation significant fauna. It is quantified on the basis of predicted population change (**Table 2-8**). Population change can be the result of direct habitat loss and/or impacts upon ecological processes.

The significance of population change is contextual. The EPA (2016c) suggested that the availability of fauna habitats within a radius of 15 km can be used as a basis to predict low, moderate or high impacts. In this case, a high impact is where the impacted environment and its component fauna are rare (less than 5% of the landscape within a 15 km radius or within the Bioregion), whereas a low

impact is where the environment is widespread (e.g. >10% of the local landscape). Under the Ramsar Convention, a wetland that regularly supports 1% of a population of a waterbird species is considered to be significant. These provide some guidance for impact assessment criteria. In the following criteria (**Table 2-8**), the significance of impacts is based upon the percentage of population decline within a 15 km radius (effectively local impact) and upon the effect of the decline upon the conservation status of a recognised taxon (recognisably discrete genetic population, sub-species or species). Note that percentage declines can usually only be estimated on the basis of the distribution of a species derived from the extent of available habitat while for a few species, such as the Black-Cockatoos, there is guidance for the assessment of impact significance.

Table 2-8. Assessment criteria for impacts upon fauna.

Impact Category	Observed Impact
Negligible	Effectively no population decline; at most few individuals impacted and any decline in population size within the normal range of annual variability.
Minor	Population decline temporary (recovery after end of project such as through rehabilitation) or permanent, but < 1% within 15 km radius of centre-point of impact area (or within bioregion if this is smaller). No change in viability or conservation status of taxon.
Moderate	Permanent population decline 1-10% within 15 km radius. No change in viability or conservation status of taxon.
Major	Permanent population decline 10-50% within 15 km radius. No change in viability or conservation status of taxon.
Critical	Taxon decline > 50% (including local extinction) within 15 km and/or change in viability or conservation status of taxon.

2.7 Mapping

As requested, high resolution maps have been provided within the body of this report. GIS files will be required as per client specifications. As per the recommendation of EPA (2020), maps use the GDA94 datum and are projected into the appropriate Map Grid of Australia (MGA94) zone.

3 Fauna values

3.1 Vegetation and Substrate Associations (VSAs)

Vegetation and substrate associations within the project area are a complex mosaic, largely reflecting soil types. Previous surveys in the Mt Marion area provided an understanding of the VSAs considered likely to be present. From this, and observations made during the field investigations, seven major VSAs were identified in relation to fauna in the project area. Six of these were presented in the 2019 review (Metcalf and Bamford 2019), with the descriptions being modified slightly here. The VSAs identified within the project area are:

1. **Mixed Eucalypt woodland over sclerophyll shrubland on undulating hills.** Dominant species vary across the project area, including *Eucalyptus transcontinentalis, E. salmonophloia, E. lesouefii, E. gracilis, E. ravida,* and *E. oleosa.* Equivalent to VSA 1 in Metcalf and Bamford 2019. Occurs in L/M and Hamptons. See **Plate 1**.
2. **Acacia shrubland on slopes with scattered Eucalypts over rocky loam.** Equivalent to VSA 2 in Metcalf and Bamford 2019. Occurs in Hamptons. See **Plate 2.**
3. **Open to closed Eucalypt woodland or Mallee over mixed shrubland on flats.** Dominant Eucalypt species vary across the project area. Equivalent to VSA 3 in Metcalf and Bamford 2019. This VSA covers majority of the project area and occurs in L/M, Hamptons and East. See **Plate 3**.
4. **Mixed Eucalypt woodland over *Melaleuca sheathiana* on gravelly rises.** *Melaleuca sheathiana* thickets and scattered smooth-barked Eucalypts over stony brown loam rises. Equivalent to VSA 4 in Metcalf and Bamford 2019. Occurs in L/M. See **Plate 4**.
5. **Dense Mallee and Eucalypt woodland associated with minor drainage lines.** Dense Mallee over Acacia with scattered Eucalypts over fine red loam in drainage lines. Equivalent to VSA 5 in Metcalf and Bamford 2019. Occurs in L/M and East. See **Plate 5**.
6. **Acacia shrubland on brown loam flats.** Open Acacia shrubland with lack of understorey over stony brown loam flats. Equivalent to VSA 6 in Metcalf and Bamford 2019. Occurs in L/M. See **Plate 6**.
7. **Dense Acacia shrubland on exposed granite.** Acacia shrubland with scattered Eucalypts over mixed shrubland on rocky exposed granite and red loam. Occurs in East. This VSA was not listed in the 2019 review. See **Plate 7**.

VSA mapping is not available as the leases were not traversed completely (in particular, East). It is expected that the remaining areas of the leases are likely to contain the above VSAs and be dominated by VSA 3, which is the most prevalent VSA across previously-surveyed areas in Mt Marion. More detailed and extensive surveys will be required to understand the full extent of VSAs within the project area.

Plate 1. VSA 1: Mixed Eucalypt woodland over sclerophyll shrubland on undulating hills.

Plate 2. VSA 2: Acacia shrubland on rocky rises.

Plate 3. VSA 3: Eucalypt woodland over mixed shrubs on red loam flats.

Plate 4. VSA 4: Mixed Eucalypt woodland over Melaleuca sheathiana on gravelly rises.

Plate 5. VSA 5: Dense Mallee and Eucalypt woodland associated with minor drainage lines.

Plate 6. VSA 6: Acacia shrubland on brown loam flats.

Plate 7. VSA 7: Dense Acacia shrubland on exposed granite.

3.2 Fauna assemblage

3.2.1 Expected vertebrate fauna assemblage

The desktop study identified 288 vertebrate fauna species as potentially occurring in the Mt Marion Lithium Project area (see **Appendix 5**): five frogs, 85 reptiles, 164 birds, 25 native and ten introduced mammals. Of these, 95 species have been recorded during fauna assessments within the project area, including one frog, 12 reptiles, 66 bird species, ten native mammals and six introduced mammals. This list does not include locally extinct species and records of species that may formally have been present are limited. However, based on broad patterns of distribution and habitat, locally extinct species are likely to include the Numbat *Myrmecobius fasciatus*, Brushtail Possum *Trichosurus vulpecula* the Greater Bilby *Macrotis lagotis* and one of the stick-nest rats *Leporillus* sp..

The 2021 survey confirmed the presence of three reptiles, 34 birds, two native mammals and one introduced mammal. The camera trap survey recorded the presence of three reptile, nine bird and three mammal species, with the most abundantly recorded group being birds (number of detections=49), followed by reptiles (number of detections=13) and mammals (number of detections=11). Notable camera trap detections included one incidence of mating Spotted Nightjars, a family of Emus (one adult male and six juveniles), and a feral cat. **Appendix 6** lists all species recorded during 2021 field investigations. Raw camera trap data are presented in **Appendix 7**.

The faunal assemblage expected is typical of the Coolgardie region. Most fauna species recorded or expected to occur in the project area are widespread, but some species may have restricted or habitat limited distributions, and some fauna species expected have declined in the region. The composition of the vertebrate fauna expected to occur and recorded within the project area is presented in **Table 3-1**. The conservation significant fauna species occurring or likely to occur in the project area are discussed in the following section.

Key features of the fauna assemblage expected in the project area are:

- Uniqueness: The assemblage is typical of that found in Goldfields eucalypt woodlands. The project area occurs near the edge of some fauna species' distribution e.g., Blue-breasted Fairy-wren and Western Yellow Robin;
- Completeness: The assemblage of species from the project area is mostly complete, with a portion of the mammal fauna considered locally extinct; and
- Richness: The assemblage contains a high level of richness to be expected in relatively undisturbed intact woodland vegetation.

Table 3-1. Composition of vertebrate fauna assemblage of the project area.

Taxon	Number of species	Total species recorded	Number of species in each status category			
			Resident	Migrant or regular visitor	Irregular visitor	Vagrant
Frogs	5	1	5	-	-	-
Reptiles	85	12	85	-	-	-
Birds	164	66	86	35	7	36
Native Mammals	25	10	22	1	1	-
Introduced Mammals	10	6	5	2	3	-
Total	**288**	**95**	**203**	**38**	**11**	**36**

3.2.2 Vertebrate fauna of conservation significance

Of the 288 species of vertebrate fauna that are expected to occur in the project area, 33 are considered to be of conservation significance (10 CS1, two CS2 and 21 CS3; see **Appendix 1** for descriptions of these CS (conservation significance) levels). A summary of the numbers in each vertebrate class is presented in

Table 3-2. The majority of conservation significant species are expected as residents (13 species), following by vagrants (7 species), regular visitors (7 species) and irregular visitors (6 species). The list of expected conservation significant species, their CS levels, expected status in the project area, and local records are given in

Table 3-3.

A total of ten conservation significant species have been recorded to date, comprising one CS1 and 9 CS3 species (

Table 3-2 and **Appendix 5**). Only one conservation significant species was recorded during 2021 field investigations – the CS3 Copper-backed Quail-thrush, recorded on a camera trap in Hamptons (see **Appendix 7**).

Table 3-2. Summary of conservation significant species expected and recorded in Mt Marion.

Number of species recorded in parenthesis. See **Appendix 1** for full explanation of Conservation Significance (CS) levels: CS1 = listed under WA State and/or Commonwealth legislation; CS2 = listed as Priority by DBCA; CS3 = considered locally significant.

Taxon	Significant Fauna expected (recorded)		
	CS1	CS2	CS3
Frogs	0	0	0
Reptiles	0	0	1
Birds	9 (1)	1	19 (9)
Native Mammals	1	1	1
Introduced Mammals	0	0	0
Total	**10**	**2**	**21**

Table 3-3. Significant fauna species recorded or expected in the Mt Marion Lithium Project area.

Common Name	Latin Name	Conservation Status				Expected status in project area	Local records
BCA		EPBC	BCA	Priority	CS3		
Conservation Significance 1 (CS1)							
Malleefowl	*Leipoa ocellata*	Vul	Vul			Visitor	Mt Marion
Fork-tailed Swift	*Apus pacificus*	Mig	Mig			Irregular visitor	Woolgangie
Hooded Plover	*Thinornis rubricollis*	Mig	Mig			Vagrant	Bulong
Sharp-tailed Sandpiper	*Calidris acuminata*	Mig	Mig			Vagrant	Kambalda West
Curlew Sandpiper	*Calidris ferruginea*	Mig	Mig			Vagrant	Kambalda East
Red-necked Stint	*Calidris ruficollis*	Mig	Mig			Vagrant	Kambalda East
Common Greenshank	*Tringa nebularia*	Mig	Mig			Vagrant	Kambalda East
Wood Sandpiper	*Tringa glareola*	Mig	Mig			Vagrant	Kambalda East
Peregrine Falcon	*Falco peregrinus*		OS			Visitor	St Ives
Chuditch	*Dasyurus geoffroyii*	Vul	Vul			Vagrant to Irregular Visitor	Kalgoorlie
Conservation Significance 2 (CS2)							
Western Rosella (Inland)	*Platycercus icterotis xanthogenys*			4		Irregular Visitor	Kalgoorlie
Central Long-eared Bat	*Nyctophilus major tor*			3		Resident	Coolgardie
Conservation Significance Level 3							
Carpet Python	*Morelia spilota imbricata*				X	Resident	Kalgoorlie
Australian Bustard	*Ardeotis australis*				X	Irregular Visitor	Coolgardie
Bush Stone-curlew	*Burhinus grallarius*				X	Visitor	Jilbadji
Square-tailed Kite	*Lophoictinia isura*				X	Visitor	St Ives
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*				X	Resident	Mt Marion
Regent Parrot	*Polytelis anthopeplus*				X	Visitor	St Ives

Common Name	Latin Name	Conservation Status				Expected status in project area	Local records
BCA		EPBC	BCA	Priority	CS3		
Scarlet-chested Parrot	*Neophema splendida*				X	Irregular Visitor	St Ives
Major Mitchell's Cockatoo	*Cacatua leadbeateri*				X	Visitor	Coolgardie
Rainbow Bee-eater	*Merops ornatus*				X	Regular Visitor	Mt Marion
White-browed Treecreeper	*Climacteris affinis*				X	Resident	Cannon
Rufous Treecreeper	*Climacteris rufus*				X	Resident	Mt Marion
Blue-breasted Fairy-wren	*Malurus pulcherrimus*				X	Resident	Mt Marion
Purple-gaped Honeyeater	*Lichenostomus cratitius*				X	Resident	Kalgoorlie
Shy Heathwren	*Hylacola cauta whitlocki*				X	Irregular visitor	St Ives
White-browed Babbler	*Pomatostomus superciliosus*				X	Resident	Mt Marion
Copper-backed Quail-thrush	*Cinclosoma clarum*				X	Resident	Mt Marion
Gilbert's Whistler	*Pachycephala inornata*				X	Resident	Mt Marion
Crested Shrike-tit	*Falcunculus frontatus*				X	Resident	Kalgoorlie
Western Yellow Robin	*Eopsaltria griseogularis*				X	Resident	Mt Marion
Southern Scrub-robin	*Drymodes brunneopygia*				X	Irregular Visitor	Mt Marion
Kultarr	*Antechinomys laniger*				X	Resident	Kalgoorlie

See **Appendix 2** for descriptions of conservation status codes. EPBC Act (EPBC) and Biodiversity Conservation Act (BCA): Vul: Vulnerable; End: Endangered; CE: Critically Endangered, Mig: Migratory, OS: Other Specially Protected Fauna; DBCA Priority: P1 – P4 = Priority 1 - 4. CS3: locally significant but not listed.

