Appendix 3
Supporting Technical Studies

Earl Grey Lithium Project:

Level 2 vertebrate fauna survey with targeted Chuditch and Malleefowl surveys, 2016 - 2017

Chuditch (top), and Malleefowl on mound (bottom)

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Executive Summary

Introduction

Kidman Resources Limited (KRL) propose to mine lithium at their Earl Grey Lithium Project. The Mt Holland Project is situated 100 km south of Southern Cross in the Shire of Yilgarn. KRL commissioned Western Wildlife to carry out fauna surveys, including a targeted Malleefowl (*Leipoa ocellata*) survey, in the Development Envelope, and a targeted survey for Chuditch (*Dasyurus geoffroii*) in the wider region.

The aims of the vertebrate fauna survey were to:

- Identify the fauna habitats present in the Development Envelope.
- List the vertebrate fauna that were recorded in the Development Envelope and/or have the potential to occur in the study area.
- Identify species of conservation significance, or habitats of particular importance for fauna, that potentially occur in the Development Envelope.
- Comment on the potential impacts that a mining development may have on fauna, particularly on fauna of conservation significance.

Methods

The fauna surveys were undertaken in accordance with Environmental Protection Authority (EPA) Statement of Environmental Principles, Factors and Objectives (EPA 2016a), Environmental Factor Guidelines – Terrestrial Fauna (EPA 2016b), Technical Guide – Terrestrial Fauna Surveys (EPA 2016c) and the Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA & DEC 2010). The field surveys were carried out between the following dates:

- 10 – 15 Oct 2016:

  A Level 1 fauna survey with targeted Malleefowl and Chuditch surveys in Survey Area A (part of the Earl Grey Lithium Project Development Envelope).

- 21 Nov – 4 Dec 2016:

  A Level 2 single season fauna survey with targeted Malleefowl and Chuditch surveys in the Earl Grey Lithium Project Development Envelope, some trapping in the Regional Survey Area at Prince of Wales and Van Uden, with some targeted Chuditch and Malleefowl surveys in the Regional Survey Area.

- 16 Jan – 25 Feb 2017:

  A targeted Chuditch survey across the Regional Survey Area.

- 12 – 21 Sept 2017:

  A targeted Malleefowl survey across the Earl Grey Lithium Project Development Envelope with a targeted Chuditch survey in the wider region.

- 2 – 14 Oct 2017:

  A Level 2 single season fauna survey with targeted Malleefowl survey of the Earl Grey Lithium Project Development Envelope.

- 25 – 30 Nov 2017:

  Cage trapping transects to survey for Chuditch in the Regional Survey Area.

The field studies included:

- Identification of fauna habitats
- Trapping for terrestrial fauna
- Bird surveys
- Bat call survey
- Spotlighting
- Opportunistic record keeping and hand-searching
- Targeted searches for evidence of conservation significant species:
    - Malleefowl (*Leipoa ocellata*) – transects to search for mounds
    - Chuditch (*Dasyurus geoffroii*) – camera trap survey at 136 locations, cage trapping as part of the fauna survey in the Development Envelope and cage trapping in two transects of 50 cage traps each in the Regional Survey Area

Species of conservation significance were classified as: Conservation Significance 1 (CS1) if listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Western Australian Wildlife Conservation Act 1950* (WC Act); Conservation Significance 2 (CS2) if listed as a Priority species by the Department of Biodiversity, Conservation and Attractions (DBCA); or Conservation Significance 3 (CS3) if a locally significant species.

Fauna Habitats

Three broad fauna habitats were identified across the Earl Grey Lithium Project Development Envelope:

- Mallee woodland
- Salmon Gum woodland
- Shrubland

These habitats were also represented in the Regional Survey Area, along with additional habitats such as sandplain. Habitats that are uncommon in the Bioregion, such as granite outcrops, salt lakes or freshwater wetlands, were absent from the Development Envelope. However, the habitats are regionally important, in that they form part of the Great Western Woodlands, a 16 million hectare area of woodlands of which a key feature is its relative intactness. On a local scale, unburnt habitats in the Development Envelope are important refuges for fauna in a landscape that has been subject to widespread fires.

Faunal Assemblage

The Development Envelope is likely to support a relatively intact faunal assemblage, with only regionally extinct species likely to be missing from the area. The faunal assemblage is diverse as it contains elements from both the Eremaen (arid with irregular rainfall) and Bassian (southwest with regular winter rainfall) regions.

The Development Envelope has the potential to support up to nine frog, 67 reptile, 110 bird and 32 mammal (27 native and five introduced) species. A significant proportion of these were recorded during the fauna surveys. A total of one frog, 32 reptiles, 77 birds and 19 mammals (14 native and five introduced) were recorded in the Earl Grey Lithium Project Development Envelope.

Conservation Significant Fauna

Thirteen vertebrate fauna of conservation significance have the potential to occur in the Development Envelope, seven of CS1, five of CS2 and one of CS3. The seven species of Conservation Significance 1 are:

- **Malleefowl** (*Leipoa ocellata*) - EPBC Act (Vulnerable), WC Act (Schedule 3)
- **Peregrine Falcon** (*Falco peregrinus*) – WC Act (Schedule 7)
- **Carnaby's Black-Cockatoo** (*Calyptorhynchus latirostris)* - EPBC Act (Endangered), WC Act (Schedule 2)
- **Fork-tailed Swift** (*Apus pacificus*) – EPBC Act (Migratory), WC Act (Schedule 5)
- **Rainbow Bee-eater** *(Merops ornatus*) – WC Act (Schedule 5)
- **Chuditch** (*Dasyurus geoffroii*) - EPBC Act (Vulnerable), WC Act (Schedule 3)
- **Red-tailed Phascogale** (*Phascogale calura*) - EPBC Act (Endangered), WC Act (Schedule 6)

Of these, the Malleefowl, Peregrine Falcon, Rainbow Bee-eater and Chuditch were recorded in the Earl Grey Lithium Project Development Envelope.

The Malleefowl was sighted and two active mounds, four recently active mounds and 31 inactive (historic) mounds were recorded in the Earl Grey Lithium Project Development Envelope. Malleefowl have large overlapping home-ranges of one to many square kilometers. Malleefowl in the Development Envelope are likely to range over all habitats, favouring patches of shrubland on gravelly sands for mound construction. Although birds may forage in recently burnt habitats, unburnt areas are required for mound construction.

Eighteen individual Chuditch were trapped in the Development Envelope in 2016 (ten adult and eight dispersing young) and ten were trapped in the Regional Survey Area (three adults and seven young) in 2017. Chuditch were recorded on 52 of the 136 camera trap locations, showing a preference for unburnt habitats. The Chuditch of the Mt Holland population appeared to occur in greater densities than those at Cosmic Boy Mine, 55 km south, despite being in the same bioregion. Factors that may have positively influenced Chuditch numbers at Mt Holland include low numbers of feral predators and the presence of long-unburnt habitats to provide shelter and denning sites. Individuals are likely to have a core home range of 2,125 ha (males) or 189 ha (females), though they are likely to range even more widely and the core home-ranges are likely to overlap. Chuditch are likely to occur in all habitats in the Development Envelope, and may use hollow logs, burrows and old White-browed Babbler (*Pomatostomus superciliosus*) nests as den sites, as well as man-made structures such as rocky abandonment bund walls.

For both the Malleefowl and Chuditch, habitat loss, habitat fragmentation and feral predators are recognized as current threats. Large-scale fires are also likely to impact these species, resulting in loss of den sites and prey for Chuditch and loss of leaf-litter for Malleefowl to build their mounds.

The Peregrine Falcon is likely to forage in open habitats and nest on ledges in open pits. The Rainbow Bee-eater is likely to be a breeding summer visitor to the area. The populations of both these species are large and secure.

Of the species that remain unrecorded, Carnaby's Black-Cockatoo is on the eastern limit of it range in the area and its presence in the Development Envelope remains unconfirmed. If Carnaby's Black-Cockatoo is present, Salmon Gums (*Eucalyptus salmonophloia*) with large hollows are potential breeding habitat and surrounding areas of woodlands and shrublands are potential foraging habitat.

The Fork-tailed Swift is a widespread migratory species, with a population that is large and secure. The Red-tailed Phascogale is relatively unlikely to be present due to lack of its favoured habitat, and most records of this species are to the west of the Development Envelope.

The five species of Conservation Significance 2 that may occur are the:

- **Lake Cronin Snake** (*Paroplocephalus atriceps*) - Priority 3
- **Woma** (*Aspidites ramsayi*) – Priority 1
- **Inland Western Rosella** (*Platycercus icterotis xanthogenys*) - Priority 4
- **Western Brush Wallaby** (*Macropus irma*) - Priority 4
- **Central Long-eared Bat** (*Nyctophilus major tor*) - Priority 4

Of these, the Inland Western Rosella and Western Brush Wallaby were recorded in the Earl Grey Lithium Project Development Envelope. The Inland Western Rosella is likely to forage in all habitats, nesting in tree hollows in Salmon Gum and other woodlands. The Western Brush Wallaby is likely to occur throughout the mallee woodlands and shrublands.

Although not recorded, both the Central Long-eared Bat and Lake Cronin Snake are moderately likely to occur as the habitats in the Development Envelope are suitable and the area is within the known range of these species. The Central Long-eared Bat is likely to occur in the mallee and open woodlands, where they may use hollows for roosting. The Lake Cronin Snake may occur in woodlands or shrublands in the Development Envelope and is known from Jilbadji Nature Reserve. The Woma may occur in sandplains, but appears likely to be locally extinct.

The one species of Conservation Significance 3 that may occur is the:

- **Spotted Knob-tail Gecko** (*Nephrurus stellatus*)

This gecko has a very restricted range and was recorded in sandplain in the Regional Survey Area, within 10 km of the Development Envelope.

Potential impacts are some direct mortality of fauna, habitat loss, a small increase in habitat fragmentation, disturbance to fauna, increases in feral fauna populations and changed fire regimes. The potential impacts are likely to be small on a regional scale, as only a small area of fauna habitat is likely to be disturbed within a very large tract of intact habitat. On a local scale, impacts will be high within the mine footprint where most fauna habitat will be lost. Recommendations have been provided with the aim of minimising or mitigating these impacts on adjacent habitats during the planning phase of the mining development.

Recommendations:

- *Minimise habitat loss in the planning phase by using existing cleared or disturbed lands and minimising the mine footprint.*
- *Protect active Malleefowl mounds from disturbance.*
- *Where practicable, restrict vehicle speed limits on roads adjacent to active Malleefowl mounds.*
- *Protect mature eucalypt trees with hollows where practicable.*
- *Where possible, avoid clearing during late winter and spring, to avoid mortalities of young birds in nests.*

- *Appropriately dispose of food waste so it does not attract Chuditch or feral predators (foxes and cats). Where containers (e.g. skip bins) are used, ensure they are securely lidded to avoid Chuditch being fatally trapped.*

- *Prohibit feeding of any fauna on site.*

- *Ensure all drill holes are securely capped to prevent fauna becoming fatally trapped.*

- *Where appropriate, carry out re-vegetation once mining activities are complete, to restore fauna habitats.*

- *Ensure that site inductions include adequate environmental education for all personnel involved. This includes ensuring personnel can recognise and report species of conservation significance such as the Malleefowl.*

- *Where practicable, reduce disturbance to nocturnal fauna by minimising work at night.*

- *Prevent the introduction of weeds by washing down muddy vehicles and machinery prior to use on site.*

- *Consider control of foxes and feral cats in and around the Development Envelope.*

- *Implement a fire management plan with the aim of protecting areas of long-unburnt habitat.*

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1. Introduction

Kidman Resources Limited (KRL) propose to mine lithium at their Earl Grey Lithium Project. KRL commissioned Western Wildlife to carry out various surveys of vertebrate fauna between October 2016 and November 2017. As the results of the initial surveys indicated the presence of high quality fauna habitat and threatened fauna species in the Development Envelope, further surveys were commissioned, to provide additional data for the Development Envelope and regional context for threatened species.

The fauna survey involved a field study to inventory the fauna and fauna habitats present in the Development Envelope. To supplement the information gathered during the survey, a review of relevant fauna literature for the area was also undertaken.

The aims of the fauna survey were to:

- Identify the fauna habitats present in the Development Envelope.
- List the vertebrate fauna that were recorded in the study area and/or have the potential to occur in the Development Envelope.
- Identify species of conservation significance, or habitats of particular importance for fauna, that potentially occur in the Development Envelope.
- Comment on the potential impacts that a mining development may have on fauna, particularly on fauna of conservation significance.

This report details the findings of the fauna surveys conducted between October 2016 and November 2017.

2. Background

2.1 Regional Location

The Earl Grey Lithium Project is situated at KRL's Mt Holland Operations. It is located in the Shire of Yilgarn in the Goldfields region of Western Australia, about 100km south of Southern Cross (Figure 1).

The Development Envelope is within the Great Western Woodlands (GWW) (Figure 1). The GWW are a 16 million hectare area extending from the wheatbelt to the edge of the deserts and is the largest intact area of Mediterranean Woodland on earth (DEC 2010). The GWW includes open eucalypt woodlands (63%), mallee eucalypt woodlands, shrublands and grasslands (Fox *et al*. 2016). Less common habitats in the GWW include granite outcrops, banded ironstone formations, salt lakes and freshwater wetlands (Fox *et al*. 2016). The relative intactness of the GWW is recognised as a key value by Fox *et al*. (2016), in that it provides connectivity for birds in a landscape that varies both spatially and temporally. The south-western half of the GWW provides habitat for many birds that are locally extinct or have reduced populations in the adjacent and substantially cleared wheatbelt (Fox *et al*. 2016).

Jilbadji Nature Reserve is a large reserve of over 200,000 ha within the GWW (Plate 1). Jilbadji Nature Reserve is known to support a range of fauna, including conservation significant species such as the Malleefowl (*Leipoa ocellata*) (Keighery *et al*. 1995). A significant portion of the reserve was burnt in 2009, as well as more recently in 2015.