3.2.3 Conservation significant species accounts

Conservation significant species which may occur in the project area on a regular basis (as regular visitor or resident) are discussed here under CS categories, except for the Chuditch (an irregular visitor to vagrant) which is included on the basis of being a targeted species in the 2021 investigations.

Conservation Significance Level 1

Malleefowl

In Western Australia, Malleefowl occur mainly in scrubs and thickets of Mallee (*Eucalyptus* spp.), Boree (*Melaleuca lanceolata*), Bowgada (*Acacia linophylla*), and other dense, litter-forming shrublands including Mulga (*Acacia aneura*) (Johnstone and Storr 2004). The species' distribution was once larger and less fragmented, but the widespread clearing of suitable habitat, coupled with the degradation of habitat by fire and livestock, and fox predation, has reduced Malleefowl numbers considerably (Johnstone and Storr 2004). It is expected to be a regular visitor to the area, with recent breeding recorded in the Hamptons lease (in the past 1 to 5 years).

The field investigations recorded two Malleefowl mounds, both located within the Hamptons lease (see **Figure 3-1**). Details of these mounds are given in **Table 3-4** with photographs of each mound in **Figure 3-2** and **Figure 3-3**. These mounds are located outside previous survey areas and have not been

recorded in previous BCE surveys. Both mounds are within one km of the closest mound recorded by BCE to the south in 2016 (Bamford et al. 2016; see **Figure 3-4**). It is noted that one of the mounds recorded in the present survey was assessed as being of "Recent" age (1-5 years), though not currently active. All other mounds previously recorded by BCE in the Mt Marion area were classed as Moderately Old (5-20 years), Old (20-100 years), or Very Old (100+ years) (see **Table 3-5**).

No Malleefowl were seen, and there were no signs of Malleefowl presence (e.g. tracks, droppings, feathers). There is potential nesting habitat in the densely-vegetated part of Hamptons which contained the Malleefowl mounds, with little obvious habitat in East and in M (which is mostly drill-pads) and L (**Figure 3-1**).

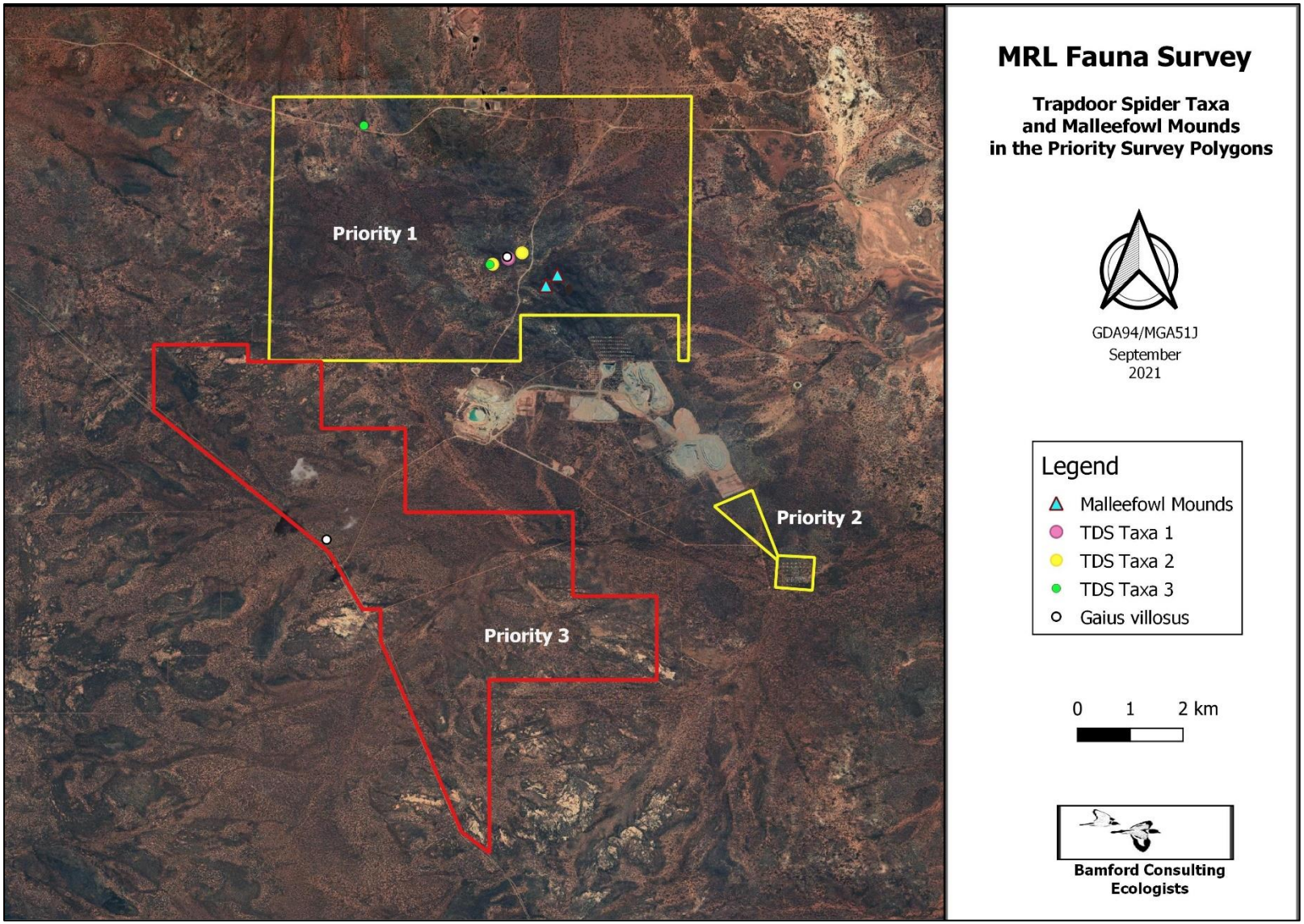


Figure 3-1. Map showing locations of Malleefowl mounds and Trapdoor Spider burrows recorded during 2021 survey.

Table 3-4. Details of Malleefowl mounds recorded in 2021 field investigations.

UTM Zone 51. Mound width (W, metres), height (H, centimetres), depth (D, centimetres) and profile (P) listed. See Methods for explanation of profile and age categories.

Lease	Status	Age (yrs)	W	H	D	Habitat	Easting	Northing	P	Comments
Hamptons	Inactive	Old (20-100)	10	55	25	Lower slopes of acacia shrubland on rocky red loam	351590	6563269	1	Low shrubs growing out of mound edges
Hamptons	Inactive	Recent (1-5)	6	40	65	Adjacent to drainage line in acacia shrubland on rocky loam	351804	6563508	1	Old egg shell fragments, no tracks

Figure 3-2. Malleefowl mound categorised as "Recent" and inactive; recorded in 2021 survey.

Figure 3-3. Mallefowl mound categorised as "Old"; recorded in 2021 survey.

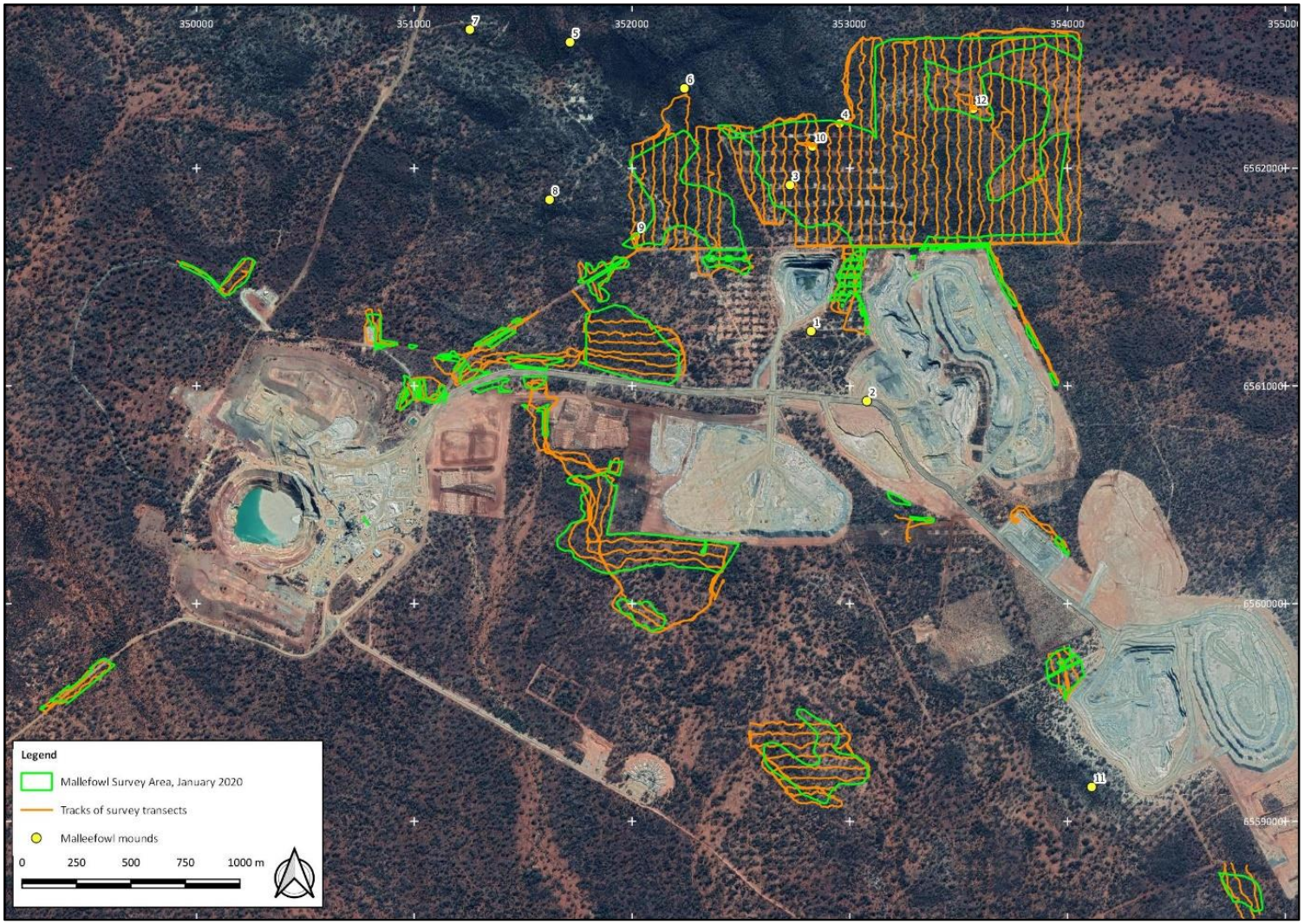


Figure 3-4. Malleefowl mounds recorded in previous BCE surveys across the Mt Marion site (figure taken from Bancroft and Bamford 2020); closest mound (#7) is located <1 km south of mounds recorded in 2021 survey. Details of 2020 mounds are given in Table 3-5.

Table 3-5. Details of Malleefowl mounds recorded in previous surveys across Mt Marion site (taken from Bancroft and Bamford 2020).

	Easting	Northing	Habitat / Vegetation	W	H	D	Age	P	Reference
1	352822	6561252	*Eucalyptus spp.* And *Acacia acuminata* over *Melaleuca* and *Eremophila.*	3	50	-	Very Old	6	Rapallo (2010)
2	353078	6560931	*Allocasuarina* over *Melaleuca pauperiflora* shrubland	4	40	20	Very Old	6	Rapallo (2010)
3	352725	6561923	*Acacia quadrimarginea* over *Allocasuarina* on gravelly/rocky slight	NA	NA	NA	Very Old	NA	BCE (2016b)
4	352953	6562206	*A. quadrimarginea* shrubland, *A. acuminata*, *E. oldfieldi*	7	50	40	Moderately old	1	BCE (2016a)
5	351715	6562579	*A. quadrimarginea* shrubland, *A. acuminata*, *E. lesouefii*	6	30	30	Very Old	1	BCE (2016a)
6	352240	6562367	*Acacia, Allocasuarina, Senna,* Mallee thicket	7	100	50	Old	1	BCE (2016a)
7	351255	6562637	Mallee*, A. quadrimarginea, Dodonea sp, Scavola spinescens*	4	50	20	Old	1	BCE (2016a)
8	351621	6561856	Mallee, Melaleuca thicket	5	10	10	Very Old	1	BCE (2016a)
9	352017	6561688	Mallee, Melaleuca thicket	10	50	0	Very Old	6	BCE (2016a)
10	352828	6562100	*A. quadrimarginea*, *A. acuminata*, *E. oldfieldi, E scoparia*	7	50	0	Very Old	6	BCE (2016a)
11	354110	6559159	*Eucalypt* woodland over open mixed shrubland	4	20	0	Very Old	6	Metcalf and Bamford (2017)
12	353566	6562272	*Acacia* spp. Shrubland	4.5	20	0	Very Old	6	Bancroft and Bamford (2020)

Peregrine Falcon

This species is found in a wide variety of habitats, with its distribution often linked to the abundance of prey. Blakers *et al*. (1984) consider that Australia is one of the strongholds of the species since it has declined in many other parts of the world. It is considered likely to be a regular visitor to the project area, with the possibility that the area is within the range of a resident pair. If a pair is resident, they may nest in an old raven or crow nest in a tall eucalypt.

Chuditch

The Chuditch occurs in Jarrah woodlands, mallee shrublands and heathlands. Its range has contracted drastically since European settlement as a result of feral predation, land clearing and removal of den sites. The project area represents the north-eastern edge of its range, and it is expected as a vagrant in the Mt Marion area.

No Chuditch were recorded on camera traps in the 2021 field investigations. However, suitable habitat for Chuditch exists throughout the project area, and the species is considered likely to occur as a vagrant, more likely in autumn when juveniles and breeding adults are dispersing. The closest records of Chuditch are ~ 200 km southwest of Mt Marion around Mt Holland, with eighteen

individuals recorded in 2016 and ten individuals recorded in 2017, including adults and dispersing juveniles (Western Wildlife 2017). Given the home range of the Chuditch extends up to 15 km^2 for males and 3-4 km^2 for females (DBCA 2017), Mt Marion may be outside the range for this population but within the range of dispersing individuals, hence the expectation that the species may be an irregular visitor or vagrant in the area.

Conservation Significance Level 2

Central Long-eared Bat
Critical habitat for this species would be tree-hollows, most likely in large eucalypts. There is the potential for a resident population in the Mt Marion area.

Conservation Significance Level 3
The CS3 class is more subjective but includes species that have declined extensively across the Wheatbelt and Goldfields due to land clearing, and species that occur at the edge of their range in the region. This makes their presence in the project area significant as populations on the edge of a species' range are often less abundant and more vulnerable to extinction than populations at the centre of the range (Curnutt *et al.* 1996).

Carpet Python
This species is often associated with cover provided by exposed rocks or fallen timber. There is the potential for a resident population in the Mt Marion area.

CS3 birds
There are 15 locally significant birds expected to occur as regular visitor or resident in the Mt Marion area. A number of south-west Australian woodland bird species are recognized as declining (Saunders and Ingram 1995) and are listed in this review under CS3 (see
Table 3-3). These species have lost considerable areas of habitat throughout the Wheatbelt and adjacent Goldfields as a result of large-scale habitat clearance and the removal of mature Eucalypt trees. Species include Regent Parrot, Southern Scrub-robin, Purple-crowned Lorikeet, Gilbert's Whistler, Rufous Tree-creeper and Purple-gaped Honeyeater. These species generally remain widespread and, in some cases, common in the broader Great Western Woodlands. The retention of these species in their natural abundances is of particular conservation significance as these species are now increasingly absent or rare over much of the Wheatbelt (Duncan *et al.* 2006, Watson *et al.* 2008). Furthermore, some species recorded at Mount Marion are near the limit of their range and are also considered locally significant (and thus listed here as CS3). These include the Blue-breasted Fairy-wren and Western Yellow Robin.

Kultarr
Specific habitat associations for this species are unclear. There is the potential for a resident population in the Mt Marion area.

3.2.4 Invertebrate fauna of conservation significance

Five conservation significant invertebrate species have been recorded in the Coolgardie - Kalgoorlie area from database searches (DBCA 2019, ALA 2021). These are the ABAB (*Ogyris subterrestris petrina*), Inland Hairstreak (*Jalmenus aridus*), the freshwater shrimp *Branchinella denticulate*, the

Coolgardie Shield-backed Trapdoor Spider *Idiosoma* intermedium, and the Central Eastern Wheatbelt Shield-backed Trapdoor Spider *Idiosoma mcnamarai*. In addition, trapdoor spiders are considered likely to occur in the project area. These are discussed under headings below.

Arid Bronze Azure Butterfly

The Arid Bronze Azure Butterfly (ABAB) is listed as critically endangered under the national EPBC Act 1999 and the state Biodiversity Conservation Act 2016. The ABAB is listed due to its low abundance and fragmented distribution, with only two extant subpopulations remaining in Western Australia (one in Wheatbelt and one in Goldfields; DBCA 2020). It is only known from Barbalin Nature Reserve (10 km west of Mukinbudin, in the Wheatbelt), however was formerly known from the Lake Douglas area (12 km south-west of Kalgoorlie and only 15 km north of the Mt Marion Project). At Lake Douglas, the ABAB was recorded from undulating stony rises supporting *Eucalyptus concinna*. While the species has not been recorded in the Lake Douglas area since 1993, it has the potential to persist in the wider area.

All leases contained habitat considered suitable for the ABAB-associated sugar ant (i.e. smooth-barked eucalypts on red loam with disturbance), however, no *Camponotus* ants were found. As the ant has not been recorded in this and multiple previous surveys, while not necessarily absent, the ABAB is considered unlikely to occur in the Mt Marion area. Details of each tree surveyed is given in **Table 3-6** and shown in **Figure 2-1**.

Table 3-6. Details of smooth-barked eucalypts surveyed for ABAB-associated ants

Form	DBH	*C. terebrans*	Easting	Northing	Zone	Priority Area
Tree	300	nil	356037	6556710	51J	2
Mallee	300	nil	356647	6556887	51J	2
Mallee	250	nil	356373	6556756	51J	2
Tree	450	nil	355811	6557636	51J	2
Tree	400	nil	355522	6557938	51J	2
Tree	200	nil	355195	6558324	51J	2
Tree	500	nil	355553	6558753	51J	2
Tree	200	nil	355581	6558623	51J	2
Tree	300	nil	355584	6558352	51J	2
Tree	800	nil	355862	6557677	51J	2
Tree	900	nil	355917	6557528	51J	2
Mallee	150	nil	351206	6563537	51J	1
Tree	600	nil	353048	6566609	51J	1
Tree	200	nil	347517	6566201	51J	1
Mallee	150	nil	347602	6566049	51J	1
Tree	400	nil	347600	6566316	51J	1
Tree	250	nil	347538	6566276	51J	1
Mallee	150	nil	346758	6566899	51J	1
Mallee	200	nil	350594	6557095	51J	3
Tree	250	nil	349674	6556569	51J	3
Mallee	250	nil	349161	6556343	51J	3
Mallee	300	nil	348772	6555303	51J	3
Tree	350	nil	344151	6560616	51J	3
Tree	370	nil	347542	6557804	51J	3

Form	DBH	*C. terebrans*	Easting	Northing	Zone	Priority Area
Mallee	250	nil	347505	6557617	51J	3
Tree	300	nil	350367	6564125	51J	1
Mallee	150	nil	350633	6564390	51J	1
Mallee	150	nil	351174	6564319	51J	1
Tree	300	nil	352369	6563722	51J	1
Tree	300	nil	351969	6564189	51J	1
Tree	200	nil	351600	6564029	51J	1
Tree	150	nil	352220	6565197	51J	1
Tree	500	nil	353046	6564275	51J	1
Tree	200	nil	353313	6563548	51J	1
Mallee	500	nil	354013	6565321	51J	1
Tree	300	nil	350843	6566446	51J	1
Tree	900	nil	349269	6561585	51J	1
Tree	150	nil	355522	6557888	51J	2
Tree	180	nil	355405	6558082	51J	2
Tree	250	nil	355244	6558251	51J	2
Tree	150	nil	355055	6558464	51J	2
Mallee	180	nil	355387	6558352	51J	2
Tree	150	nil	355378	6558190	51J	2
Tree	200	nil	355530	6558140	51J	2
Tree	350	nil	355746	6557850	51J	2
Tree	200	nil	351314	6563570	51J	1
Tree	350	nil	351300	6563579	51J	1
Tree	400	nil	351289	6563559	51J	1
Tree	200	nil	351263	6563558	51J	1
Tree	150	nil	351235	6563559	51J	1
Tree	300	nil	351100	6563978	51J	1
Mallee	150	nil	347525	6566371	51J	1
Tree	200	nil	347488	6566408	51J	1
Tree	300	nil	347374	6566318	51J	1
Tree	200	nil	349149	6556337	51J	3
Mallee	150	nil	348743	6555297	51J	3
Tree	300	nil	344164	6560634	51J	3
Tree	250	nil	344297	6560635	51J	3
Mallee	150	nil	347375	6557711	51J	3
Mallee	150	nil	347405	6557834	51J	3
Tree	200	nil	347419	6557931	51J	3
Tree	200	nil	351569	6564003	51J	1
Tree	150	nil	352199	6565167	51J	1
Tree	300	nil	354001	6565282	51J	1
Tree	350	nil	350845	6566495	51J	1
Tree	350	nil	351557	6565361	51J	1
Tree	850	Nil	349293	6561589	51J	1

Inland Hairstreak

The Inland Hairstreak is listed as Priority 1 by the DBCA. There is limited knowledge of its distribution and biology; it is only known from an area near Kalgoorlie, the larvae feed on leaves and flowers of *Senna nemophila* and *Acacia tetragonophylla*, and the caterpillars are attended to by the ant species *Froggattella kirbii.*

Freshwater shrimp *Branchinella denticulata*

The freshwater shrimp *Branchinella denticulata* is listed as Priority 3 by the DBCA. There is limited information on the species range, population dynamics and threats, but it is considered vulnerable (Inland Water Crustacean Specialist Group, 1996). No suitable waterbodies have been identified within the project area, therefore it is considered unlikely to occur within the project area.

Tree-stem Trapdoor Spider

The Tree-stem Trapdoor Spider *Aganippe castellum* is listed as Priority 4 by DBCA and while not returned from databases, there is some suitable habitat for the species in the general area (typically shrublands on the mid to lower slopes of rocky ridges and the adjacent plains, where it builds a distinctive burrow against eucalypts, Broom-bush, Sheoaks and other shrubs (BCE database)). The nearest records come from Koolyanobbing Range, Bungalbin Hill and Mt Dimer (over 100 km west of Kalgoorlie, DBCA 2019 and BCE records), where the Tree-stem Trapdoor Spider appears to be widespread (BCE database). It was not recorded in the 2021 field investigations and has not been previously recorded in the Mt Marion area. It is considered unlikely to be present in the project area.

Shield-backed Trapdoor Spiders *Idiosoma* spp.

There are two species of Shield-backed Trapdoor Spider *Idiosoma spp.* that may occur within the project area: Coolgardie Shield-backed Trapdoor Spider *Idiosoma intermedium*, listed as P3, recorded in the Goldfields region (DBCA); and Central Eastern Wheatbelt Shield-backed Trapdoor Spider *Idiosoma mcnamarai*, listed as P1, recorded in the Wheatbelt region (DBCA) (ALA 2021). Both species therefore fall under the CS2 category of conservation significance in this report.

The field investigations recorded seven locations of trapdoor spider, with two of these being matriarchial clusters (i.e., a large burrow of the matriarch spider surrounded by multiple smaller burrows of juvenile spiders). All trapdoor spider burrows of interest were located within Hamptons. The locations of these burrows are shown in **Figure 3-1**. Details of each burrow are presented in **Table 3-7** and photographs of burrows shown in **Figure 3-5** to **Figure 3-10**.

Three specimens were collected for identification and all were unidentifiable species of the genus *Idiosoma*, with two juveniles and one adult female identified. It was not possible to know if they were all the same species or not. The precautionary approach was taken and it is considered possible that the collected specimens were individuals of either one or both of the expected priority-listed Shield-backed Trapdoor Spider: the Coolgardie Shield-backed Trapdoor Spider and/or the Central Eastern Wheatbelt Shield-backed Trapdoor Spider. Therefore, it is possible that one or both of these priority-listed species was recorded in the project area.