Lake Cronin Nature Reserve is a smaller reserve of around 1,000 ha and is also within the GWW, about 30 km south of the Development Envelope (Figure 1). Lake Cronin is the largest example of a semi-permanent freshwater lake in the region, and the areas in and around the reserve are recognized as including significant areas of sandplains, shrublands and woodlands (EPA 2009). Lake Cronin Nature Reserve supports a diverse faunal assemblage, including conservation significant species such as the Malleefowl, Lake Cronin Snake (*Paroplocephalus atriceps*) and Inland Western Rosella (*Platycercus icterotis xanthogenys*) (EPA 2009).

Plate 1. Jilbadji Nature Reserve.

The Development Envelope is in the Southern Cross Subregion of the Coolgardie Bioregion of the Interim Biogeographic Regionalism for Australia (IBRA) classification system (DoEE 2017) (Figure 2). The dominant land-uses in this bioregion are Crown Reserves and Unallocated Crown Land (66.7%), grazing on native pastures (17%), conservation (11.5%) and dryland agriculture (2.3%) (Cowan *et al*. 2001). The greenstone hills, alluvial valleys and broad plains of calcareous earths support diverse eucalypt woodlands. The uplands support mallee woodlands and scrub-heaths on sandplains, gravelly sandplains and lateritic breakaways (Cowan *et al*. 2001). Chains of salt lakes with dwarf shrublands of samphire occur in the valleys.

The Development Envelope lies in the Southwest Interzone, the transitional area between the Southwest (Bassian) and Eremaen Provinces (Figure 3). These provinces are determined by vegetation mapping (Beard 1980) and broadly correspond to climactic regions, the Southwest Province experiencing warm dry summers and cool wet winters and the Eremaean Province experiencing low, irregular rainfall.

2.2 Survey Area

The size and shape of the fauna survey areas evolved as the proposed mine footprint was developed and the Development Envelope finalised. The original survey in October 2016 focused on the area of the orebody, and further surveys were commissioned in 2016 and 2017 to cover the remainder of the Development Envelope and to investigate Chuditch distribution over a wider area.

The results of these surveys have been combined for the purposes of this report, distinguishing between records made within the Development Envelope and those in the Regional Survey Area, as shown in Figure 3. The Development Envelope is 1993.59 ha and was the focus of the fauna surveys. Its key existing features are shown in Figure 4. The Regional Survey Area is over 70,000 ha, but this area was not surveyed in detail.

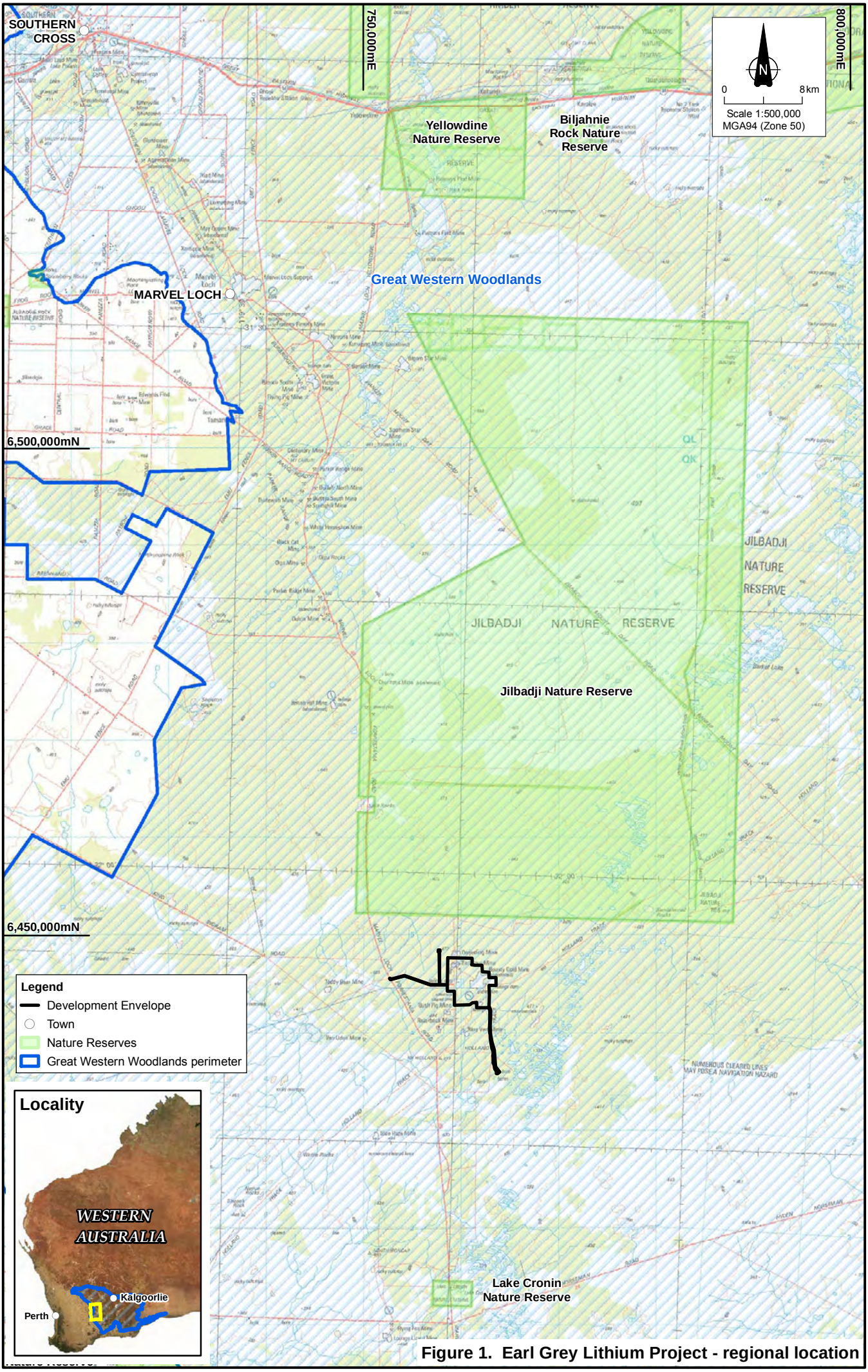

Figure 1. Earl Grey Lithium Project - regional location

Author: Western Wildlife ~ Drawn: CAD Resources ~ Tel 9246 3242 ~ URL www.cadresources.com.au ~ December 2017 ~ A4 ~ Rev: A ~ CAD Ref: a2441_F041

Figure 2. Earl Grey Lithium Project: IBRA bioregions and subregions (DoEE 2017) and Botanical Provinces (Beard 1980)

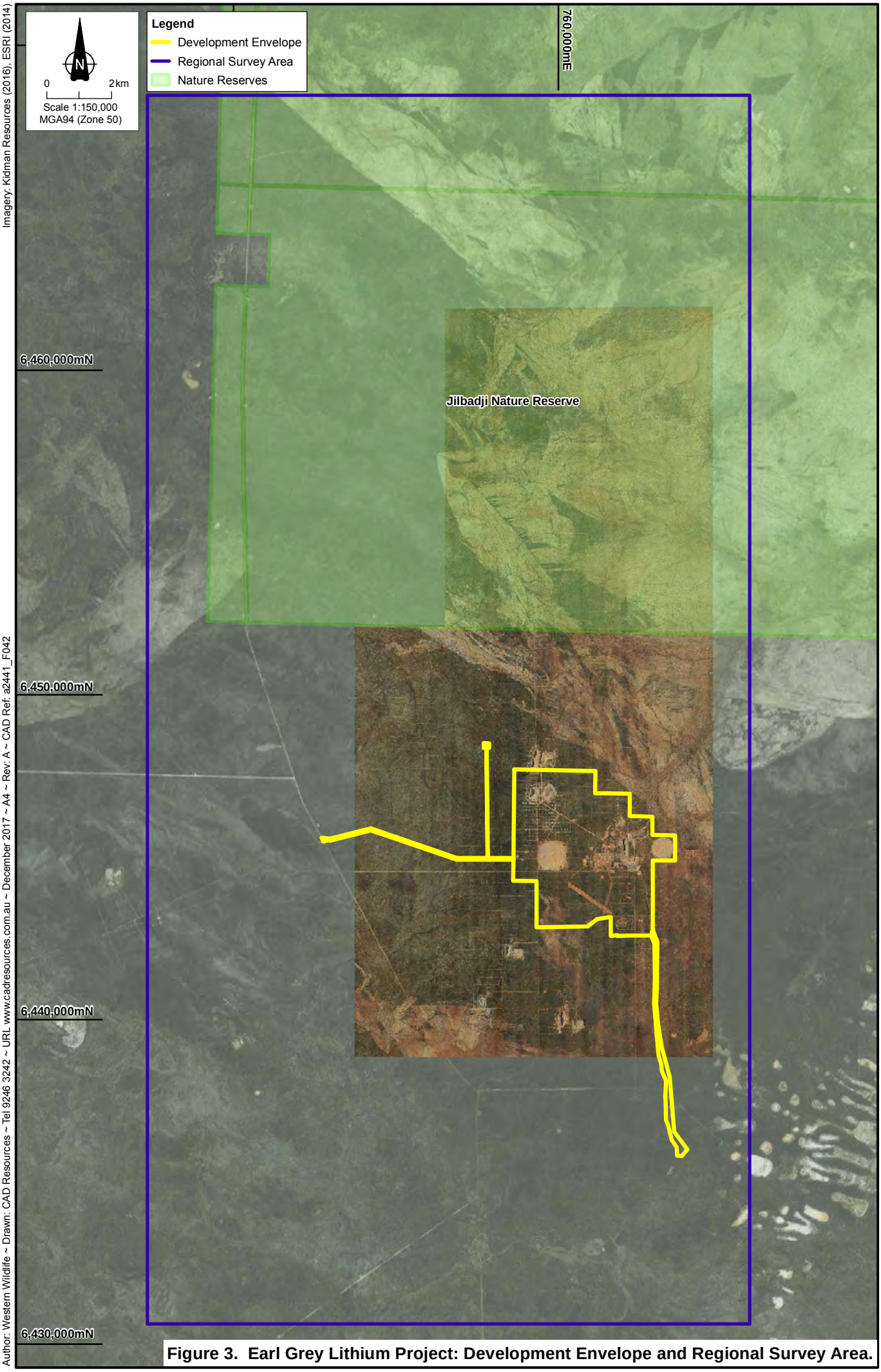

Figure 3. Earl Grey Lithium Project: Development Envelope and Regional Survey Area.

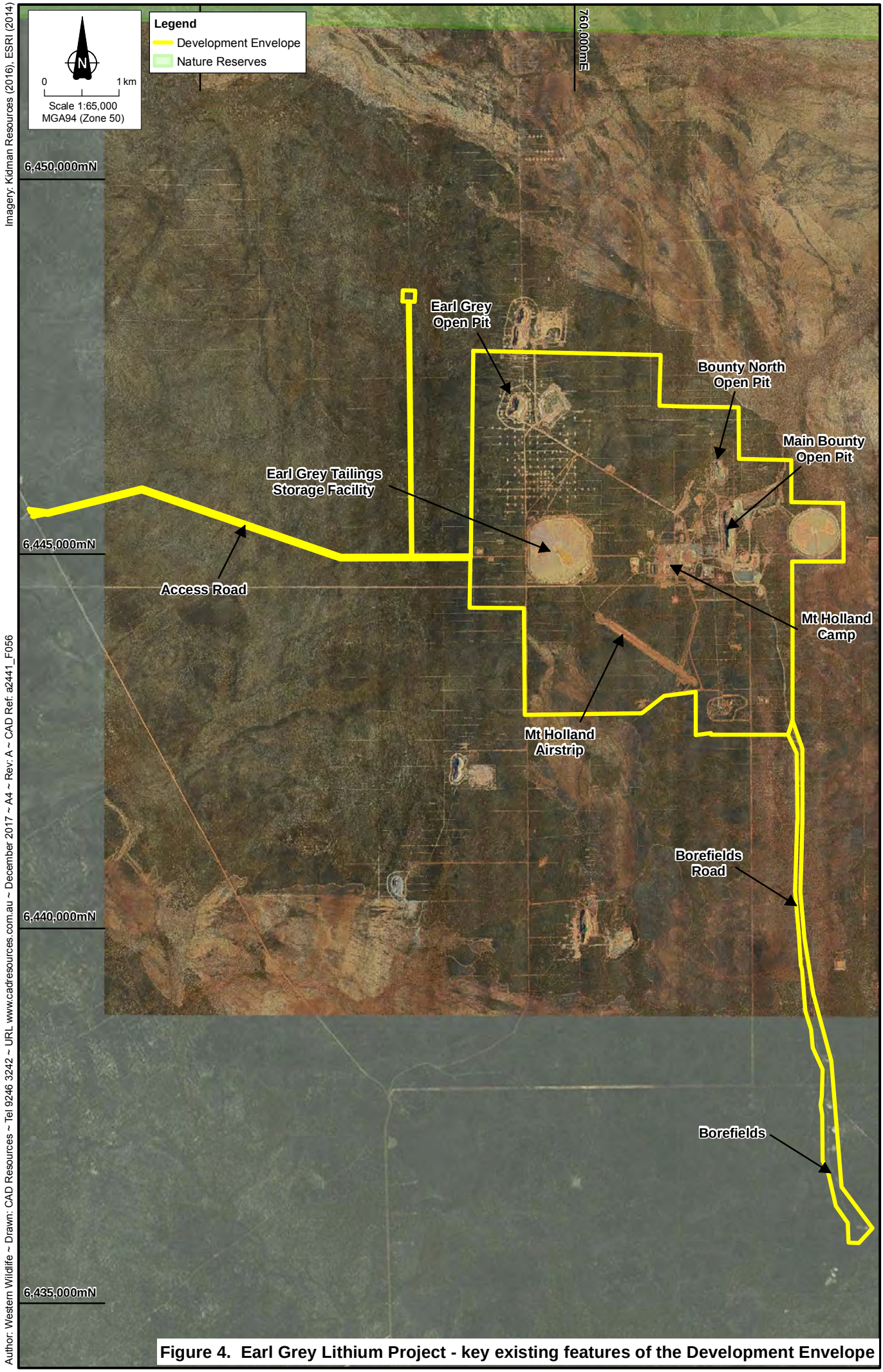

Figure 4. Earl Grey Lithium Project - key existing features of the Development Envelope

Imagery: Kidman Resources (2016), ESRI (2014)

Author: Western Wildlife ~ Drawn: CAD Resources ~ Tel 9246 3242 ~ URL www.cadresources.com.au ~ December 2017 ~ A4 ~ Rev: A ~ CAD Ref: a2441_F056

2.3 Climate and Weather

The Development Envelope is situated midway between two Bureau of Meteorology weather stations; Southern Cross Airport and Hyden. The monthly mean temperatures are relatively similar between the stations, with December to February the hottest months and June to August the coolest (Figure 5). The rainfall recorded at Hyden shows a definite winter maximum with a mean annual rainfall of 340.5 mm. The variable rainfall recorded at Southern Cross Airport is indicative of the Eremaen region, and this weather station has a mean annual rainfall of 306 mm. It is likely that the rainfall patterns in the Development Envelope fall somewhere between the two.