Table 3-7. Details of trapdoor spider species recorded in 2021 field investigations

Taxa#	Priority Area	Lid Architecture	Habitat	Details	Easting	Northing	Aspect	Photograph
Sp. 1	1	Typical fan with leaves 8mm diameter	High in landscape, mid-slope mallee woodland over open shrubland on rocky red loam.	Matriarchial cluster of 7, Voucher collected. Identified as juvenile *Idiosoma sp.*.	350866	6563858	East	Figure 3-5, Figure 3-6
Sp. 2	1	Typical fan with leaves 7-9mm diameter. Loam used as a 'glue' to keep fan twigs in position. Lid is sand covered.	Lower slope in open eucalypt woodland over open shrubland. Close to disturbance and drainage line.	Matriarchial cluster of 20, Voucher collected. The lid and associated fan is slightly raised (5mm) above ground level. Possibly due to position in landscape where elevation above water runoff is advantageous. Voucher collected. Identified as juvenile *Idiosoma sp.*.	351127	6563985	West	Figure 3-7
Sp. 2	1	As above for Sp. 2	Upper mid-slope in eucalypt woodland over acacia shrubland on stony red loam.	Single burrow found. No voucher collected as corresponded to the lid architecture of previous Sp. 2 taxa.	350573	6563726	South	
Sp. 3	1	Typical fan with acacia phyllodes and leaves. 10mm diameter	Upper mid-slope in eucalypt woodland over acacia shrubland on stony red loam.	Single burrow found. Voucher collected. Identified as female adult *Idiosoma sp.*.	350520	6563719	South	Figure 3-8
Sp. 3	1	As above	Open acacia shrubland on rocky red loam flats	No voucher taken - already specimen of taxa Sp. 3 collected.	348087	6566746	South	
Unidentified spider burrow	1	Large, 15 - 20mm diameter no 'moustache'/fan	Hill top with low acacia shrubland on rocky red loam	No voucher required – too large to be considered a CS species.	350845	6563893	nil	Figure 3-9

Taxa#	Priority Area	Lid Architecture	Habitat	Details	Easting	Northing	Aspect	Photograph
Unidentified spider burrow	3	Large, 15 - 20mm diameter no 'moustache'/fan	Salmon gum woodland on red loam flats	No voucher required – too large to be considered a CS species.	347510	6557615	nil	Figure 3-10

Figure 3-5. Trapdoor Spider burrow Species 1 (specimen collected and identified as *Idiosoma sp.*)

Figure 3-6. Trapdoor Spider burrow Species 1, same burrow with lid closed

Figure 3-7. Trapdoor Spider burrow Species 2 showing matriarchal cluster (specimen collected and identified as *Idiosoma sp.*)

Figure 3-8. Trapdoor Spider burrow Species 3 (specimen collected and identified as *Idiosoma sp.*)

Figure 3-9. Unidentified large spider burrow

Figure 3-10. Unidentified large spider burrow

No additional invertebrate species of listed conservation significance were recorded during the desktop assessment or field investigations. Invertebrates in general are beyond the scope of assessment for environmental impact assessment because the vast amounts of varying species and their taxonomy is so poorly understood, but it is possible to focus on a small range of taxa that are

short-range endemics (SRE). Harvey (2002) notes that the majority of invertebrate species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Schizomida (schizomids; spider-like arachnids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). Harvey (2002) classes invertebrates as SRE species if they have a distribution of <10,000 km2 and notes that they are often associated with fragmented and/or relictual environments. No other SRE taxa were recorded during the survey and in general the environment is not conducive to the evolution of such species, but this does not rule out the possibility of limited range species in the region.

3.3 Patterns of biodiversity

Investigating patterns of biodiversity can be complex and is beyond the scope of the present assessment and previous fauna assessments conducted across the Mt Marion Lithium Project area. However, the presence of a range of VSAs are factors in patterns of biodiversity. Within the project area, the VSAs are considered to be mostly intact with some historical mining, timber harvesting and grazing disturbance. Fauna that occur in eucalypt woodlands throughout the region are likely to utilise the project area for foraging, transit and/or nesting. Areas of dense thicket are important for species that prefer dense cover such as the Blue-breasted Fairy-wren and Western Yellow Robin. Areas with exposed granite may support a unique suite of species. The presence of large Eucalypts (predominantly Salmon Gums) containing large hollows is likely to influence patterns of distribution of fauna that rely on such hollows for breeding, such as several parrot species and the Rufous Tree-creeper.

3.4 Ecological processes

The nature of the landscape and the fauna assemblage indicate some of the ecological processes that may be important for ecosystem function (see **Appendix** 4 for descriptions and other ecological processes). Key ecological processes affecting the fauna assemblage in the project area are habitat loss, hydrology, feral species and interactions with native species, habitat degradation due to clearing and loss of connectivity.

Local hydrology. There is a paleo-drainage system in the area which drains into Lake Lefroy, south-east of the project area. The generally heavy soils in the area mean that surface and sub-surface water movement can be complex and can affect the distribution of plants.

Feral species and interactions with over-abundant native species. Feral species occur throughout Western Australia and it is expected that the fauna assemblage within the project area has been impacted by feral species (particularly foxes, feral cats and goats), which has resulted in the loss of some mammal and bird species. Rabbits and introduced rodents may cause further degradation to the native vegetation and, in combination with introduced predators (cats, dogs and foxes), reduce the capacity of the area to support native fauna diversity. Over-abundant native species such as the Galah may have suppressed the abundance of species such as Major Mitchell's Cockatoo. A feral cat was recorded on a camera trap in Hamptons in the present survey.

Connectivity and landscape permeability. The project area is part of a much greater area of native vegetation. The eucalypt woodlands in the project area provide connectivity between the surrounding woodlands, with fauna, such as birds and mammals, likely to move across the landscape.

Fire. Fire may rarely be a feature of this landscape, with some of the vegetation too open to carry fire regularly, but thickets are more likely to burn. The fauna is largely adapted to occasional fires but alterations to fire regimes have probably affected the abundance of some species, and thus fire is a factor to consider in understanding impacts.

3.5 Summary of fauna values

The desktop study identified 288 vertebrate fauna species as potentially occurring in the project area: five frogs, 85 reptiles, 164 birds, 25 native and ten introduced mammals. Ninety-five of these species have been recorded during fauna assessments to date, including species recorded in the 2021 field investigations. This total includes one frog, 12 reptiles, 66 bird species, ten native mammals and six introduced mammals. Conservation significant fauna species recorded comprised nine locally significant bird species and mounds of the CS1 Malleefowl.

Fauna values within the study area can be summarised as follows:

Fauna assemblage. Largely intact and rich, and broadly typical of the Coolgardie Bioregion. Some south-western species occur at the eastern edge of their range (Blue-breasted Fairy-wren, Western Yellow Robin) and the assemblage also has elements from adjacent biogeographic zones.

Species of conservation significance. Nineteen significant species likely to occur as residents or regular visitors of the project area. The majority of these are locally significant and are not listed under legislation. Significant species are:

- Malleefowl (CS1) – regular visitor; two mounds were recorded in Hamptons (one recent, one old) and suitable habitat is present mostly in Hamptons;
- Rainbow Bee-eater (CS3) – regular visitor;
- Peregrine Falcon (CS1) – resident or regular visitor;
- Chuditch (CS1) – vagrant; no Chuditch were recorded on camera traps;
- Central Long-eared Bat (CS2) – resident;
- Carpet Python (CS3) – resident;
- Locally significant (CS3) declining woodland birds; nine species recorded including Rainbow Bee-eater, Purple-crowned Lorikeet, Rufous Treecreeper, Blue-breasted Fairy-wren, White-browed Babbler, Copper-backed Quail-thrush, Gilbert's Whistler, Southern Scrub-Robin (irregular visitor) and Western Yellow Robin, and an additional seven species expected as residents or regular visitors including Bush Stone-curlew, Square-tailed Kite, Regent Parrot, Major Mitchell's Cockatoo, White-browed Treecreeper, Purple-gaped Honeyeater and Crested Shrike-tit; and
- Kultarr (CS3) – resident.

A further 13 conservation significant species are expected to occur as vagrants or irregular visitors.

Invertebrate species of conservation significance. No ants with which the ABAB is associated were recorded, although suitable habitat exists across the project area. Three trapdoor spider specimens were identified as species of *Idiosoma*, with the potential for them to represent two CS2 species.

Vegetation and Substrate Associations (VSAs). There were seven VSAs identified. Most of the project area contains intact eucalypt woodland or Mallee over a range of understorey types (ranging from Melaleuca and Acacia thickets, Eremophila shrub lands or sparsely vegetated). There are areas of open Salmon Gum woodland containing mature, hollow-bearing trees and valleys and slopes of the Saddle Hills contain dense Acacia shrub lands. Small areas on the crests of hills contain Casuarina or Melaleuca thickets. All VSAs are considered important for fauna, with large Salmon Gums providing important nesting opportunities for fauna and dense vegetation providing cover and habitat for species such as the Golden Whistler, Western Yellow Robin and Malleefowl. Two VSAs, #5 and #7, are not well represented within the project area. It is expected they will be represented outside of the project area as a similar portion of the landscape.

Patterns of biodiversity. The fauna assessment did not provide adequate data to examine detailed patterns of biodiversity but the presence of a range of VSAs are factors in patterns of biodiversity; fauna that occur in eucalypt woodlands throughout the region are likely to utilise the project area, areas of dense thicket are important for species that prefer dense cover, areas with exposed granite may support a unique suite of species and large, hollow-bearing trees in woodlands may provide important nesting opportunities.

Key ecological processes. Key ecological processes affecting the fauna assemblage in the project area are hydrology, feral species and possibly over-abundant native species.

4 Impact assessment

4.1 Impacting processes

Threatening processes have to be considered in the context of fauna values and the nature of the proposed action and are examined below. Impact categories are defined in **Table 2-8**.

Habitat loss leading to population decline *Minor to Moderate*

For the Coolgardie Bioregion (a Group 2 Bioregion), the EPA (2004) considers a proposal impacting > 50 ha as having a high impact, with the smaller leases in the project area being 50 ha and 67 ha, and Hamptons and East much larger (> 3000 ha). Population decline is inevitable with some habitat loss, but significance depends on proportion of VSA and of populations impacted. Most of the project area contains VSAs that are well represented in the region. The loss of potential breeding areas for Malleefowl is unlikely to impact the local population provided any active nests are protected to ensure breeding success. Large, hollow-bearing Eucalypt trees occur within the project area, support conservation significant fauna and contain breeding or roosting sites (tree hollows) for a range of fauna.

Habitat loss leading to population fragmentation *Negligible to Minor*

Linear landscape features that might be disrupted include drainage lines and to some extent hills, although these are broadly undulating rather than confined. Roads may limit movement of small, terrestrial fauna species.

Local hydrology *Minor (with management)*

There is a paleo-drainage system in the area which drains into Lake Lefroy, south-east of the project area. Surface and sub-surface drainage patterns are likely to be complex due to heavy soils. Alteration of drainage pattern can significantly impact downstream environments, therefore maintaining local hydrology is considered to be of high importance.

Degradation of habitat due to weed invasion *Negligible*

This impact should be Negligible assuming standard hygiene procedures are followed (see recommendations).

Ongoing mortality from operations *Minor (with management)*

The viability of species that occur at low population densities in areas adjacent to the project area may be compromised by ongoing mortality, such as through roadkill. The Malleefowl is of particular concern as it may occur in low densities within and adjacent to the project area (at least around Hamptons) and is highly susceptible to roadkill. The status of the Chuditch in the area is uncertain, but it may be present in low numbers and thus the occasional road death would be a significant impact on this population.

Species interactions *Minor (with management)*

Feral fauna can increase in abundance around human disturbance which may exacerbate localised impacts on other native fauna. Tracks through otherwise intact native vegetation can facilitate access by feral predators. At least one feral cat was active in the project area in 2021. Increases in the abundance of predatory and/or scavenging bird species can adversely impact smaller birds, including some of those listed as CS3. The abundance of some native species can increase around a mine, possibly due to the presence of fresh water (such as for more-aggressive birds) and increased foraging opportunities in cleared areas (such as for kangaroos); this can impact less common native species through competition and displacement.

Altered fire regimes *Negligible*

Impacts from fire arising from the project are anticipated to be Negligible providing management measures are in place.

Disturbance (dust, noise, light) *Minor (with management)*

The level of dust, noise and light from the proposed action is uncertain but impacts would be localised. Minor impact with some management possible.

4.2 Summary of impacts and Recommendations

Impacts upon significant fauna species and key fauna values are summarised in **Table 4-1** and

Table 4-2, and are mostly considered to be Negligible to Minor; this is largely because the project area is small relative to the broad and largely intact landscape. Impact upon some of the less widespread VSAs may be Minor to Moderate because they are limited in extent within the project area and their status in the broader region is uncertain (though they are expected to be represented at a similar portion of the landscape outside the project area); examples of these are VSA 5 (drainage lines) and VSA 7 (Acacia on exposed granite). Recommendations on management measures to mitigate potential impacts are included in **Table 4-1** and

Table 4-2.

Table 4-1. Impact assessment of the significant fauna species expected to occur in the project area.

Common Name	Status	Habitat	Occurrence	Management	Residual Impact
Malleefowl	Vul	Dense shrublands	Potential visitor	Survey for nests prior to clearing. Protect active nests, habitat preservation, roadkill management, monitor local population. Avoid increasing abundance of feral species.	Negligible
Carpet Python	CS3	Woodland tree hollows	Potential Resident	Conserve mature trees. Relocate if encountered during clearing.	Negligible
Peregrine Falcon	OS (Sect 18 of WA BCA)	Woodland tree hollows	Potential Resident	Maintain breeding sites if found (if possible), avoid direct impact on active nests.	Negligible
Major Mitchell's Cockatoo	CS3	Woodland tree hollows	Irregular visitor	Conserve mature trees, maintain breeding sites if found (if possible), avoid direct impact on active nests. Avoid encouraging over-abundant native species (such as the Galah).	Negligible
Central Long-eared Bat	P4	Woodland tree hollows	Potential Resident	Conserve mature trees, maintain breeding sites if found.	Negligible
Rainbow Bee-eater	CS3	Woodland	Regular Migrant	None	Negligible
CS3 Birds	CS3	Woodland	Resident	Habitat preservation / conserve mature trees where possible. Avoid over-abundant native species.	Negligible

Table 4-2. Summary of potential impacts upon key fauna values.

Fauna Value	Nature and Significance of Impact		Recommended Actions
	Potential Impacts	Significance	
Fauna assemblage	Increased mortality; loss of habitat; species interactions.	Minor as impacts very localised in a regional context	• Minimise impact footprint; • Conserve large, mature, hollow-bearing trees where possible; • Ensure landscape permeability is maintained by creating cross-over/underpass points along transport corridors/pipelines; and • Manage feral and over-abundant species
VSAs	Loss of habitat; habitat degradation.	Minor to Moderate – most of the area contains widespread VSAs; some VSAs are restricted within and outside the project area.	• Minimise footprint; • Minimise disturbance to mature Eucalypt trees and areas of dense understorey.
Significant fauna	Ongoing mortality; loss of habitat; species interactions.	Minor as impacts localised but consideration may be needed for Malleefowl if present in adjacent areas.	• Minimise footprint; • Habitat preservation – retain / manage important areas; • Monitor local Malleefowl population if present; • Protect active nests; and • Retain mature, hollow-bearing trees where possible.
Patterns of biodiversity	Loss of habitat	Minor as impacts very localized.	• Minimise footprint; and • Minimise disturbance to mature Eucalypt trees and dense Acacia shrubland areas.
Ecological processes	Increased mortality; habitat degradation	Minor	• Minimise disturbance footprint; • Manage hydrology; and • Feral species management

In addition, several recommendations are made for future surveys when more detail around a clearing footprint is available. These include:

- Malleefowl – conduct targeted systematic surveys for active Malleefowl mounds within and adjacent to the footprint;
- Chuditch – conduct camera trap surveys within and surrounding the footprint.
- ABAB – search for ABAB-associated ants within and surrounding the footprint; and
- Trapdoor Spiders – search for presence of threatened trapdoor spider burrows within and surrounding the footprint.

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6 Appendices

Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal, but contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

Assemblage characteristics

Uniqueness. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

Completeness. An assemblage may be complete (i.e. has all the species that would have been present at the time of European settlement), or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

Richness. This is a measure of the number of species at a site. At a simple level, a species rich site is more valuable than a species poor site, but value is also determined, for example, by the sorts of species present.

Vegetation and substrate associations (VSAs)

VSAs combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver *et al.* 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relictual or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

VSA assessment was made with reference to the key attributes provided by (EPA 2020):

- soil type and characteristics
- extent and type of ground surfaces and landforms
- height, cover and dominant flora within each vegetation stratum
- presence of specific flora or vegetation of known importance to fauna
- evidence of fire history including, where possible, estimates of time since fire
- evidence and degree of other disturbance or threats, e.g. feral species
- presence of microhabitats and significant habitat features, such as coarse woody debris, rocky
- outcrops, tree hollows, water sources and caves
- evidence of potential to support significant fauna
- function of the habitat as a fauna refuge or part of an ecological linkage.

Patterns of biodiversity across the landscape

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act). In addition, the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in **Appendix 2**.

<u>Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts</u>.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN 2012), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The *Wildlife Conservation Act 1950* uses a series of seven Schedules to classify conservation status that largely reflect the IUCN categories (IUCN 2012).

Conservation Significance (CS) 2: Species listed as Priority by DBCA but not listed under State or Commonwealth Acts.

In Western Australia, DBCA has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the *Wildlife Conservation Act 1950* but for which DBCA feels there is cause for concern.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DBCA, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (DEP 2000).

Marine-listed species

Some conservation significant species may also be listed as 'Marine' under the EPBC Act. This listing protects these species in 'Commonwealth areas' which include "marine areas beyond the coastal waters of each State and the Northern Territory, and includes all of Australia's Exclusive Economic Zone (EEZ)" (DAWE 2020b). The EEZ extends to 200 nautical miles (approximately 350 kilometres) from the coast (DAWE 2020b). This may mean that the 'Marine' listing does not apply to the project/survey area (depending on its location). Therefore, when a species is otherwise protected (under the EPBC Act or BC Act) or priority-listed (by the DBCA) then the Marine listing is also noted but it does not have site-specific relevance. In cases where a species is solely Marine-listed (for a list see DAWE 2020a) and a project/survey area is not within a Commonwealth area then it is treated like all other fauna.

Invertebrates

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

Ecological processes upon which the fauna depend

These are the processes that affect and maintain fauna populations in an area and as such are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in a project may be affected by processes such as fire regime, landscape patterns (such as fragmentation and/or linkage), the presence of feral species and hydrology. Impacts may be significant if processes are altered such that fauna populations are adversely affected, resulting in declines and even localised loss of species. Threatening processes as outlined in **Appendix 3** are effectively the ecological processes that can be altered to result in impacts upon fauna.

Appendix 2. Categories used in the assessment of conservation status.

IUCN (International Union for the Conservation of Nature) categories, as outlined by IUCN (2012), and as used for the *Environment Protection and Biodiversity Conservation Act 1999* and the Western Australian *Biodiversity Conservation Act 2016*.

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (Ex)	Taxa known to survive only in captivity.
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (E)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (V)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the WA *Biodiversity Conservation Act 2016*

Schedule 1 (S1)	Critically Endangered fauna.
Schedule 2 (S2)	Endangered fauna
Schedule 3 (S3)	Vulnerable Migratory species listed under international treaties.
Schedule 4 (S4)	Presumed extinct fauna
Schedule 5 (S5)	Migratory birds under international agreement
Schedule 6 (S6)	Conservation dependant fauna
Schedule 7 (S7)	Other specially protected fauna

WA DBCA Priority species (species not listed under the *WA Biodiversity Conservation Act 2016*, but for which there is some concern).

Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
Priority 4. (P4)	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5 (P5)	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).

Appendix 3. Explanation of threatening processes.

Potential impacts of proposed developments upon fauna values can be related to threatening processes. This is recognised in the literature and under the EPBC Act, in which threatening processes are listed (see **Appendix 4**). Processes that may impact fauna values are discussed below. Rather than being independent of one another, processes are complex and often interrelated. They are the mechanisms by which fauna can be affected by development. Impacts may be significant if large numbers of species or large proportions of populations are affected.

Note that the terms direct and indirect impacts are used by the DotE (2013), DSEWPaC (2013) and EPA (2016a), but there is some inconsistency in how these are defined. The federal guidance does not define direct impact but has a very broad definition of indirect, and makes the statement (DotE 2013) '*Consideration should be given to all adverse impacts that could reasonably be predicted to follow from the action, whether these impacts are within the control of the person proposing to take the action or not. Indirect impacts will be relevant where they are sufficiently close to the proposed action to be said to be a consequence of the action, and they can reasonably be imputed to be within the contemplation of the person proposing to take the action*.' Indirect impacts therefore can even include what the DotE (2013) calls facilitated impacts, which are the result of third party actions triggered by the primary action. In contrast, the EPA (2016a) defines direct impacts to '*include the removal, fragmentation or modification of habitat, and mortality or displacement of individuals or populations.*' This document then lists as indirect impacts what in many cases are the consequences of the removal, fragmentation or modification of habitat. For example, '*disruption of the dispersal of individuals required to colonise new areas inhibiting maintenance of genetic diversity between populations'* is a consequence of habitat fragmentation. Impacts of light, noise and even roadkill are defined as indirect but they are clearly the result of the action and in control of the person taking the action. Roadkill is as direct a form of mortality as can be observed, but it is considered as an indirect impact in the context of a development presumably because it is not directly linked to land clearing. The EPA (2016a) makes a strong distinction between removal of vegetation (direct impact) and the consequences of such clearing and other aspects of a development (indirect impacts). It is not obvious how this distinction between direct and indirect impacts is helpful in the EIA process, as the key aim is to ensure that all impacts that result from a project are addressed in this assessment process. Interestingly, Gleeson and Gleeson (2012), in a major review of impacts of development on wildlife, do not use the terms direct or indirect. In the following outlines of threatening processes that can cause impacts, the emphasis is upon interpreting how a threatening process will cause an impact. For example, loss of habitat (threatening process) can lead to population decline and to population fragmentation, which are two distinct impacts, with population decline considered a direct impact and fragmentation an indirect impact by the EPA (2016a).

Loss of habitat affecting population survival

Clearing for a development can lead to habitat loss for a species with a consequent decline in population size. This may be significant if the smaller population has reduced viability. Conservation significant species or species that already occur at low densities may be particularly sensitive to habitat loss affecting population survival.

Loss of habitat leading to population fragmentation

Loss of habitat can affect population movements by limiting movement of individuals throughout the landscape as a result of fragmentation (Soule *et al.* 2004, Gleeson and Gleeson 2012). Obstructions associated with the development, such as roads, pipes and drainage channels, may also affect movement of small, terrestrial species. Fragmented populations may not be sustainable and may be sensitive to effects such as reduced gene flow.

Degradation of habitat due to weed invasion leading to population decline

Weed invasion, such as through introduction by human boots or vehicle tyres, can occur as a result of development and if this alters habitat quality, can lead to effects similar to habitat loss.

Increased mortality

Increased mortality can occur during project operations; for example from roadkill, animals striking infrastructure and entrapment in trenches. Roadkill as a cause of population decline has been documented for several medium-sized mammals in eastern Australia (Dufty 1989, Jones 2000). Increased mortality due to roadkill is often more prevalent in habitats that have been fragmented (Scheick and Jones 1999, Clevenger and Waltho 2000, Jackson and Griffin 2000).

Increased mortality of common species during development is unavoidable and may not be significant for a population. However, the cumulative impacts of increased mortality of conservation significant species or species that already occur at low densities may have a significant impact on the population.

Species interactions, including predation and competition

Changes in species interactions often occur with development. Introduced species, including the feral Cat, Red Fox and Rabbit may have adverse impacts upon native species and development can alter their abundance. In particular, some mammal species are very sensitive to introduced predators and the decline of many mammals in Australia has been linked to predation by the Red Fox, and to a lesser extent the feral Cat (Burbidge and McKenzie 1989). Introduced grazing species, such as the Rabbit, Goat, Camel and domestic livestock, can also degrade habitats and deplete vegetation that may be a food source for other species.

Changes in the abundance of some native species at the expense of others, due to the provision of fresh watering points, can also be a concern. Harrington (2002) found the presence of artificial fresh waterpoints in the semi-arid mallee rangelands to influence the abundance and distribution of certain bird species. Common, water-dependent birds were found to out-compete some less common, water-independent species. Similarly, Read *et al.* (2015) found a decline in some bird species but an increase in others in the vicinity of active mines and concluded this was due to the mine attracting large and aggressive species that displaced other species. Over-abundant native herbivores, such as kangaroos, can also adversely affect less abundant native species through competition and displacement.

Hydroecology

Interruptions of hydroecological processes can have major effects because they underpin primary production in ecosystems and there are specific, generally rare habitats that are hydrology-dependent. Fauna may be impacted by potential changes to groundwater level and chemistry and

altered flow regime. These changes may alter vegetation across large areas and may lead to habitat degradation or loss. Impacts upon fauna can be widespread and major.

Changes to flow regime across the landscape may alter vegetation and may lead to habitat degradation or loss, affecting fauna. For example, Mulga has a shallow root system and relies on surface sheet flow during flood events. If surface sheet flow is impeded, Mulga can die (Kofoed 1998), which may impact on a range of fauna associated with this vegetation type.

Fire

The role of fire in the Australian environment and its importance to vertebrate fauna has been widely acknowledged (Gill *et al.* 1981; Fox 1982; Letnic *et al.* 2004). It is also one of the factors that has contributed to the decline and local extinction of some mammal and bird species (Burbidge and McKenzie 1989). Fire is a natural feature of the environment but frequent, extensive fires may adversely impact some fauna, particularly mammals and short-range endemic species. Changes in fire regime, whether to more frequent or less frequent fires, may be significant to some fauna. Impacts of severe fire may be devastating to species already occurring at low densities or to species requiring long unburnt habitats to survive. In terms of conservation management, it is not fire *per se* but the fire regime that is important, with evidence that infrequent, extensive and intense fires adversely affect biodiversity, whereas frequent fires that cover small areas and are variable in both season and intensity can enhance biodiversity. Fire management may be considered the responsibility of managers of large tracts of land, including managers of mining tenements.

Dust, light, noise and vibration

Impacts of dust, light, noise and vibration upon fauna are difficult to predict. Some studies have demonstrated the impact of artificial night lighting on fauna, with lighting affecting fauna behaviour more than noise (Rich and Longcore 2006). Effects can include impacts on predator-prey interactions, changes to mating and nesting behaviour, and increased competition and predation within and between invertebrates, frogs, birds and mammals.

The death of very large numbers of insects has been observed around some remote mine sites and attracts other fauna, notably native and introduced predators (M. Bamford pers. obs). The abundance of some insects can decline due to mortality around lights, although this has previously been recorded in fragmented landscapes where populations are already under stress (Rich and Longcore 2006). Artificial night lighting may also lead to disorientation of migratory birds. Aquatic habitats and open habitats such as grasslands and dunes may be vulnerable to light spill.

Appendix 4. Ecological and threatening processes identified under legislation and in the literature.