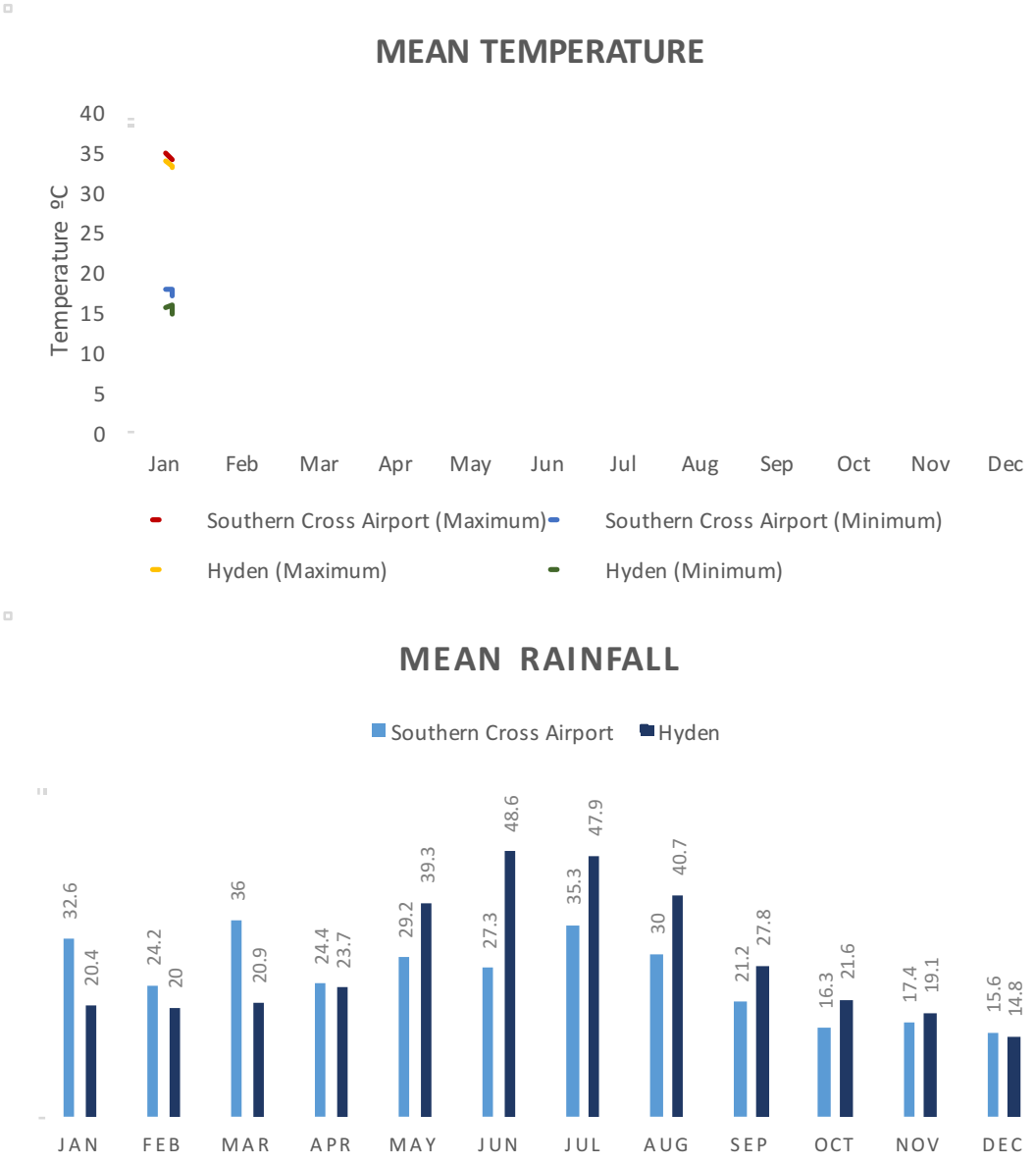

Figure 5. Mean monthly temperature and rainfall at Southern Cross Airport and Hyden (data from Bureau of Meteorology 2017).

The daily rainfall, maximum and minimum temperatures during the fieldwork are provided in Appendix 1.

3. Methods

The fieldwork was undertaken across six surveys between October 2016 and November 2017 (Table 1). The surveys were conducted with reference to the following documents:

- Statement of environmental principles, factors and objectives (Environmental Protection Authority (EPA) 2016a)
- Environmental factor guideline – terrestrial fauna (EPA 2016b)
- Technical guidance – terrestrial fauna surveys (EPA 2016c)
- Technical Guide: terrestrial vertebrate fauna surveys for environmental impact assessment (EPA and DEC 2010)
- Survey guidelines for Australia's threatened mammals (DSEWPaC 2011)
- Survey guidelines for Australia's threatened birds (DEWHA 2010)

The fauna survey included a search of available literature and databases (a desk-top study), and six periods of fieldwork as described in Table 1. The data collected in the field serve to put the desk-top study into context, as well as allowing for the identification of fauna habitats and likely fauna assemblages of the site.

Table 1. Overview of fauna surveys undertaken for the Earl Grey Lithium Project.

Survey	Level of survey	Extent of survey	Dates of fieldwork
1	Level 1 fauna survey with targeted Malleefowl and Chuditch (camera trap) surveys	Survey Area A (see Figure 6)	10 – 15 Oct 2016
2	Level 2 (single season) fauna survey with targeted Malleefowl and Chuditch (camera trap) surveys	Focus on survey Areas A and B, plus sites in the Regional Survey Area ('Prince of Wales' and 'Van Uden') Some targeted Chuditch and Malleefowl survey in Regional Survey Area – original extent (see Figure 6)	21 Nov – 4 Dec 2016
3	Targeted Chuditch survey (camera traps)	Regional Survey Area – original extent (see Figure 6)	16 Jan – 25 Feb 2017
4	Targeted Malleefowl & Chuditch (camera trap) surveys	Malleefowl survey in the Development Envelope excluding Survey Areas A and B, with targeted Chuditch survey in the Regional Survey Area – final extent (see Figure 6)	12 – 21 Sept 2017
5	Level 2 (single season) fauna survey with targeted Malleefowl survey	Development envelope, excluding Survey Areas A and B (see Figure 6)	2 – 14 Oct 2017
6	Targeted Chuditch (cage trapping) survey	Regional Survey Area – final extent, with some Malleefowl and opportunistic surveys in the Development Envelope (see Figure 6)	25 - 30 Nov 2017

3.1 Personnel

A combination of ten zoologists from Western Wildlife carried out the fieldwork, with bat call analysis provided by Kyle Armstrong of Specialised Zoological (Table 2) and additional field support provided by Dmitri Ivanov (KRL). This report was prepared by Jenny Wilcox.

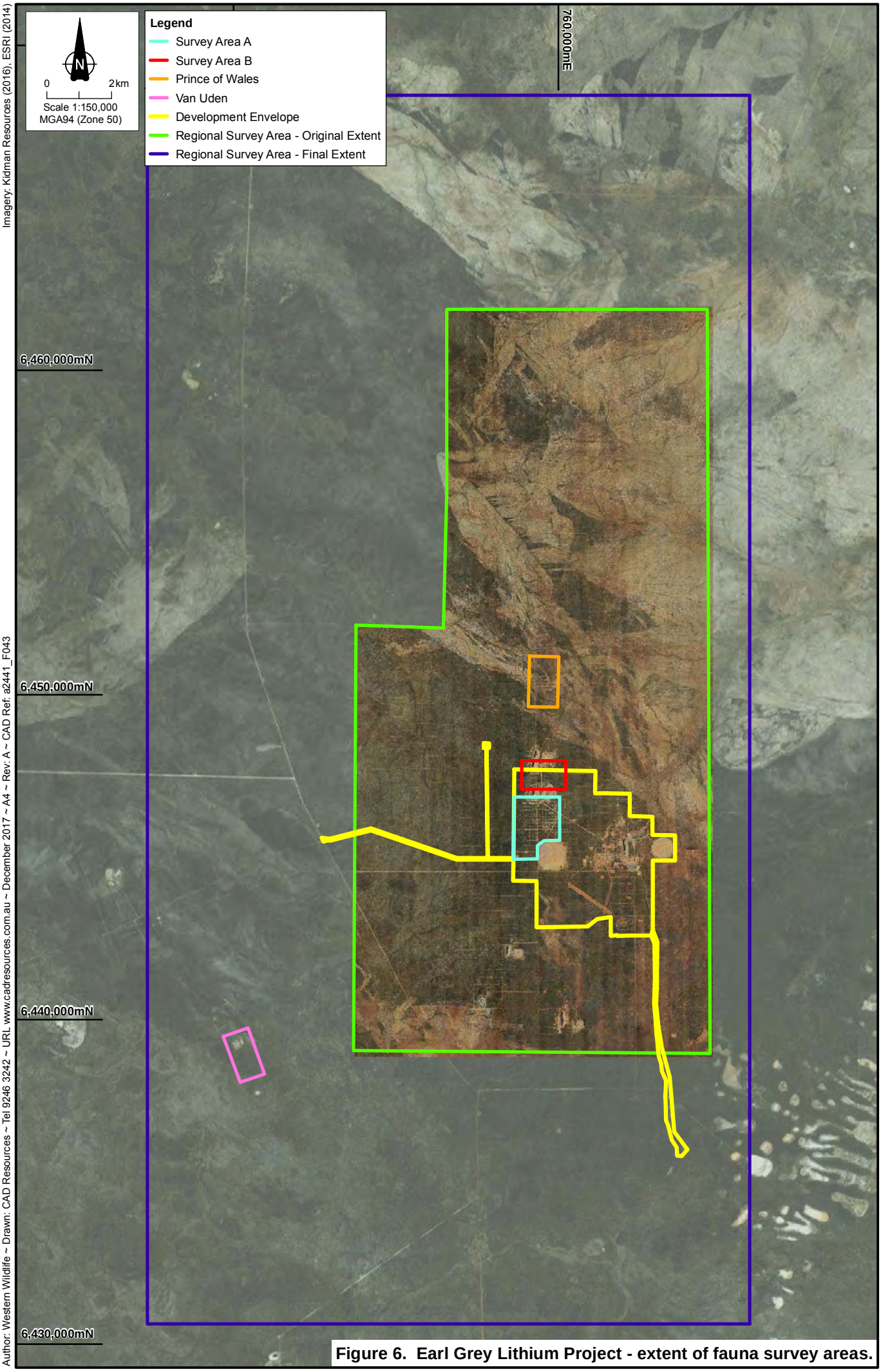

Figure 6. Earl Grey Lithium Project - extent of fauna survey areas.

Table 2. Personnel involved in the fauna survey.

Name	Role	Qualification	Experience	Survey*
Jenny Wilcox	Supervising Zoologist (plan and lead fieldwork, prepare report)	BSc.Biol./Env.Sci., Hons.Biol.	17 years	1, 2, 3, 4, 5 & 6
Brenden Metcalf	Zoologist (fieldwork)	BSc. Env.Sci., Hons.Env.Sci.	17 years	1, 2, 4 & 6
Mike Brown	Zoologist (fieldwork)	BSc. Env.Sci.	11 years	1, 2, 4 & 5
Glen Murray	Zoologist (fieldwork)	BSc. Resource & Env.Sci.	9 years	2
Jeffrey Turpin	Zoologist (fieldwork)	BSc. Zool.	18 years	2
Cameron Everard	Zoologist (fieldwork)	BSc. Env.Sci., M.Sc.	9 years	2 & 5
Wes Bancroft	Zoologist (fieldwork)	PhD. Zoology	17 years	2
Amy Griffiths	Zoologist (fieldwork)	BSc.Biol., Hons.Biol.	7 years	4
Ray Lloyd	Zoologist (fieldwork)	BSc. Env.Sci.	10 years	4
Genevieve Murray	Trainee Zoologist (fieldwork)	-	<1 year	1
Dmitri Ivanov	Field Assistant (fieldwork)	BSc. Env.Sci.	2 years	3
Kyle Armstrong	Bat call analysis	PhD. Zoology	20 years	2 & 5

* See Table 1

3.2 Taxonomy and Nomenclature

Taxonomy and nomenclature for fauna species used in this report follow the Western Australian Museum checklists, last updated in August 2016.

3.3 Literature Review

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

The databases in Table 3 were searched for fauna records in and around the Development Envelope. Some species may occur on database results that are not likely to be present in the Development Envelope, usually due either to lack of suitable habitat or the Development Envelope being outside the known range of the species. These species are not included in lists of expected fauna.

In addition, the results of the following fauna reports were used to compile the fauna lists:

- *The Biological survey of the Eastern Goldfields region of Western Australia. Part 11 Boorabbin - Southern Cross study area. Part 12, Barlee - Menzies study area* (Keighery *et al*. 1995). A comprehensive survey of Goldfields fauna was carried out by the Western Australian Museum. The Boorabbin - Southern Cross study area was surveyed in 1980 - 1981 across three surveys, sampling the amphibians, reptiles, birds and mammals at three main sites (Keighery *et al*. 1995). Only data from the Jilbadji Nature Reserve site (50H 767776 E, 6500951 N), located about 55km north of the Development Envelope, was used while compiling lists of fauna present in the area.

- *Forrestania fauna survey: Fauna and faunal assemblages report* (Biota Environmental Sciences 2006). A fauna survey was undertaken for the Flying Fox Mine, about 35km south of the Development Envelope. The survey consisted of two surveys (February/March 2005 and November 2005), at ten sites in tall woodland, mallee woodlands and shrublands. Each site consisted of six pitfall traps (three PVC pipe and three buckets) on a single 30m flywire drift-fence, six Elliott traps and one cage trap. In addition, two sites of 15 Elliott traps and one site of 15 cage traps were also deployed. Bat calls were sampled in two locations using an Anabat detector, and bird surveys were undertaken at each of the ten trapping sites.
- *Spotted Quoll haul road single phase fauna survey* (Biota Environmental Sciences 2010). In November/December 2009, a single survey was carried out for the Spotted Quoll haul road, about 45km south of the Development Envelope. The survey consisted of nine sites, each consisting of six pitfall traps (three PVC pipe and three buckets) on a single 30m flywire drift-fence, six Elliott traps and one cage trap. In addition, two sites of 18 and 19 large Elliott traps and one site of 20 cage traps were also used. Bat calls were sampled in four locations using an Anabat detector and one location using a harp trap, and bird surveys were undertaken at each of the nine trapping sites.

Table 3. Databases used in the preparation of this report.

Database	Type of records held on database	Area searched
Western Australian Museum Specimen Database (DPAW 2007-)	Records of specimens held in the WA Museum. Includes historical data.	30km surrounding 32° 05' 37" S, 119° 44' 53" E.
Fauna Survey Returns Database (DPAW 2007-)	Records of fauna captured, observed or inferred from secondary evidence during fauna surveys.	30km surrounding 32° 05' 37" S, 119° 44' 53" E.
Birds Australia Atlas Database (DPAW 2007-)	Records of bird observations in Australia, 1998-current.	30km surrounding 32° 05' 37" S, 119° 44' 53" E.
DBCA's Threatened and Priority Fauna Database	Records of Threatened and Priority species in Western Australia, also drawing from the databases above.	90km surrounding 50H 759300 E, 6448700 N.
EPBC Act Protected Matters Search Tool	Records on matters protected under the EPBC Act, including threatened species.	30km surrounding 32° 05' 37" S, 119° 44' 53" E.

The Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority Ecological Community Database was searched by Mattiske Consulting (2017). No Threatened Ecological Communities were present, and the one Priority Ecological Community present (Ironcap Hills Vegetation Complexes; Priority 3) is primarily defined by vegetation rather than fauna and has been discussed by Mattiske Consulting (2017).

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

3.4 Field Studies

Six periods of fieldwork were undertaken between October 2016 and November 2017, as summarised in Table 1 and detailed in the sections below.

3.4.1 Licensing

All field studies were carried out under Regulation 17 License to Take Fauna for Scientific Purposes 08-000081-1, 08-000122-2, 08-000186-1 and 08-001129-1, as issued by the Department of Biodiversity, Conservation and Attractions (DBCA).

3.4.2 Trapping for Terrestrial Fauna

Trapping for terrestrial fauna (frogs, reptiles and small mammals) was undertaken in two single-season surveys in spring 2016, (21 November - 4 December) and spring 2017 (2 – 14 October). The initial trapping was focused on the area surrounding the Earl Grey lithium deposit (Survey Area A, see Figure 6), and was part of a wider trapping survey that included sites outside the Development Envelope. The second trapping survey was undertaken to cover the remainder of the Development Envelope, once determined.

Six trapping sites were installed in 2016, and a further eight in 2017 (Figure 7, Table 4). The placement of sites in the Development Envelope aimed to sample the habitats present and provide geographic spread across the Development Envelope. A photograph of each site is given in Plates 2 and 3. An additional six trapping sites in the Regional Survey Area were sampled in 2016, using the same methodology (Appendix 2).

In 2016, each trapping site consisted of ten pitfall traps, ten funnel traps, ten Elliott traps and two cage traps. In 2017, the trapping sites were identical except for the lack of cage traps. Cage traps were not included in October 2017 due to the risk of capturing female Chuditch with dependent young in the den. Instead, a baited camera trap was deployed at each site for five nights. The 2016 survey demonstrated that camera traps recorded species that were captured by cage traps, primarily Chuditch and goannas (*Varanus* spp.)

The pitfall traps were placed in two transects with 25 m between each pitfall trap and 50 m between the two transects. Each pitfall trap was a 40 cm deep, white 20 L bucket with a 25 cm high flywire drift-fence extending 3m to either side of the pitfall (Plate 4). A piece of egg carton was used as shelter for any fauna in the trap. Funnel traps were 15 cm wide and 60 cm long, with a funnel entrance of 5 cm. Funnel traps were set up midway along a pitfall trap drift-fence, with the funnel entrances bisected by the fence (Plate 4). Funnel traps were covered with shade cloth in order to keep the temperature inside the funnel cool. Elliott traps were placed near each pitfall and the cage traps (when used) were placed at pitfalls 1 and 6. All cage and Elliott traps were placed under vegetation to shade any captured animals and cage traps were covered with a hessian sack. All Elliott traps were baited with a mixture of rolled oats, sardines, peanut butter and vanilla essence. Cages were baited with the same mixture with the addition of tuna oil, with the purpose of targeting Chuditch.

The sampling at the trapping sites was undertaken for eight nights at each site, to given a total of 80 pitfall trap-nights, 80 funnel trap-nights, 80 Elliott trap-nights and 16 cage trap-nights per site. Across the 14 sites sampled in the Development Envelope in 2016 and 2017, this resulted in a total of 1,120 trap-nights each for pitfalls, funnels and Elliott traps, and 96 trap-nights for cages.

All animals caught were identified and recorded, and generally released immediately at the site of capture. For any Chuditch caught, the age (adult or subadult), weight, sex, pes length and reproductive condition was recorded, and the ear temporarily marked with a unique identifier in non-toxic marker pen.

Table 4. Trapping site locations and descriptions.

Site	Dates opened & closed	Location (WGS84)	Habitat
1	22/11/16 - 30/11/16	50H 759909 E 6446533 N	**Shrubland.** Shrubland of *Acacia*, *Melaleuca*, *Santalum* sp. with scattered Mallee eucalypts on pale gravelly sand overlying pale clay. Drill pad in middle of site.
2	22/11/16 - 30/11/16	50H 759420 E 6445948 N	**Mallee Woodland**. Mallee eucalypts over tall mixed *Melaleuca* spp. on gravelly red clay-loam.
3	22/11/16 - 30/11/16	50H 759052 E 6445503 N	**Shrubland**. Sparse mallee eucalypt canopy over tall shrubland of *Allocasuarina*, *Acacia*, *Hakea* and *Melaleuca* spp., on pale gravelly sand.
4	23/11/16 - 1/12/16	50H 758866 E 6446681 N	**Shrubland.** Mixed shrubland including *Acacia* and *Hakea* spp. with patches of *Allocasuarina* sp. over on pale gravelly sand overlying pale clay.
5	23/11/16 - 1/12/16	50H 759690 E 6447287 N	**Mallee woodland/Shrubland**. Mallee woodland over mixed *Melaleuca spp*. grading into tall shrubland of (*Allocasuarina* sp., *Acacia* sp. and *Melaleuca* sp.) on pale, gravelly sand.
6	23/11/16 - 1/12/16	50H 758985 E 6447617 N	**Mallee Woodland**. Mallee woodland over patchy *Melaleuca spp*. and occasional *Callitris* on laterite rise. Surrounded by tall shrubland to South and West.
13	3/10/17 – 11/10/17	50H 761835 E 6444082 N	**Tall Woodland**. Tall eucalypt woodland with scattered Gimlet over open tall shrubland of *Melaleuca* and *Dodonaea* sp., on stony pink clay-loam.
14	3/10/17 – 11/10/17	50H 760164 E 6444207 N	**Mallee woodland**. Mallee woodland with scattered Salmon Gum (including old felled trees) over open low shrubland of *Melaleuca* spp. on red clay-loam.
15	4/10/17 – 12/10/17	50H 763492 E 6436725 N	**Tall Woodland**. Tall eucalypt woodland over open tall *Melaleuca* shrubland on stony pink clay-loam.
16	3/10/17 – 11/10/17	50H 760999 E 6447461 N	**Mallee woodland**. Open Mallee woodland with scattered *Callitris* and *Santalum* sp. over mid shrubland of *Melaleuca*, *Hakea* and patchy *Allocasuarina* sp. on gravelly sand on a lateritic rise.
17	4/10/17 – 12/10/17	50H 762103 E 6446403 N	**Mallee woodland**. Mallee woodland over sparse *Melaleuca* shrubland on red clay.
18	5/10/17 – 13/10/17	50H 757425 E 6444968 N	**Shrubland**. Tall shrubland of *Allocasuarina* sp. with scattered *Acacia* and low Mallee over open shrubland of mixed *Melaleuca* spp. on pale gravelly sand.
19	5/10/17 – 13/10/17	50H 760354 E 6445625 N	**Mallee woodland**. Open Mallee woodland over tall shrubland of *Melaleuca* sp. with scattered *Callitris* on pale sand over clay.
20	6/10/17 – 13/10/17	50H 760561 E 6442909 N	**Shrubland**. Tall shrubland of *Allocasuarina*, *Hakea*, *Acacia* and *Melaleuca* sp. with occasional *Banksia* sp. and scattered low Mallee, over low sparse *Melaleuca* shrubland on gravelly sands on lateritic rise.

Site 1

Site 2

Site 3

Site 4

Site 5

Site 6

Plate 2. Representative photographs for Trapping Sites 1 - 6.

Site 13

Site 14

Site 15

Site 16

Site 17

Site 18

Site 19

Site 20

Plate 3. Representative photographs for Trapping Sites 13 - 20.

Plate 4. Examples of pitfall and funnel trap setup.

3.4.3 Bird Surveys

Birds surveys were carried out at each of the trapping sites in the early morning while bird activity was high. A total of seven 20 minute surveys were undertaken for each trapping site. Birds were recorded whether seen or heard. As birds were often difficult to observe or count in dense habitats, each species was recorded as present only, and the frequency of occurrence calculated for each site.

3.4.4 Bat Surveys

In 2016, bats were surveyed using SM2 ultrasonic bat detectors at trapping sites 1 - 12 for one night, plus one night at the camp (see Figure 7 for site locations). In 2017, bats were surveyed using Anabat Swift bat detectors at trapping sites 13 – 20 and opportunistically at the camp and two sites near water (Figure 7). Analysis of the recordings was undertaken by Dr Kyle Armstrong of Specialised Zoological.

3.4.5 Spotlighting

Spotlighting was carried out on two nights in 2016, 27 November and 3 December. Nocturnal conditions were cold during the 2017 survey, and spot-lighting was undertaken once on the 12 October 2017. Spotlighting was carried out by six people in three teams of two in 2016 and four people in teams of two in 2017. A combination of road-spotting using car headlights and head-torching in suitable habitat (e.g. around water for frogs or on large eucalypts for arboreal geckoes). Owls and other nocturnal birds were recorded if seen or heard.

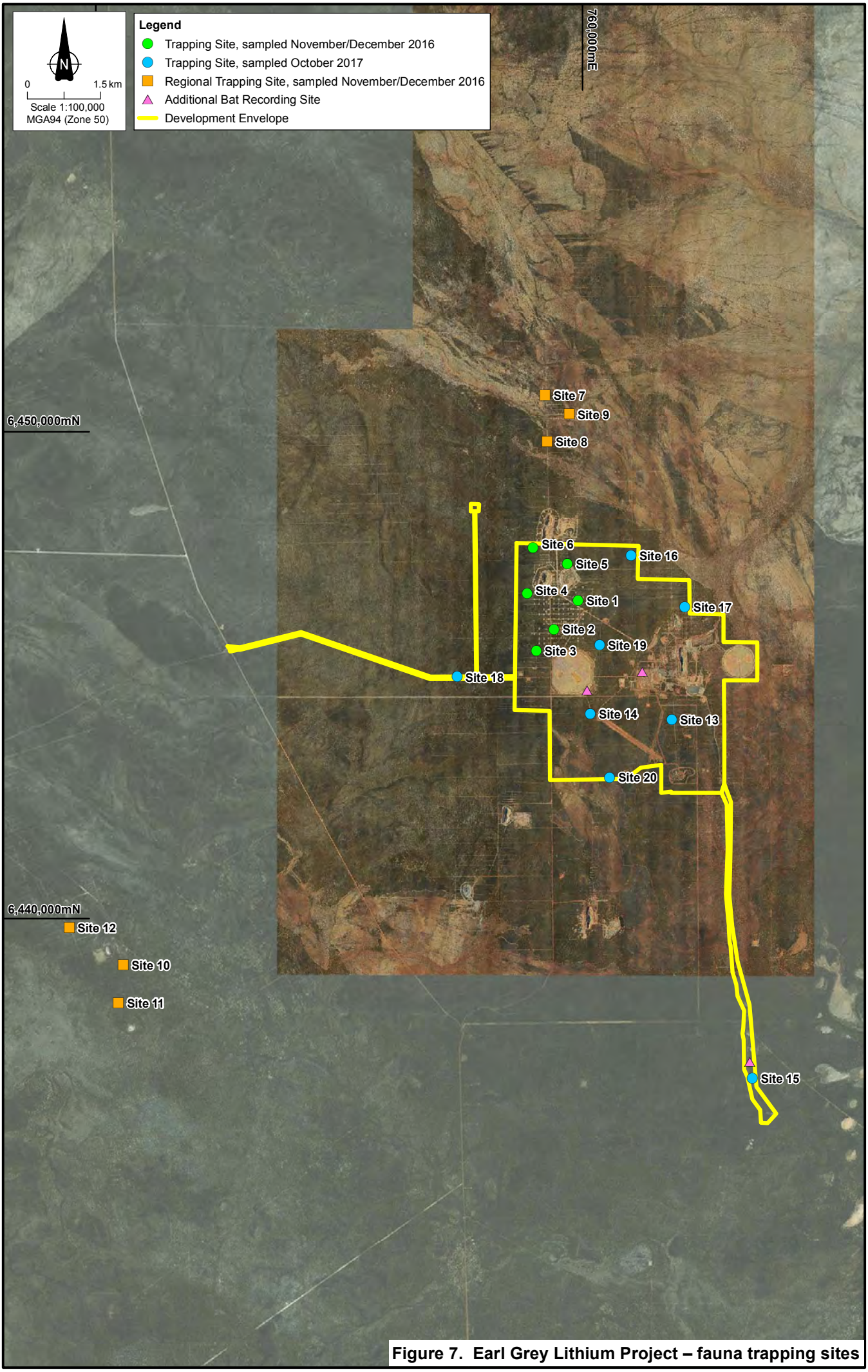

Figure 7. Earl Grey Lithium Project – fauna trapping sites

Imagery: Kidman Resources (2016), ESRI (2014)

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3.4.6 Opportunistic and Hand-searching Records

At all times, observations of fauna were noted when they contributed to the accumulation of information on the fauna of the site. These included casual observations of reptiles, mammals and birds seen while travelling between sites or while undertaking other activities, such as Malleefowl transects. Hand-searching (raking under shrubs and in leaf litter, turning over logs) was carried out opportunistically during the Level 1 and Level 2 surveys, with the aim of searching for reptile species not recorded in the trapping. Opportunistic observations were recorded to a general location for common species, and conservation significant species were recorded with a GPS location.