Ecological processes are processes that maintain ecosystems and biodiversity. They are important for the assessment of impacts of development proposals, because ecological processes make ecosystems sensitive to change. The issue of ecological processes, impacts and conservation of biodiversity has an extensive literature. Following are examples of the sorts of ecological processes that need to be considered.

Ecological processes relevant to the conservation of biodiversity in Australia (Soule *et al.* 2004):

- Critical species interactions (highly interactive species);
- Long distance biological movement;
- Disturbance at local and regional scales;
- Global climate change;
- Hydroecology;
- Coastal zone fluxes;
- Spatially-dependent evolutionary processes (range expansion and gene flow); and
- Geographic and temporal variation of plant productivity across Australia.

Threatening processes (EPBC Act)

Under the EPBC Act, a key threatening process is an ecological interaction that threatens or may threaten the survival, abundance or evolutionary development of a threatened species or ecological community. There are currently 20 key threatening processes listed by the federal Department of the Environment (DotE 2014):

- Competition and land degradation by rabbits.
- Competition and land degradation by unmanaged goats.
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*).
- Incidental catch (bycatch) of Sea Turtle during coastal otter-trawling operations within Australian waters north of 28 degrees South.
- Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations.
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis.
- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.
- Invasion of northern Australia by Gamba Grass and other introduced grasses.
- Land clearance.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean.
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.
- Novel biota and their impact on biodiversity.
- Predation by European red fox.
- Predation by exotic rats on Australian offshore islands of less than 1000 km^2 (100,000 ha).
- Predation by feral cats.
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.
- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species.
- The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Bufo marinus*).
- The reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant, *Solenopsis invicta* (fire ant).

General processes that threaten biodiversity across Australia (The National Land and Water Resources Audit):

- Vegetation clearing;
- Increasing fragmentation, loss of remnants and lack of recruitment;
- Firewood collection;
- Grazing pressure;
- Feral animals;
- Exotic weeds;
- Changed fire regimes;
- Pathogens;
- Changed hydrology—dryland salinity and salt water intrusion;
- Changed hydrology— such as altered flow regimes affecting riparian vegetation; and
- Pollution.

In addition to the above processes, the federal Department of Agriculture, Water and the Environment (DAWE) produced Significant Impact Guidelines that provide criteria for the assessment of the significance of impacts. These criteria provide a framework for the assessment of significant impacts. The criteria are listed below.

- Will the proposed action lead to a long-term decrease in the size of a population?
- Will the proposed action reduce the area of occupancy of the species?
- Will the proposed action fragment an existing population?
- Will the proposed action adversely affect habitat critical to the survival of a species?
- Will the proposed action disrupt the breeding cycle of a population?
- Will the proposed action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?
- Will the proposed action result in introducing invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?
- Will the proposed action introduce disease that may cause the species to decline?
- Will the proposed action interfere with the recovery of the species?

Appendix 5 Fauna expected to occur in the project area.

These lists are derived from the results of database and literature searches and from previous field surveys conducted in the Kalgoorlie region. These are:

- Species listed under fauna databases – NatureMap (DBCA 2019), Birdata (BirdLife Australia 2019), Atlas of Living Australia (ALA 2019) or EPBC Protected Matters Search (DEE 2019), or from the literature;
- Local records (BCE database) and fauna recorded during previous BCE fauna assessments in the local area:
- Species previously recorded at Mt Marion by BCE (2012) or Rapallo (2010);
- Alacer Gold Level 1 Fauna surveys (conducted by BCE during 2012 at the South Kalgoorlie operations) listed under "A" (see BCE, 2012a, b, c, d).
- Level 1 Fauna survey of Excelsior Gold's Bardoc Project (listed under "B", BCE, 2012e).
- Level 1 Fauna survey of the Metals X Cannon Project (listed under "C", see BCE 2015);
- Level 1 Fauna survey of the Metals X Gunge West Project (listed under "G", BCE 20126);
- Level 1 Fauna survey at Red Hill, Kambalda (listed under "K", BCE 2015);
- Level 2 Fauna survey conducted by BCE at St Ives, Lake Lefroy (Si);
- Fauna recorded during a previous Mount Marion BCE survey (listed under "BCE", 2016)
- Fauna recorded during a BCE survey of M15/717, within the Mt Marion area (listed under "BCE", 2017a);
- Fauna recorded during the BCE survey of the Stage 1 borefields pipeline corridor listed under "BCE", 2017b);
- Fauna recorded during the BCE survey of the Woolibar Stage 2, borefields pipeline corridor (listed under "BCE", 2018);
- Note conservation significant fauna are listed under CS;
- Species recorded opportunistically outside the survey, but within the region, are listed under "R";
- Species recorded indirectly by prints, nests, bones etc and listed under "S";
- Species recorded breeding within the area are listed under "X^B";
- Species recorded or expected from the region, but not the specific study area are listed as "-"; and
- Species recorded using motion-sensitive cameras are listed as "C".

Table 6-1. Frogs recorded or expected to occur in the Mt Marion area.

FROGS		CS	Outside Areas	Mt Marion surveys						
				Rapallo 2010	BCE					
					2012	2016	2017a	2017b	2018	2021
Limnodynastidae (burrowing frogs)										
Kunapalari Frog	*Neobatrachus kunapalari*		**SI, B**			**X**				
Humming Frog	*Neobatrachus pelobatoides*									
Shoemaker Frog	*Neobatrachus sutor*									
Goldfields Bull Frog	*Neobatrachus wilsmorei*									
Myobatrachidae (ground-frogs)										
Western Toadlet	*Pseudophryne occidentalis*		**SI, B**							
Total Number of Species Expected: 5 Total Number of Species Recorded from the Mt Marion Lithium Project Area: 1			**2**	**0**	**0**	**1**	**0**	**0**	**0**	**0**

Table 6-2. Reptiles recorded or expected to occur in the Mt Marion area.

REPTILES		CS	Outside Areas	Mt Marion surveys						
				Rapallo 2010	BCE					
					2012	2016	2017a	2017b	2018	2021
CARPHODACTYLIDAE										
Pale Knob-tailed Gecko	*Nephrurus laevissimus*		SI							
Midline Knob-tail	*Nephrurus vertebralis*									
Barking Gecko	*Underwoodisaurus milii*		SI, B, A, K			X				
DIPLODACTYLIDAE										
Clawless Gecko	*Crenadactylus ocellatus*		SI							
Western Stone Gecko	*Diplodactylus granariensis*		SI, K			X				

REPTILES		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
Beautiful Gecko	*Diplodactylus pulcher*		SI, K							
Reticulated Velvet Gecko	*Hesperoedura reticulata*		SI			X				
Beaded Gecko	*Lucasium damaeum*									
Main's Ground Gecko	*Lucasium maini*		SI, K							
Beaked Gecko	*Rhynchoedura ornata*					X				
Thorn -tailed Gecko	*Strophurus assimilis*		SI							
Jewelled Gecko	*Strophurus elderi*		SI							
Ring-tailed Gecko	*Strophurus strophurus*									
GEKKONIDAE										
Marbled Gecko	*Christinus marmoratus*		SI							
Purplish Dtella	*Gehyra purpurascens*		SI							
Tree Dtella	*Gehyra variegata*		SI, A, K, G	X		X				
Bynoe's Gecko	*Heteronotia binoei*		SI, B, A, K	X		X				
PYGOPODIDAE										
Marble-faced Delma	*Delma australis*		SI							
Unbanded Dema	*Delma butleri*		SI							
Fraser's Delma	*Delma fraseri*		SI							
Burton's Legless-Lizard	*Lialis burtonis*		SI							
Common Scaly-foot	*Pygopus lepidopodus*		SI							
Western Scaly-foot	*Pygopus nigriceps*									
AGAMIDAE										
Crested Dragon	*Ctenophorus cristatus*		SI, A, K	X	X	X				
Mallee Dragon	*Ctenophorus fordi*		SI							
Western Netted Dragon	*Ctenophorus reticulatus*		SI, A							
Claypan Dragon	*Ctenophorus salinarum*		SI, K							
Lozenge-marked Dragon	*Ctenophorus scutulatus*		SI, B							
Mulga Dragon	*Diporiphora amphiboluroides*									
Thorny Devil	*Moloch horridus*		SI, K							
Bearded Dragon	*Pogona minor*		SI							
Pebble Dragon	*Tympanocryptis pseudopsephos*		SI, C							
SCINCIDAE										
A skink	*Cryptoblepharus australis*									
A skink	*Cryptoblepharus buchananii*		SI	X						
Southern Mallee Skink	*Ctenotus atlas*		SI							
Leonhardi's Ctenotus	*Ctenotus leonhardii*		SI							
Barred Wedge-snouted Ctenotus	*Ctenotus schomburgkii*		SI							
Rock Ctenotus	*Ctenotus severus*									
Spotted Ctenotus	*Ctenotus uber*		SI, A							
Spinifex Slender Blue-tongue	*Cyclodomorphus melanops*		SI							
Pygmy Spiny-tailed Skink	*Egernia depressa*		B, A							
Goldfields Crevice Skink	*Egernia formosa*		SI, B, A		X	X				
Woodland Crevice Skink	*Egernia richardi*									
Broad-banded Sandswimmer	*Eremiascincus richardsonii*		SI							
Southern Five-toed Mulch Skink	*Hemiergis initialis*		SI							
Four-toed Mulch Skink	*Hemiergis peronii*									
South-west Four-toed Lerista	*Lerista distinguenda*		SI							
King's Lerista	*Lerista kingi*									
Robust Lerista	*Lerista macropisthopus*									
Goldfields Robust Lerista	*Lerista picturata*		SI							
Common Mulch Lerista	*Lerista timda*									
Desert Skink	*Liopholis inornata*		SI							
Bull-headed Skink	*Liopholis multiscutata*		SI							
Night Skink	*Liopholis striata*									
Common Dwarf Skink	*Menetia greyii*		SI							
Saltbush Flecked Skink	*Morethia adelaidensis*		SI							
Woodland Dark Fleck Skink	*Morethia butleri*		SI							
Woodland Flecked Skink	*Morethia obscura*		SI							
Western Blue-tongue	*Tiliqua occipitalis*		SI							
Bobtail	*Tiliqua rugosa*		SI, A, C, K, G							C
VARANIDAE										
Pygmy Mulga Monitor	*Varanus caudolineatus*									
Bungarra or Sand Monitor	*Varanus gouldii*		SI, B, A, C, K		X	X				C
Racehorse Monitor	*Varanus tristis tristis*		A							C

REPTILES		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
TYPHLOPIDAE										
Southern Blind Snake	*Anilios australis*		SI							
Dark-spined Blind Snake	*Anilios bicolor*		SI							
Prong-snouted Blind Snake	*Anilios bituberculatus*		SI							
Hook-Snouted Blind Snake	*Anilios hamatus*									
Common Beaked Blind Snake	*Anilios waitii*									
BOIDAE										
Stimson's Python	*Antaresia stimsoni*									
Carpet Python	*Morelia spilota imbricata*	3	SI							
ELAPIDAE										
Desert Death Adder	*Acanthophis pyrrhus*									
Narrow-banded Shovel-nosed Snake	*Brachyurophis fasciolata*		SI							
Southern Shovel-nosed Snake	*Brachyurophis semifasciata*		SI							
Yellow-faced Whipsnake	*Demansia psammophis*		SI							
Bardick	*Echiopsis curta*									
Moon Snake	*Furina ornata*									
Black-naped Snake	*Neelaps bimaculatus*									
Gould's Snake	*Parasuta gouldii*		SI							
Monk Snake	*Parasuta monachus*		SI							
Black-backed Hooded Snake	*Parasuta nigriceps*									
Mulga Snake	*Pseudechis australis*		SI							
Ringed Brown Snake	*Pseudonaja modesta*		SI							
Western Brown Snake	*Pseudonaja mengdeni*		SI, K							
Jan's Banded Snake	*Simoselaps bertholdi*		SI							
Rosen's Snake	*Suta fasciata*									
Total Number of Species Expected: 85 **Total Recorded from the Mt Marion Lithium Project Area: 12**			**59**	**4**	**3**	**9**	**0**	**0**	**0**	**3**

Table 6-3. Birds recorded or expected to occur in the Mt Marion area.

Birds		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
CASUARIIDAE										
Emu	*Dromaius novaehollandiae*		SI,B,A, G,C		X	X	S	X[B]	X	X, C
ANATIDAE										
Pink-eared Duck	*Malacorhynchus membranaceus*		A				-	-	-	
Black Swan	*Cygnus atratus*		A				-	-	-	
Australian Shelduck	*Tadorna tadornoides*		A				-	-	-	
Hardhead	*Aythya australis*						-	-	-	
Australasian Shoveler	*Spatula rhynchotis*						-	-	-	
Australian Wood Duck	*Chenonetta jubata*		A				-	-	-	
Pacific Black Duck	*Anas superciliosa*		A				-	-	-	
Grey Teal	*Anas gracilis*						-	-	-	
Chestnut Teal	*Anas castanea*						-	-	-	
Freckled Duck	*Stictonetta naevosa*						-	-	-	
Musk Duck	*Biziura lobata*						-	-	-	
MEGAPODIIDAE										
Malleefowl	*Leipoa ocellata*	1	SI,A,K, G,C	X		X	S		S	S
PHASIANIDAE										
Stubble Quail	*Coturnix pectoralis*								-	
PODICIPEDIDAE										
Australasian Grebe	*Tachybaptus novaehollandiae*		B,A				-	-	-	
Hoary-headed Grebe	*Poliocephalus poliocephalus*						-	-	-	
COLUMBIDAE										
Common Bronzewing	*Phaps chalcoptera*		SI,B,K, G,C	X		X		X	X	C
Crested Pigeon	*Ocyphaps lophotes*		SI,B,A, K,C							
Diamond Dove	*Geopelia cuneata*		A							
CUCULIDAE										
Horsfield's Bronze-Cuckoo	*Chalcites basalis*		SI,A,K, C							X
Black-eared Cuckoo	*Chalcites osculans*		K,C			X				
Fan-tailed Cuckoo	*Cacomantis flabelliformis*									
Pallid Cuckoo	*Heteroscenes pallidus*			X						
OTIDIDAE										
Australian Bustard	*Ardeotis australis*	3								
PODARGIDAE										
Tawny Frogmouth	*Podargus strigoides*		B,A,G, C		X	X				
EUROSTOPODIDAE										
Spotted Nightjar	*Eurostopodus argus*					X				C
AEGOTHELIDAE										
Australian Owlet-nightjar	*Aegotheles cristatus*		SI,K		X					
APODIDAE										
Fork-tailed Swift	*Apus pacificus*	1								
RALLIDAE										
Buff-banded Rail	*Hypotaenidia philippensis*						-	-	-	
Australian Spotted Crake	*Porzana fluminea*		A				-	-	-	
Baillon's Crake	*Zapornia pusilla*						-	-	-	
Spotless Crake	*Zapornia tabuensis*						-	-	-	
Black-tailed Native-hen	*Tribonyx ventralis*						-			
Eurasian Coot	*Fulica atra*						-	-	-	
BURHINIDAE										
Bush Stone-curlew	*Burhinus grallarius*	3								
RECURVIROSTRIDAE										
Red-necked Avocet	*Recurvirostra novaehollandiae*						-	-	-	
Pied (Black-winged) Stilt	*Himantopus leucocephalus*		A				-	-	-	
Banded Stilt	*Cladorhynchus leucocephalus*		A				-	-	-	
CHARADRIIDAE										
Red-capped Plover	*Charadrius ruficapillus*						-	-	-	
Hooded Plover	*Thinornis rubricollis*	2					-	-	-	
Black-fronted Dotterel	*Elseyornis melanops*		A				-	-	-	

Birds		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
Banded Lapwing	*Vanellus tricolor*									
Red-kneed Dotterel	*Erythrogonys cinctus*						-	-	-	
Inland Dotterel	*Charadrius australis*									
SCOLOPACIDAE										
Sharp-tailed Sandpiper	*Calidris acuminata*	1					-	-	-	
Curlew Sandpiper	*Calidris ferruginea*	1					-	-	-	
Red-necked Stint	*Calidris ruficollis*	1					-	-	-	
Common Greenshank	*Tringa nebularia*	1					-	-	-	
Wood Sandpiper	*Tringa glareola*	1					-	-	-	
TURNICIDAE										
Little Button-quail	*Turnix velox*		A			R				
ARDEIDAE										
White-necked Heron	*Ardea pacifica*						-	-	-	
Eastern Great Egret	*Ardea alba*						-	-	-	
White-faced Heron	*Egretta novaehollandiae*		B,A				-	-	-	
PLATALEIDAE										
Straw-necked Ibis	*Threskiornis spinicollis*						-	-	-	
Yellow-billed Spoonbill	*Platalea flavipes*						-	-	-	
ANHINGIDAE										
Little Pied Cormorant	*Microcarbo melanoleucos*						-	-	-	
Little Black Cormorant	*Phalacrocorax sulcirostris*						-	-	-	
ACCIPITRIDAE										
Black-shouldered Kite	*Elanus axillaris*									
Black-breasted Buzzard	*Hamirostra melanosternon*									
Square-tailed Kite	*Lophoictinia isura*	3								
Wedge-tailed Eagle	*Aquila audax*		SI,B,A, G,C							X
Little Eagle	*Hieraaetus morphnoides*		K							
Spotted Harrier	*Circus assimilis*									X
Brown Goshawk	*Accipiter fasciatus*		SI,B,C							X
Collared Sparrowhawk	*Accipiter cirrocephalus*									
Whistling Kite	*Haliastur sphenurus*									X
Black Kite	*Milvus migrans*									
TYTONIDAE										
Eastern Barn Owl	*Tyto alba delicatula*									
STRIGIDAE										
Southern Boobook	*Ninox boobook*									
MEROPIDAE										
Rainbow Bee-eater	*Merops ornatus*	3	SI,A,K		X	X				
HALCYONIDAE										
Sacred Kingfisher	*Todiramphus sanctus*		A							
Red-backed Kingfisher	*Todiramphus pyrrhopygius*				X					
FALCONIDAE										
Nankeen Kestrel	*Falco cenchroides*		B,K							
Australian Hobby	*Falco longipennis*									
Brown Falcon	*Falco berigora*		SI,B,A, K,C	X		X		X		
Peregrine Falcon	*Falco peregrinus*	1								
CACATUIDAE										
Cockatiel	*Nymphicus hollandicus*									
Galah	*Eolophus roseicapillus*		K							
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	3								
Little Corella	*Cacatua sanguinea*									
PSITTACIDAE										
Regent Parrot	*Polytelis anthopeplus*	3	SI							
Mulga Parrot	*Psephotus varius*		SI,B,G, C			X	X	X		
Western Rosella (inland)	*Platycercus icterotis xanthogenys*	2								
Australian Ringneck	*Barnardius zonarius*		SI,B,A, K,G,C	X	X	X	X		X	X, C
Scarlet-chested Parrot	*Neophema splendida*	3	SI							
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	3	SI, B, K, G, C	X	X	X	X	X	X	
Budgerigar	*Melopsittacus undulatus*		SI,K							
CLIMACTERIDAE										

Birds		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
White-browed Treecreeper	*Climacteris affinis*	3	C							
Rufous Treecreeper	*Climacteris rufa*	3	SI,C		X	X	X		X	
MALURIDAE										
Blue-breasted Fairy-wren	*Malurus pulcherrimus*	3	A,K,G		X	X	X	X	X	
Variegated Fairy-wren	*Malurus lamberti*									X
Splendid Fairy-wren	*Malurus splendens*		B,A,C							
White-winged Fairy-wren	*Malurus leucopterus*		SI,B,A, K							
MELIPHAGIDAE										
Black Honeyeater	*Sugomel niger*									
Brown Honeyeater	*Lichmera indistincta*		SI,B,A, K,G,C	X	X	X				X
White-cheeked Honeyeater	*Phylidonyris niger*									
White-eared Honeyeater	*Nesoptilotus leucotis*		B,A,K, G,C	X	X	X	X	X		X
Brown-headed Honeyeater	*Melithreptus brevirostris*		SI,B,A, K,G,C	X	X	X	X	X		X
Pied Honeyeater	*Certhionyx variegatus*									
Crimson Chat	*Epthianura tricolor*									
Orange Chat	*Epthianura aurifrons*									
White-fronted Cat	*Epthianura albifrons*		A							
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*		SI,B,A, K,C		X	X	X	X	X	
Red Wattlebird	*Anthochaera carunculata*		SI,B,A, K,G,C	X	X	X	X	X	X	X
Singing Honeyeater	*Gavicalis virescens*		SI,B,A, K,G,C		X					X
Yellow-plumed Honeyeater	*Ptilotula ornatus*		SI,B,A, K,G,C	X	X	X	X	X	X	
Grey-fronted Honeyeater	*Ptilotula plumula*		B							
White-fronted Honeyeater	*Purnella albifrons*		SI,B,A, K,C	X	X	X	X	X		
Purple-gaped Honeyeater	*Lichenostomus cratitius*	3								
Yellow-throated Miner	*Manorina flavigula*		SI,B,A, K,C	X	X	X	X	X	X	X, C
PARDALOTIDAE										
Spotted Pardalote	*Pardalotus punctatus*				X					
Striated Pardalote	*Pardalotus striatus*		SI,B,A, K,G,C		X	X	X	X		X
ACANTHIZIDAE										
Western Gerygone	*Gerygone fusca*							X		
Weebill	*Smicrornis brevirostris*		SI,B,A, K,G,C	X	X	X	X	X	X	
Redthroat	*Pyrrholaemus brunneus*		SI,B,A, K,G,C	X	X	X				
Shy Heathwren	*Calamanthus cauta whitlocki*	3	SI							
Rufous Fieldwren	*Calamanthus campestris*									
White-browed Scrubwren	*Sericornis frontalis*									
Southern Whiteface	*Aphelocephala leucopsis*		C							
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		B,A,K, C	X		X				
Inland Thornbill	*Acanthiza apicalis*		SI,B,A, K,G,C	X	X	X	X		X	
Slaty-backed Thornbill	*Acanthiza robustirostris*		K							
Slender billed Thornbill	*Acanthiza iredalei*									
Chestnut-rumped Thornbill	*Acanthiza uropygialis*		SI,B,A, K,G,C	X	X	X	X			X
POMATOSTOMIDAE										
White-browed Babbler	*Pomatostomus superciliosus*	3	B,A,K, G,C	X	X	X	X	X		X
NEOSITTIDAE										
Varied Sittella	*Daphoenositta chrysoptera*		SI,B,A, K,G,C		X	X				
CAMPEPHAGIDAE										
Ground Cuckoo-shrike	*Coracina maxima*									

Birds		CS	Outside Areas	Mt Marion surveys						
				Rapallo	BCE					
				2010	2012	2016	2017a	2017b	2018	2021
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		SI,B,A, K,C	X	X	X	X	X		X
White-winged Triller	*Lalage tricolor*									
PSOPHODIDAE										
Copper-backed Quail-thrush	*Cinclosoma clarum*	3	A,K,G, C	X	X	X	X	X[B]		X, C
PACHYCEPHALIDAE										
Gilbert's Whistler	*Pachycephala inornata*	3	B,A,K, C		X	X				
Rufous Whistler	*Pachycephala rufiventris*		B,A,K, G,C			X				X
Golden Whistler	*Pachycephala pectoralis*			X		X				X
Grey Shrike-thrush	*Colluricincla harmonica*		SI,B,A, K,G,C	X	X	X		X	X	X
FALCUNCULIDAE										
Crested Shrike-tit	*Falcunculus frontatus*	3								
OREOICIDAE										
Crested Bellbird	*Oreoica gutturalis*		SI,B,A, K,G,C		X	X	X	X	X	X
ARTAMIDAE										
Grey Currawong	*Strepera versicolor*		SI,B,A, K,G,C		X	X	X	X		X, C
Australian Magpie	*Gymnorhina tibicen*		SI,B,A, K,C							X
Pied Butcherbird	*Cracticus nigrogularis*		A,G,C		X				X	X
Grey Butcherbird	*Cracticus torquatus*		SI,B,A, K,G,C		X	X	X			
Masked Woodswallow	*Artamus personatus*		SI,A,K							X
Dusky Woodswallow	*Artamus cyanopterus*		SI,G,C		X	X	X	X	X	X
Black-faced Woodswallow	*Artamus cinereus*		B,K		X					
Little Woodswallow	*Artamus minor*									
RHIPIDURIDAE										
Willie Wagtail	*Rhipidura leucophrys*		SI,B,A, K,G,C	X	X	X		X	X	X, C
Grey Fantail	*Rhipidura fuliginosa*						X			
CORVIDAE										
Torresian Crow	*Corvus orru*			X						
Australian Raven	*Corvus coronoides*		SI,B,A, K,G,C		X	X	X			X, C
MONARCHIDAE										
Magpie-lark	*Grallina cyanoleuca*		A							X
PETROICIDAE										
Red-capped Robin	*Petroica goodenovii*		SI,B,A, K,C		X					
Jacky Winter	*Microeca fascinans*		B,A,G, C	X	X	X	X	X		X
Southern Scrub-robin	*Drymodes brunneopygia*	3				R				
Western Yellow Robin	*Eopsaltria griseogularis*	3	A,K,G, C	X		X	X	X		
Hooded Robin	*Melanodryas cucullata*									
NECTARINIIDAE										
Mistletoebird	*Dicaeum hirundinaceum*		SI,B,A, K,C	X		X				
ESTRILDIDAE										
Zebra Finch	*Taeniopygia guttata*									
MOTACILLIDAE										
Australasian Pipit	*Anthus novaeseelandiae*		SI,A,K							
HIRUNDINIDAE										
White-backed Swallow	*Cheramoeca leucosterna*		SI,A,K, G							
Fairy Martin	*Petrochelidon ariel*		A							
Tree Martin	*Petrochelidon nigricans*		SI,A,K, G,C		X	X		X		
Welcome Swallow	*Hirundo neoxena*		A,K,G		X	X		X		
ZOSTEROPIDAE										

Birds	CS	Outside Areas	Mt Marion surveys						
			Rapallo	BCE					
			2010	2012	2016	2017a	2017b	2018	2021
Silvereye *Zosterops lateralis*		SI,A							
MEGALURIDAE									
Rufous Songlark *Cincloramphus mathewsi*									
Brown Songlark *Cincloramphus cruralis*									
Total Number of Species Expected for Region: 164 **Total number of species recorded from the Mt Marion Lithium Project Area: 66**		**50**	**32**	**43**	**48**	**30**	**29**	**20**	**34**

Table 6-4. Mammals recorded or expected to occur in the Mt Marion area.