3.4.7 Targeted Malleefowl Survey

Malleefowl were targeted by walking transects totaling approximately 1,375 km, of which 1,145 km were within the Development Envelope (Table 5, Figure 8). The primary areas targeted for transects were the Earl Grey lithium deposit and proposed mine footprint (including proposed waste rock dumps, roads, etc.). Secondary targets were in areas of potential breeding habitat identified from aerial photography, spaced to give some coverage over the remainder of the development envelope. In 2016 intensive transects were also completed outside the Development Envelope as part of a wider fauna survey targeting other areas of interest for KRL.

Table 5. Summary of Malleefowl mound survey effort.

Survey	Survey type	Dates of survey	Transect length (km)	
			Development Envelope	Regional Survey Area
1	Transects, 4 people, 10m spacing	10 – 15 Oct 2016	268	-
2	Transects, 6 people, 10m spacing	27 Nov – 3 Dec 2016	97	209
2, 3 and 6	Opportunistic	Nov/Dec 2016, Jan/Feb 2017, Sept-Nov 2017	-	-
4, 5 and 6	Transects, 2 – 6 people, 10m spacing, some walking of historic drill lines.	12 – 20 Sep, 7 – 13 Oct 2017 and 26 – 30 Nov 2017.	780	21
		Total transect length:	**1,145**	**230**

In 2017, as well as intensive transects, historic drill lines were walked to search for evidence of recent Malleefowl activity. The reasoning behind this being that almost all recent activity in 2016, including all the active and recently active mounds found, were adjacent to existing tracks and taking advantage of soil mounded up by track clearing.

The transects were walked by two to six zoologists spaced 10 m apart, each using a handheld GPS for guidance (Plate 5). The close spacing was due to the low visibility in the dense shrublands. Any mounds identified were recorded with a GPS location, photograph, description of the habitat, estimated age of the mound and any evidence of eggshell fragments. Excavations that were not used for nesting (i.e. the mound attempt abandoned or site deemed unsuitable by the Malleefowl) were also recorded as evidence of Malleefowl activity in the area. Any mounds encountered opportunistically were also recorded. Two mounds recorded in previous surveys (Western Wildlife 2014, 2016) were also included as they were within the Regional Survey Area.

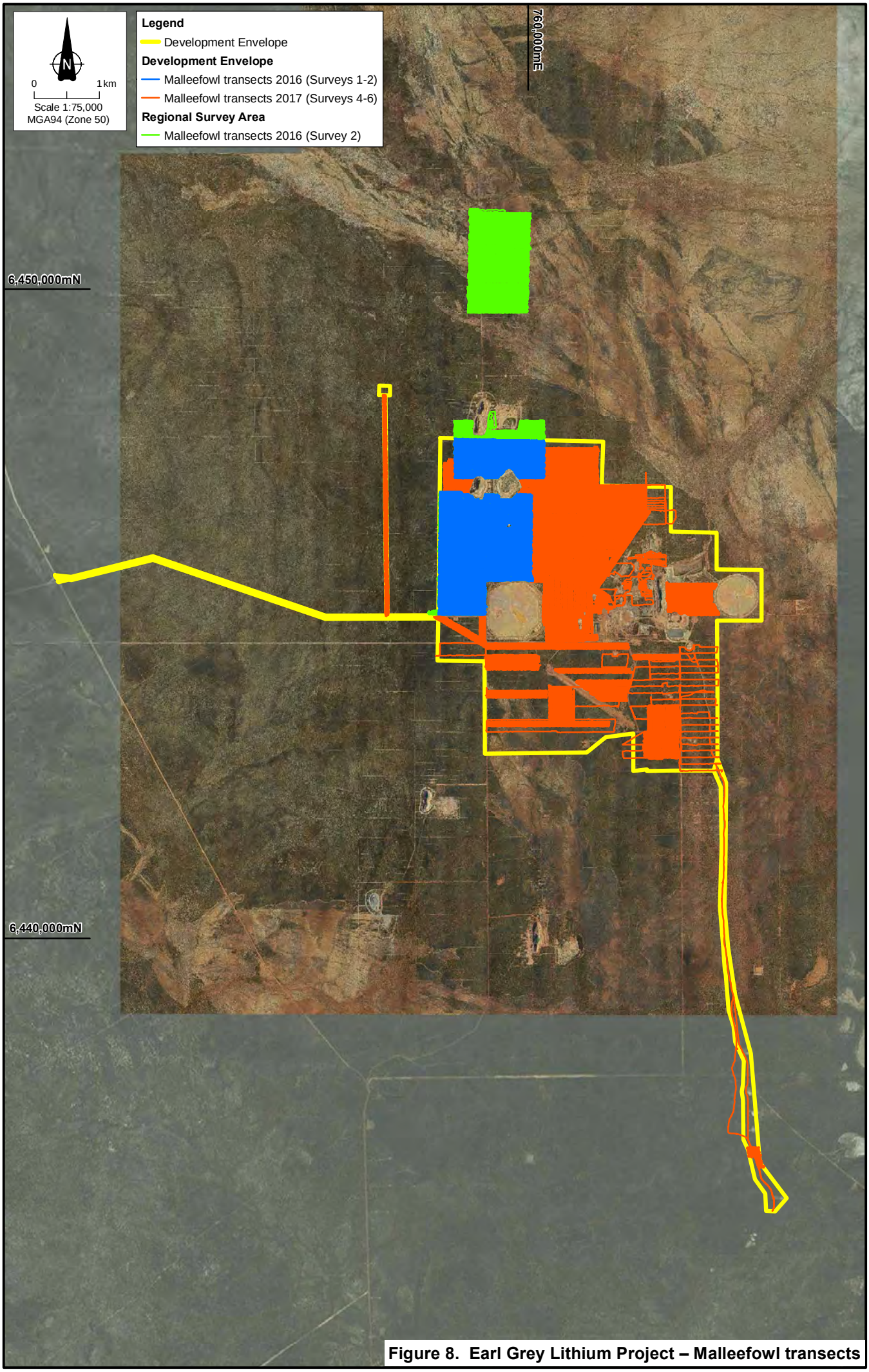

Figure 8. Earl Grey Lithium Project – Malleefowl transects

Plate 5. Preparing to walk Malleefowl mound transects.

3.4.8 Targeted Chuditch Surveys

Chuditch were targeted using motion-sensitive camera traps and cage traps.

A total of 136 camera trap sites targeted Chuditch, 42 in the development Envelope and 94 in the Regional Survey Area (Table 6, Figure 9). The camera traps were deployed on tracks and historic drill-lines across the Development Envelope, with the camera mounted on a dropper post (Plate 6). Cameras were set for between four nights and up to three weeks between October 2016 and October 2017. Deployment dates and habitat for each camera are given in Appendix 3A. Additional habitat data for cameras in January 2017 are given in Appendix 3B.

The cameras used were branded either *Bushnell* or *Ltl Acorn*, which have similar settings and capabilities. Cameras were set to take three pictures when triggered. For surveys 1, 2 and 5 (Table 1), cameras were set to take pictures day or night, in order to record all fauna as part of Level 1 or 2 fauna surveys. The bait used for these surveys used was a mixture of rolled oats, sardines, peanut butter and tuna oil. For surveys 3 and 4, cameras were set to only take pictures at night, (when Chuditch are active), to avoid filling the memory cards during a longer-term deployment. In these instances, bait tubes filled with sponge soaked in tuna oil were used, as these baits were intended to remain effective over a longer time period. Bait tubes were securely staked to the ground with a tent peg.

Cage trapping in the Regional Survey Area was undertaken between 25 – 30 November 2017, timed to avoid the breeding season. Two transects of 50 cage traps were established, one to the north and one to the south of the Development Envelope (Figure 10). The transect locations were chosen to be accessible for early morning checks, in areas where Chuditch were recorded on camera traps on previous surveys and to cover a range of burnt and unburnt, woodland and shrubland habitats. The location and habitat of each cage trap is given in Appendix 4.

The cage traps were deployed on the edges of roads and tracks with 200 m between traps. This is consistent with the methodology used by DBCA for fauna monitoring as part of their Western Shield program. Each cage trap was baited with a mixture of rolled oats, peanut butter and sardines, with the bait balls soaked in tuna oil. All traps were shaded with a hessian bag and checked twice daily, in the early morning and late afternoon to give a total of four nights trapping (400 trap-nights). Any Chuditch trapped were microchipped with a uniquely numbered Trovan microchip, to aid in identifying recaptures. In addition, the age (adult or subadult), weight, sex, pes length and reproductive condition was recorded. Note that Chuditch within the Development Envelope were targeted with cage traps as part of the Level 2 survey in 2016 (see section 3.4.2).

Table 6. Summary of camera trapping effort.

Survey (see Table 1)	Total number of camera trap sites	Overall dates of camera deployment (see also Appendix 3A)	Survey Area			
			Development Envelope		Regional Survey Area	
			Camera sites	Trap-nights	Camera sites	Trap-nights
1	12	10 Oct – 15 Oct 2016	12	60	-	-
2	45	22 – 4 Dec 2016	14	59	31	130
3	44	16 Jan – 24 Feb 2017	1	22	43	772
4	20	19 Sep – 7 Oct 2017	-	-	20	350
5	15*	8 – 13 Oct 2017	15	75	-	-
		Totals:	**42**	**216**	**94**	**1,252**

* An additional 3 camera traps were deployed that did not target Chuditch

Plate 6. Camera trap set up.

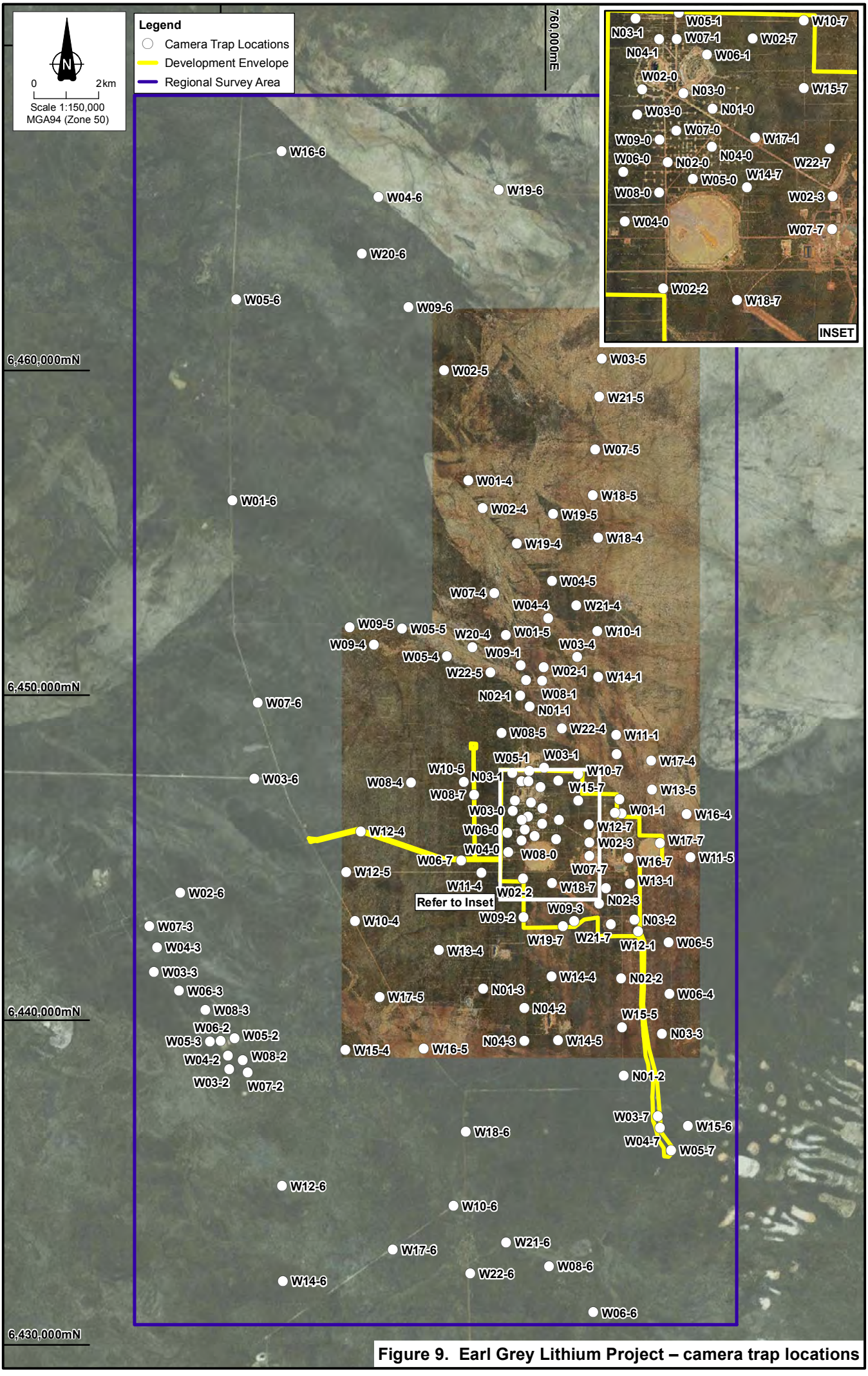

Figure 9. Earl Grey Lithium Project – camera trap locations

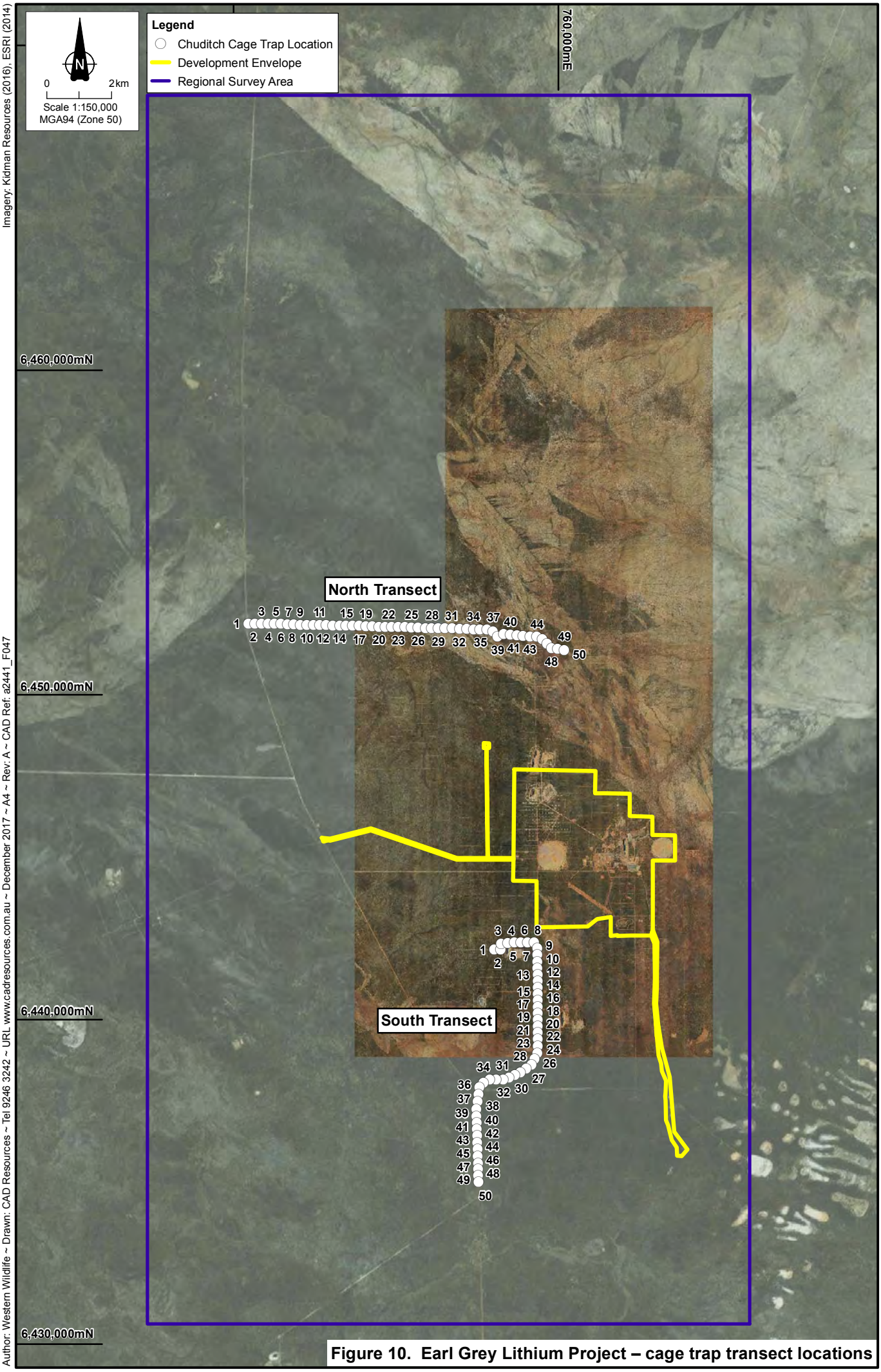

Figure 10. Earl Grey Lithium Project – cage trap transect locations

3.5 Habitat Mapping

Habitat mapping was undertaken using observations made by fauna personnel in the field, interpretation of aerial photography and interpretation of existing vegetation mapping produced by Mattiske Consulting (2017). During the Malleefowl transects, GPS locations were recorded to mark areas of potential Malleefowl breeding habitat, and these points were used to inform the habitat map for this species. the CAD Resources produced the maps from information provided by Mattiske Consulting and Western Wildlife.

3.6 Survey Limitations

Various factors can limit the effectiveness of a fauna survey. Pursuant to EPA Guidance (EPA 2016b), these factors have been identified and their potential to impact on the effectiveness of the surveys has been assessed in Table 7. All fauna surveys have limitations, and not all fauna species present on the site are likely to be sampled during a survey. Fauna may not be recorded because they are rare, they are difficult to trap or observe, or because they are only present on the site for part of the year.

Table 7. Fauna survey limitations.

Potential Limitation	Extent of limitation for the fauna survey	
Experience of fauna personnel	Not limiting:	The supervising zoologist has over 17 years' experience in fauna surveys, and team members have 1 to 20 years' experience.
Types of traps or other survey methods used	Not limiting:	All standard trap types were used (Pitfalls, funnels, Elliotts, cages) plus camera traps, bird surveys, spotlighting and observations by experienced zoologists. Targeted survey methods were used for key species; Malleefowl and Chuditch.
Number of trapping sites	Not limiting:	Fourteen trapping sites were established in the development envelope. This is a high number compared to the size of the Development Envelope.
Ability to survey all habitats present	Not limiting:	All habitats present in the Development Envelope were surveyed during the fauna survey.
Availability of fauna information for the area in literature and on databases	Not limiting:	Moderate amount of fauna information available on databases and in the literature, supported by additional data from trapping sites outside the Development Envelope.
Effects of weather during the survey	Minor limitation on some surveys:	Weather during the surveys 1 and 2 was cool to hot, ranging from clear and sunny to overcast, providing ideal conditions for trapping and observations of fauna. Although the rainy weather during survey 3 (see Appendix 1) may have impacted on the bait-tubes used to attract Chuditch, the cameras all experienced a period of dry weather prior to the downpours. Weather was not limiting for survey 4, though cool nighttime temperatures likely impacted captures on survey 5. Heavy rain on one night of survey 6 may have impacted captures, but good capture rates were experienced on subsequent nights.
Seasonal effects	Not limiting:	As several surveys were undertaken, Development Envelope has been visited across several seasons, particularly in spring and summer when faunal activity is high.
Disturbance to site such as recent fires, cattle grazing	Minor limitation in some areas:	Much of the Regional Survey Area and a small part of the Development Envelope are recovering after extensive fire. This facilitated observation of Malleefowl mounds in some cases, but reduced the number of other fauna observations and is likely to have impacted the distribution of some species including Chuditch. Similar unburnt habitats were available nearby to survey.
Ease of access to site	Not limiting:	Site access to the Development Envelope was very good, with all areas accessible by vehicle or on foot. Access to the Regional Survey Area was fair, with sufficient access to carry out the targeted Chuditch surveys.

Although only a single trapping event was undertaken for each trapping site, it was scheduled in spring to coincide with high levels of activity of most vertebrate fauna groups. The surveys undertaken in other months (October 2016, January/February 2017, September 2017 and November 2017) provided additional opportunities for opportunistic observations, particularly of birds. The only vertebrate group not targeted was frogs. This is a minor limitation only, as no conservation significant frog species are present in the region, and the Development Envelope lacks wetland habitats likely to be significant for breeding frogs.

A significant portion of the region has been impacted by large scale bushfire, including much of the Regional Survey Area and the eastern edge of the Development Envelope. These areas are recovering, and support fauna, but the faunal assemblages of these areas are likely to differ in their species composition and abundance compared with unburnt sites. This is a minor limitation as trapping sites in the Development Envelope were situated in unburnt habitats and trapping in the Regional Survey Area occurred across both burnt and unburnt sites.

3.7 Assessing Conservation Significance of Fauna

Three levels of conservation significance are used within this report to indicate the level of significance of fauna species. These are described in the following sub-sections.

3.7.1 Conservation Significance 1

Conservation Significance 1 (CS1) is the highest level of conservation significance, describing species that are protected under State or Commonwealth legislation. These species are considered to be of state and/or national conservation significance, and some species (e.g. some migratory species) may be considered of international significance.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Commonwealth Government's primary piece of environmental legislation. Listed under Part 3 of the EPBC Act are 'Matters of National Environmental Significance'. These include threatened species, threatened ecological communities and migratory species.

Fauna species are assessed against categories based on International Union for Conservation of Nature (IUCN) criteria. These criteria are as follows:

Extinct:	Taxa not definitely located in the wild during the past 50 years.
Extinct in the wild:	Taxa known to survive only in captivity.
Critically Endangered:	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered:	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable:	Taxa facing a very high risk of extinction in the wild in the medium-term future.
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.

Of the above, only fauna classified as 'extinct in the wild' 'critically endangered', 'endangered' or 'vulnerable' are listed as Matters of National Environmental Significance. The migratory species listed under the EPBC Act are those recognised under international agreements. These agreements are the China-Australia Migratory Bird Agreement (CAMBA), the Japan-Australia Migratory Bird Agreement (JAMBA), the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), or species listed under the Bonn Convention for which Australia is a range state.

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

The *Western Australian Wildlife Conservation Act 1950* (WC Act) is State legislation for fauna protection administered by the Department of Biodiversity, Conservation and Attractions (DBCA). The WC Act lists species under a set of Schedules, as listed below.

Schedule 1:	Fauna that is rare or likely to become extinct (critically endangered fauna)
Schedule 2:	Fauna that is rare or likely to become extinct (endangered fauna)
Schedule 3:	Fauna that is rare or likely to become extinct (vulnerable fauna)
Schedule 4:	Fauna presumed to be extinct
Schedule 5:	Migratory birds protected under an international agreement
Schedule 6:	Fauna that is of special conservation need (conservation dependent fauna)
Schedule 7:	Other specially protected fauna

3.7.2 Conservation Significance 2

Species of Conservation Significance 2 (CS2) are not listed under State or Commonwealth Acts, but are listed as Priority species by DBCA. These species may be considered to be regionally significant. In Western Australia, DBCA maintains a list of Priority Fauna made up of species that are not considered Threatened under the WC Act, but for which DBCA feels there is cause for concern. There are four levels of Priority as defined by DBCA, as summarised below.

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

3.7.3 Conservation Significance 3

Conservation Significance 3 (CS3) species are not listed under State or Commonwealth Acts or in publications on threatened fauna or as Priority species by DBCA, but are considered by Western Wildlife to potentially be of local significance because they are at the limit of their distribution in the area, they have a very restricted range or they occur in breeding colonies (e.g. some waterbirds). This level of significance has no legislative recognition and is based on interpretation of information on the species patterns of distribution. For example, the Government of Western Australia (2000) used a similar sort of interpretation to identify significant bird species in the Perth metropolitan area as part of Bush Forever. Recognition of such species is consistent with the aim of preserving regional biodiversity.

4. Fauna Habitats

Three broad fauna habitats were identified in the Development Envelope, with some further subdivision on the basis of soil type:

- Mallee woodland
    - on sands
    - on clay-loams
    - on sandy clays
- Salmon Gum woodland
- Shrubland
    - on flats
    - on laterite rises

As the vegetation mapping for the Development Envelope was undertaken with a 1 km buffer (Mattiske Consulting 2017), the habitat mapping has also been extended to cover this area (Figure 11).

It is important to recognize that the fauna habitats are extremely variable on the local scale. For example, within the mallee woodland are small patches of shrubland that are too small to be separately mapped, but can provide Malleefowl breeding habitat within a matrix of less suitable habitat. This variability within the habitats contributes to the richness of the faunal assemblage.

Fauna habitats were not mapped for the Regional Survey Area, though some habitat data were collected in conjunction with the camera trap and cage trap surveys (Appendices 3 and 4). From opportunistic observations during the fauna survey, the Regional Study Area includes extensive areas of diverse mallee woodlands and shrublands, as well as smaller patches of open woodland (e.g. Salmon Gum woodlands) and sandplain.

Mattiske Consulting (2017) noted that the vegetation communities in the Development Envelope are typical of those reported in the Forrestiana region both historically (Beard 1972, 1990) and in recent flora and vegetation surveys. Although the fauna habitats identified are extensive in the region, they are regionally significant in that they are part of the relatively continuous area of habitat known as the Great Western Woodlands.

Uncommon habitat types, such as granite outcrops, salt lakes or freshwater wetlands, are absent from the Development Envelope. Historically cleared areas, waste dumps and open pits are present, and these are only likely to support a small complement of native fauna. Cleared areas, including tracks, can provide access for feral predators.