MAMMALS		CS	Outside Areas	Mt Marion Surveys						
				Rapallo 2010	BCE					
					2012	2016	2017a	2017b	2018	2021
Tachyglossidae										
Echidna	*Tachyglossus aculeatus*		SI,A,B,C,K,G		X	X		X	X	
Dasyuridae										
Chuditch	*Dasyurus geoffroii*									
Ride's Ningaui	*Ningaui ridei*		SI							
Mallee Ningaui	*Ningaui yvonneae*		SI							
Kultarr	*Antechinomys laniger*	CS3								
Fat-tailed Dunnart	*Sminthopsis crassicaudata*		SI							
Little Long-tailed Dunnart	*Sminthopsis dolichura*		SI,G							C
Gilbert's Dunnart	*Sminthopsis gilberti*									
Burramyidae										
Western Pygmy-possum	*Cercartetus concinnus*		SI							
Macropodidae										
Western Grey Kangaroo	*Macropus fuliginosus*		SI,A,B,C,K,G		X	X	X	X	C	C
Euro	*Macropus robustus*		SI,K,G	X		X				
Red Kangaroo	*Macropus rufus*		SI							
Molossidae										
Inland Freetail Bat	*Mormopterus petersi*		SI,A							
Southern Freetail Bat	*Mormopterus kitcheneri*				X					
White-striped Freetail Bat	*Austronomus australis*		SI,A		X					
Vespertilionidae										
Gould's Wattled Bat	*Chalinolobus gouldii*		SI,A		X					
Chocolate Wattled Bat	*Chalinolobus morio*		A		X					
Lesser Long-eared Bat	*Nyctophilus geoffroyi*									
Greater Long-eared Bat	*Nyctophilus major tor*	CS2								
Inland Broad-nosed Bat	*Scotorepens balstoni*		A							
Southern Forest Bat	*Vespadelus regulus*		A		X					
Inland Forest Bat	*Vespadelus baverstocki*		A		X					
Muridae										
Mitchell's Hopping Mouse	*Notomys mitchelli*		SI,K							
Bolam's Mouse	*Pseudomys bolami*		SI							
Sandy Inland Mouse	*Pseudomys hermannsburgensis*		SI							
INTRODUCED MAMMALS										
Dingo	*Canis lupus*		SI,A	X						
European Red Fox	*Vulpes vulpes*		A,B,G	X						
Feral Cat	*Felis catus*		SI,B,K,G			X			C	C
Rabbit	*Oryctolagus cuniculus*		SI,A,B,C,K,G		X	X	X	X	X	
House Mouse	*Mus musculus*		SI,A							
Goat	*Capra hircus*		A,B,C,K,G		X	X				

MAMMALS		CS	Outside Areas	Mt Marion Surveys						
				Rapallo 2010	BCE					
					2012	2016	2017a	2017b	2018	2021
Horse	*Equus caballus*		K							
Dromedary Camel	*Camelus dromedarius*									
Cattle	*Bos taurus*		A		X					
Sheep	*Ovis aries*									
Total Number of Native Species Expected (Recorded) from the Mt Marion Project Area: 25 (10)			**19**	**1**	**8**	**3**	**1**	**2**	**2**	**2**
Total Number of Introduced Species Expected (Recorded) from the Mt Marion Project Area: 10 (6)			**8**	**2**	**3**	**3**	**1**	**1**	**2**	**1**

Appendix 6. Species recorded in the 2021 field investigations.

Species	Visual/aural	Camera Trap
Racehorse Monitor		x
Bungarra		x
Bobtail		x
Australia Raven	x	x
Australian Magpie	x	
Australian Ringneck	x	x
Black-faced Cuckoo-shrike	x	
Brown Goshawk	x	
Brown Honeyeater	x	
Brown-headed Honeyeater	x	
Copper-backed Quail-thrush	x	x
Chestnut-rumped Thornbill	x	
Common Bronzewing		x
Crested Bellbird	x	
Dusky Woodswallow	x	
Emu	x	x
Golden Whistler	x	
Grey Currawong	x	x
Grey Shrike-thrush	x	
Jacky Winter	x	
Masked Woodswallow	x	
Mudlark	x	
Pied Butcherbird	x	
Red Wattlebird	x	
Rufous Whistler	x	
Horsfield's Bronze-Cuckoo	x	
Singing Honeyeater	x	
Spotted Harrier	x	
Spotted Nightjar		x
Striated Pardalote	x	
Variegated Fairy wren	x	
Wedge-tailed Eagle	x	
Whistling Kite	x	
White-browed Babbler	x	
White-eared Honeyeater	x	
Willie Wagtail	x	x
Yellow-throated Miner	x	x
Little Long-tailed Dunnart		x
Grey Kangaroo		x
Feral cat		x

Appendix 7. Raw data of 2021 camera trap survey.

Detection	Camera	Priority Area	Date	Time	Count	Common name	Scientific name	Type	Notes
1	BCE05	2	5/10/21	11:22:15	1	Common Bronzewing	*Phaps chalcoptera*	Bird	
2	BCE05	2	6/10/21	6:19:16	1	Common Bronzewing	*Phaps chalcoptera*	Bird	
3	BCE05	2	7/10/21	6:40:49	1	Emu	*Dromaius novaehallandiae*	Bird	Juvenile
4	BCE05	2	11/9/21	5:54:18	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
5	BCE05	2	12/9/21	12:21:36	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
6	BCE05	2	13/9/21	5:46:09	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
7	BCE05	2	13/9/21	12:36:59	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
8	BCE05	2	14/9/21	5:37:29	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
9	BCE05	2	16/9/21	13:44:50	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
10	BCE05	2	18/9/21	10:10:59	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
11	BCE05	2	30/9/21	5:42:29	1	Raven	*Corvus coronoides*	Bird	Eating ants on bait tube
12	BCE05	2	13/10/21	15:29:13	1	Willy Wagtail	*Rhipidura leucophrys*	Bird	
13	BCE05	2	19/9/21	11:37:59	1	Bobtail	*Tiliqua rugosa*	Reptile	
14	BCE06	1	8/10/21	21:33:38	1	Feral cat	*Felis catus*	Mammal	
15	BCE06	1	17/9/21	12:30:55	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
16	BCE06	1	27/9/21	19:32:04	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
17	BCE06	1	9/10/21	1:35:50	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
18	BCE06	1	13/10/21	19:17:42	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
19	BCE06	1	22/9/21	13:42:40	1	Gould's Goanna	*Varanus gouldii*	Reptile	
20	BCE06	1	24/9/21	10:57:40	1	Gould's Goanna	*Varanus gouldii*	Reptile	
21	BCE06	1	30/9/21	15:28:00	1	Gould's Goanna	*Varanus gouldii*	Reptile	
22	BCE06	1	13/10/21	10:36:38	1	Gould's Goanna	*Varanus gouldii*	Reptile	
23	BCE11	1	30/9/21	9:27:46	1	Currawong	*Strepera versicolor*	Bird	
24	BCE11	1	12/9/21	9:20:08	1	Grey Kangaroo	*Macropus fuliginosus*	Mammal	

Detection	Camera	Priority Area	Date	Time	Count	Common name	Scientific name	Type	Notes
25	BCE11	1	23/9/21	16:54:45	1	Grey Kangaroo	*Macropus fuliginosus*	Mammal	
26	BCE11	1	14/9/21	18:56:57	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
27	BCE11	1	16/9/21	23:36:09	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
28	BCE11	1	30/9/21	0:00:32	1	Sminthopsis dolichura	*Little Long-tailed Dunnart*	Mammal	
29	BCE13	1	16/10/21	10:46:38	1	Currawong	*Strepera versicolor*	Bird	
30	BCE30	3	18/9/21	11:47:13	1	Australian Ringneck	*Barnardius zonarius*	Bird	
31	BCE30	3	13/9/21	17:21:31	1	Common Bronzewing	*Phaps chalcoptera*	Bird	
32	BCE30	3	14/9/21	17:49:13	2	Common Bronzewing	*Phaps chalcoptera*	Bird	
33	BCE30	3	15/9/21	17:46:06	1	Common Bronzewing	*Phaps chalcoptera*	Bird	
34	BCE30	3	10/10/21	17:24:04	1	Common Bronzewing	*Phaps chalcoptera*	Bird	
35	BCE30	3	16/9/21	6:10:17	1	Currawong	*Strepera versicolor*	Bird	
36	BCE30	3	23/9/21	12:03:27	1	Currawong	*Strepera versicolor*	Bird	
37	BCE30	3	16/9/21	0:36:39	1	Emu	*Dromaius novaehallandiae*	Bird	
38	BCE30	3	18/9/21	10:47:37	2	Emu	*Dromaius novaehallandiae*	Bird	1 Juv 1 adult
39	BCE30	3	19/9/21	16:04:09	1	Emu	*Dromaius novaehallandiae*	Bird	
40	BCE30	3	20/9/21	7:41:11	7	Emu	*Dromaius novaehallandiae*	Bird	6 Juv 1 adult
41	BCE30	3	20/9/21	14:43:03	5	Emu	*Dromaius novaehallandiae*	Bird	4 Juv 1 adult
42	BCE30	3	21/9/21	13:24:34	1	Emu	*Dromaius novaehallandiae*	Bird	
43	BCE30	3	21/9/21	15:19:56	2	Emu	*Dromaius novaehallandiae*	Bird	2 Adults
44	BCE30	3	27/9/21	7:18:09	2	Emu	*Dromaius novaehallandiae*	Bird	
45	BCE30	3	3/10/21	12:00:43	1	Emu	*Dromaius novaehallandiae*	Bird	
46	BCE30	3	7/10/21	10:38:40	1	Emu	*Dromaius novaehallandiae*	Bird	
47	BCE30	3	8/10/21	7:22:17	1	Emu	*Dromaius novaehallandiae*	Bird	
48	BCE30	3	8/10/21	10:59:19	1	Emu	*Dromaius novaehallandiae*	Bird	
49	BCE30	3	9/10/21	14:49:20	1	Emu	*Dromaius novaehallandiae*	Bird	

Detection	Camera	Priority Area	Date	Time	Count	Common name	Scientific name	Type	Notes
50	BCE30	3	9/10/21	16:32:05	2	Emu	*Dromaius novaehallandiae*	Bird	
51	BCE30	3	11/10/21	13:46:20	1	Emu	*Dromaius novaehallandiae*	Bird	
52	BCE31	1	16/9/21	11:56:45	1	Bobtail	*Tiliqua rugosa*	Reptile	
53	BCE32	1	18/9/21	9:11:19	1	Copper-backed Quail-thrush	*Cinclosoma clarum*	Bird	
54	BCE32	1	15/9/21	2:11:09	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
55	BCE32	1	17/9/21	23:01:27	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
56	BCE32	1	19/9/21	0:00:06	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
57	BCE32	1	20/9/21	22:03:06	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
58	BCE32	1	2/10/21	4:56:43	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
59	BCE32	1	3/10/21	20:08:49	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
60	BCE32	1	4/10/21	12:20:12	2	Spotted Nightjar	*Eurostopodus argus*	Bird	Mating
61	BCE32	1	5/10/21	1:21:07	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
62	BCE32	1	13/10/21	0:39:51	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
63	BCE32	1	13/10/21	0:39:51	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
64	BCE32	1	17/10/21	4:42:40	1	Spotted Nightjar	*Eurostopodus argus*	Bird	
65	BCE32	1	15/10/21	2:53:53	1	Little Long-tailed Dunnart	*Sminthopsis dolichura*	Mammal	
66	BCE32	1	21/9/21	11:18:49	1	Gould's Goanna	*Varanus gouldii*	Reptile	
67	BCE33	1	27/9/21	19:56:29	1	Grey Kangaroo	*Macropus fuliginosus*	Mammal	
68	BCE33	1	24/9/21	21:31:58	1	Little Long-tailed Dunnart	*Sminthopsis dolichura*	Mammal	
69	BCE33	1	14/9/21	14:37:31	1	Bobtail	*Tiliqua rugosa*	Reptile	
70	BCE34	3	24/9/21	8:18:35	1	Yellow-throated Miner	*Manorina flavigula*	Bird	
71	BCE34	3	5/10/21	9:22:12	1	Black-headed Monitor	*Varanus tristis*	Reptile	
72	BCE34	3	5/10/21	9:22:12	1	Gould's Goanna	*Varanus gouldii*	Reptile	
73	BCE34	3	6/10/21	9:22:12	1	Gould's Goanna	*Varanus gouldii*	Reptile	

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