Parts of the Development Envelope and Regional Survey Area were recently burnt at the time of survey. The fire that intersects the eastern and southwestern parts of the Development Envelope occurred in 2015. Earlier fires burnt the northwest quarter of the Regional Survey Area in about 2009, and a portion of the southern Regional Survey Area in 2016. While these areas are recovering after fire they are likely to support a different faunal assemblage to that in long-unburnt habitats. Unburnt habitats are important, providing habitats for fauna that favour structurally dense habitats and a source from which fauna can recolonise burnt areas as they regenerate.

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Imagery: Kidman (2016), ESRI (2014)

Figure 11A. Earl Grey Lithium Project – fauna habitats

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Imagery: Kidman (2016), ESRI (2014)

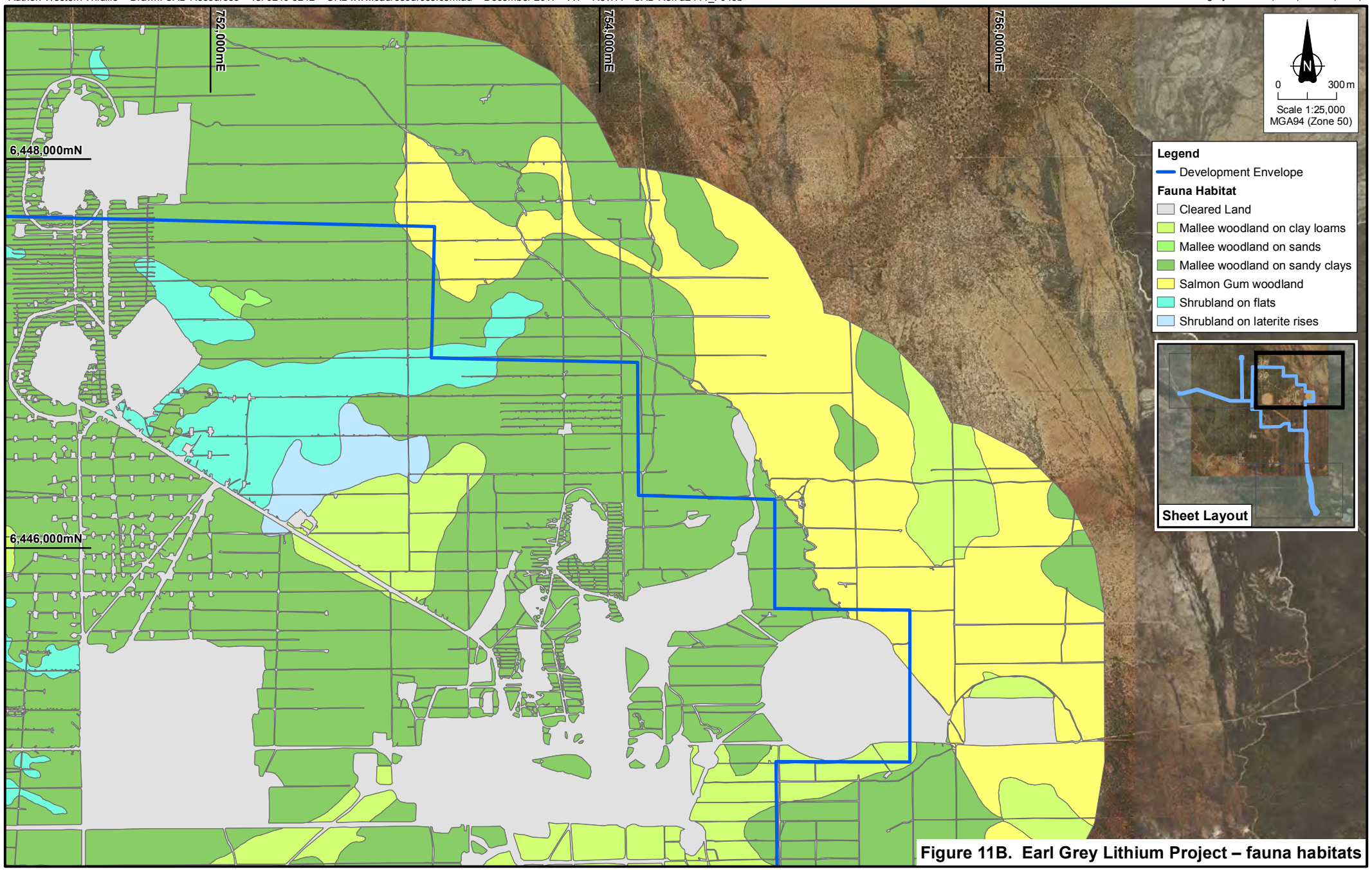

Figure 11B. Earl Grey Lithium Project – fauna habitats

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Imagery: Kidman (2016), ESRI (2014)

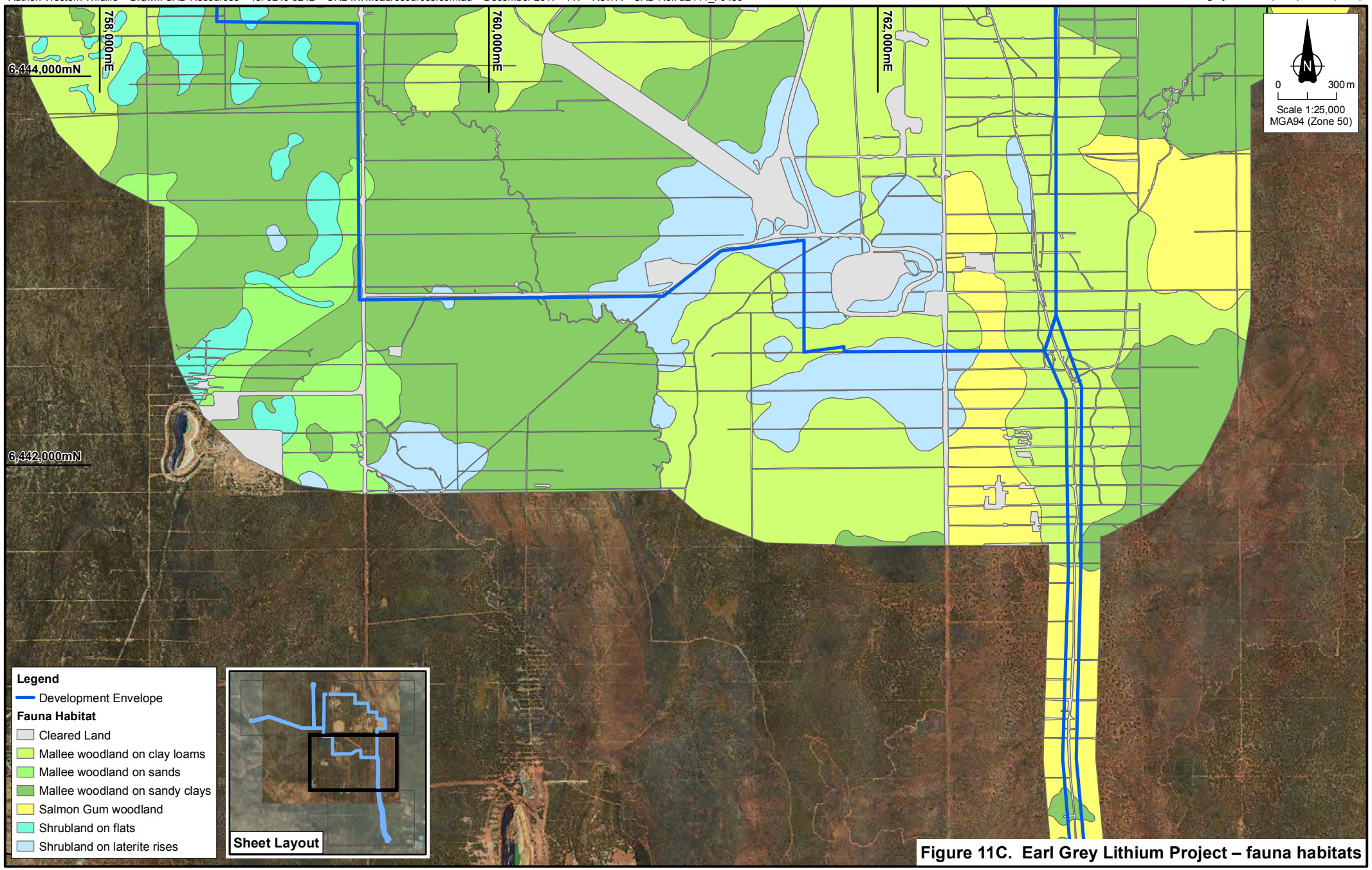

Figure 11C. Earl Grey Lithium Project – fauna habitats

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Imagery: Kidman (2016), ESRI (2014)

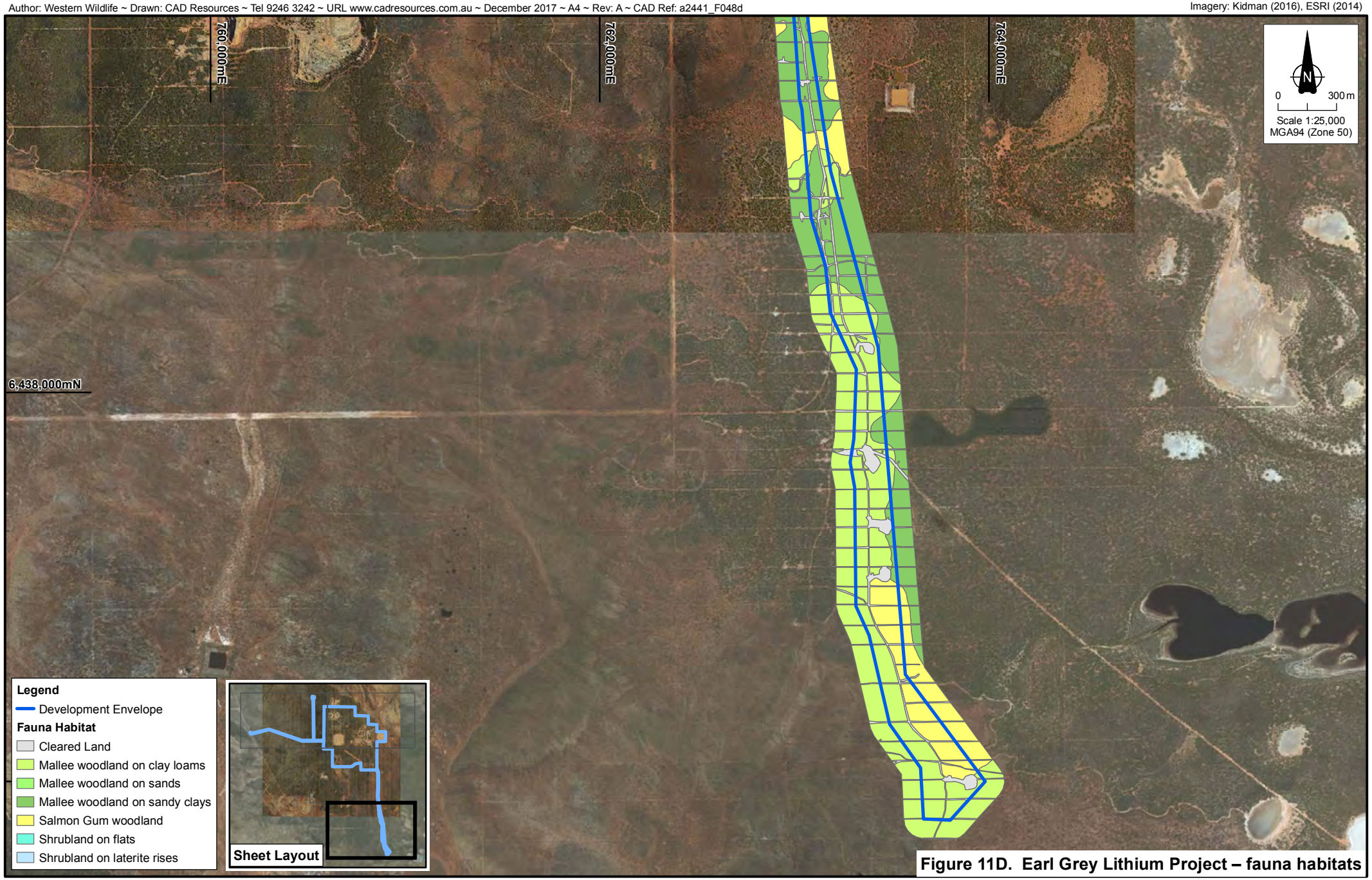


Figure 11D. Earl Grey Lithium Project – fauna habitats

4.1 Mallee Woodland

Mallee woodland is a very common habitat, both within the Development Envelope and in the Regional Survey Area. The 'mallee woodland' habitat describes a structural type, and within that the habitat there is much variability in plant species composition and the density and composition of the shrubland understory, ranging from minimal understory to dense shrubland (Plates 7 and 8).

Mallee woodlands have been sub-divided into three habitats on the basis of the underlying soil type, sands, sandy-clays or clay-loam (Figure 11), as this impacts the ground-dwelling fauna that may occur. Note that even within these subdivisions the soil surface can be variable.

The mallee eucalypt canopy includes one or more of Tall Sand Mallee (*Eucalyptus eremophila*), Stiff-leaved Mallee (*Eucalyptus rigidula*), Wheatbelt Wandoo (*Eucalyptus capillosa*), Lerp Mallee (*Eucalyptus incrassata*), Square-fruited Mallee (*Eucalyptus prolixa*), Burracoppin Mallee (*Eucalyptus burracoppinensis*), *Eucalyptus ravida*, *Eucalyptus urna*, White Mallee (*Eucalyptus cylindriflora*), Yorrell (*Eucalyptus gracilis*), Woodline Mallee (*Eucalyptus cylindrocarpa*) and Merrit (*Eucalyptus flocktoniae*) (Mattiske Consulting 2017). The understory includes a range of shrubs, particularly *Melaleuca* spp.

Plate 7. Mallee woodland in the Development Envelope.

As the mallee trees are relatively small in diameter, this habitat generally lacks tree hollows, though scattered hollow-bearing trees are present. Where the understory is dense, it provides nesting habitat for small birds. The reptile assemblage is likely to vary depending on the substrate (e.g. clay or gravelly sand). Mallee woodland potentially supports conservation significant fauna including the Malleefowl (*Leipoa ocellata*), Chuditch (*Dasyurus geoffroii*), Inland Western Rosella (*Platycercus icterotis*), Lake Cronin Snake (*Paroplocephalus atriceps*) and Central Long-eared Bat (*Nyctophilus major tor*).

Plate 8. Mallee woodland in the Regional Survey Area.

4.2 Salmon Gum Woodland

Salmon Gum woodland is less common in this mallee-dominated region. These woodlands occur mostly in the eastern and southern parts of the Development Envelope, and are characterised by an open canopy of Salmon Gum (*Eucalyptus salmonophloia*), sometimes with Merrit (*Eucalyptus flocktoniae*), Sand Mallee (*Eucalyptus eremophila*), *Eucalyptus urna* or other eucalypts, over a sparse shrub understorey on clay flats (Plate 9). Salmon Gum woodlands were also noted to occur patchily in the Regional Survey Area (Plate 10). Much of this habitat is recently burnt.

Salmon Gum woodland is significant for the tall hollow-bearing trees and large fallen logs that provide shelter and nesting opportunities for a range of fauna. This habitat potentially supports conservation significant fauna including the Chuditch (*Dasyurus geoffroii*), Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), Inland Western Rosella (*Platycercus icterotis xanthogenys*), and Central Long-eared Bat (*Nyctophilus major tor*).

Plate 9. Salmon Gum Woodland in the Development Envelope.

Plate 10. Salmon Gum woodland in the Regional Survey Area.

4.3 Shrubland

Shrublands are common but patchy in occurrence in the Development Envelope, as well as in the Regional Survey Area (Plates 11 - 13). Shrublands occur on sandy-clay flats, gravelly sands and lateritic rises and vary in composition, but are usually dominated by species of *Allocasuarina*, *Hakea, Acacia, Banksia* and/or *Melaleuca*. Although sparse low mallee eucalypts may be present, this habitat lacks large trees. The dense structure of the vegetation provides shelter and nesting habitat for ground-dwelling birds. When in flower, shrubland habitats are likely to attract a suite of nectar-feeding bird species.

Note that shrublands also occur in small patches throughout the Mallee Woodland habitat, at a scale too small to be mapped.

Plate 11. Shrubland on flats in the Development Envelope.

Shrublands potentially support conservation significant fauna including the Malleefowl (*Leipoa ocellata*), Chuditch (*Dasyurus geoffroii*), Rainbow Bee-eater (*Merops ornatus*), Western Brush Wallaby (*Macropus irma*) and Lake Cronin Snake (*Paroplocephalus atriceps*).

Plate 12. Shrublands on laterite rises in the Development Envelope.

Plate 13. Shrublands in the Regional Survey Area.

5. Vertebrate Fauna of the Development Envelope

The numbers of vertebrate species potentially occurring in the Development Envelope are summarised in Table 8. The amphibians, reptiles, birds and mammals that have the potential to occur in the Development Envelope are listed in Appendix 5. Indicated in each Appendix are the species recorded in the Development Envelope by Western Wildlife during the October 2016 - February 2017 fauna surveys, as well as records from other sources.

Table 8. Summary of vertebrate fauna potentially occurring in the Development Envelope.

Taxon	Total species	Introduced species	Recorded on this survey	Conservation significant species		
				CS1	CS2	CS3
Amphibians	9	0	1	-	-	-
Reptiles	67	0	32	-	2	1
Birds	110	0	77	5	1	-
Mammals	32	5	19	2	2	-
Totals:	**218**	**5**	**129**	**7**	**5**	**1**

The Development Envelope is likely to support a relatively intact faunal assemblage, with only regionally extinct species likely to be missing from the area. The faunal assemblage is diverse as it contains elements from both the Eremaen (arid with irregular rainfall) and Bassian (southwest with regular winter rainfall) regions. The faunal assemblages recorded and fauna of conservation significance are discussed in the sections below. The results of the EPBC Act Protected Matters search are given in Appendix 6. The results of the DBCA Threatened and Priority Fauna Database search are given in Appendix 7 and DBCA records of species likely to occur in the Development Envelope are shown in Figure 12.

5.1 Amphibians

Nine frog species have the potential to occur in the Development Envelope (Appendix 5A). One species of frog, the Western Toadlet (*Pseudophryne occidentalis*) was recorded opportunistically during the October and November 2016 surveys (Appendix 8).

Most of the species expected to occur are burrowing frogs that use either seasonal or ephemeral wetlands for breeding. These species also breed opportunistically in depressions created by exploration and historical mining activities. The Development Envelope lacks natural wetlands, but pools around the base of the existing Earl Grey waste dump, abandonment bund walls and in an excavated depression in the southwest corner of the Development Envelope were noted to be holding water in October and November 2016. Dams on the borefields road and in the vicinity of the Mt Holland camp were noted to be holding water in October 2017, though some of these waters are likely to be saline and unsuitable for frogs. During the non-breeding season burrowing frogs use terrestrial habitats, so may forage throughout the Development Envelope.

5.1.1 Amphibians of Conservation Significance

No frog species of conservation significance or significant areas of breeding habitat are likely to occur.

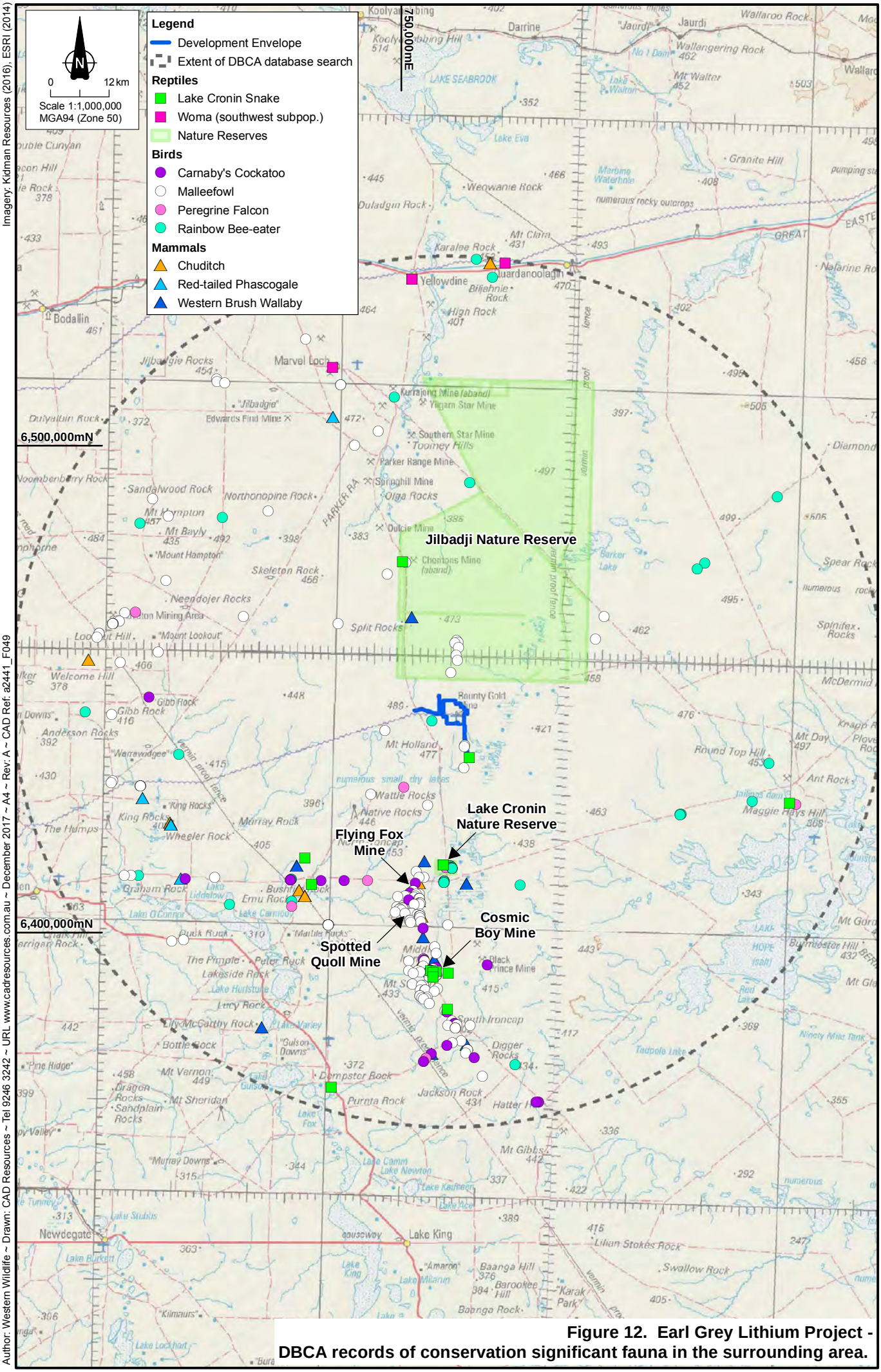


Figure 12. Earl Grey Lithium Project - DBCA records of conservation significant fauna in the surrounding area.

5.2 Reptiles

There are 67 species of reptile that potentially occur in the Development Envelope and a total of 32 species were recorded during the fauna surveys (Appendix 5B, Table 9). Given its setting in a large, continuous tract of native vegetation, the Development Envelope is likely to support a relatively intact reptile assemblage in each habitat. The expected reptile assemblage, (Appendix 5B), is both species rich and complex, as expected for the southwestern interzone where the Bassian and Eremaen regions overlap.

Most reptiles recorded in the fauna survey were represented by only a few records, and thus contribute to the species inventory for the Development Envelope as a whole, rather than provide data on habitat preferences. The observed reptile assemblage consisted of four dragons, four geckoes, three legless lizards, 16 skinks, two goannas, two blind snakes and one elapid snake (Table 9). The sites cannot be compared directly, as they were sampled in two different years and in different months, and this will have impacted the captures. However, the most species rich site was Site 6 (Mallee woodland on laterite rise) with eleven species and the lowest species richness was recorded at Site 2 (Mallee woodland on clay-loam), with two species.

A suite of species show a Bassian distribution, generally occurring in the south-west and at the north-eastern edge of their distribution in the Development Envelope. This includes species such as the Barking Gecko (*Underwoodisaurus milii*), Southern Blind Snake (*Anilios australis*) and Dusky Morethia (*Morethia obscura*). Species with an Eremean distribution occur across the heavier soils extending into the arid zone north and east of the Development Envelope.

Some reptiles favour sandy soils, and their distribution in the Development Envelope is likely to be centered around shrublands on flats or Mallee woodlands on sands. This includes species such as the Thorny Devil (*Moloch horridus*), Spotted Military Dragon (*Ctenophorus maculatus*), *Ctenotus atlas* and Spotted Knob-tail (*Nephrurus stellatus*). Species such as the Crested Dragon (*Ctenophorus cristatus*) (Plate 14), and *Egernia richardi* favour eucalypt woodlands, often sheltering in hollow logs. The Reticulated Velvet Gecko (*Hesperoedura reticulata*) inhabits smooth-barked eucalypts where it shelters in tree hollows or crevices. Recorded in the Regional Survey Area (Appendices 5B and 8), it is also likely to occur in the Development Envelope where suitable tall eucalypt woodlands are present.

Other reptiles recorded or likely to be present are likely to occur across all the habitats present in the Development Envelope. Generalist species, such as the Dwarf Skink (*Menetia greyii*), Bobtail (*Tiliqua rugosa*) and Dugite (*Pseudonaja affinis*) have large distributions and occur in a range of vegetation and soil types.

Plate 14. The Crested Dragon (*Ctenophorus cristatus*) and South Coast Gecko (*Diplodactylus calcicolus*).

Table 9. Reptiles captures at each site and opportunistic records in the Development Envelope.

Reptile species	Site														Opportunistic
	Sampled Nov/Dec 2016						Sampled Oct 2017								
	1	2	3	4	5	6	13	14	15	16	17	18	19	20	
Dragons															
Ctenophorus cristatus					1	1									
Ctenophorus maculatus	1		3	4											
Moloch horridus															x
Pogona minor				1		1							1		
Geckoes															
Crenadactylus ocellatus			1			1									
Diplodactylus granariensis	1	2				2									
Gehyra variegata															x
Underwoodisaurus milli						1									
Legless lizards															
Delma australis			1							1					
Delma fraseri						3				1					
Pygopus lepidopodus							1		1						
Skinks															
Cryptoblepharus buchananii								1			1				
Ctenotus atlas					1							4			
Ctenotus impar				1											
Ctenotus mimetes					1										
Ctenotus schomburgkii	1			1	2	5		2	2		5	1			
Ctenotus uber				1	1	4		5					2		
Egernia richardi							1								
Hemiergis initialis			1				1					1			
Lerista distinguenda						3									
Lerista kingii															x
Liopholis multiscutata												1		2	x
Menetia greyii	3		2		2		4	1	2	4	3			4	
Morethia butleri	1					1									
Morethia obscura						3	2	9	3	6	4	3	2		
Tiliqua occipitalis	1				1										
Tiliqua rugosa															x
Monitors or goannas															
Varanus gouldii		1		1	2										
Varanus rosenbergi	1									C					
Blind snakes															
Anilios bituberculatus														1	
Anilios australis			1												
Elapid snakes															
Pseudonaja affinis															x
Total species:	**7**	**2**	**6**	**6**	**8**	**11**	**5**	**5**	**4**	**5**	**4**	**5**	**3**	**3**	**5**

Note: X = observed opportunistically. C = species observed on camera trap used in lieu of cage traps, October 2017. Numbers may include individuals captured more than once over successive days.

One species, the South Coast Gecko (Plate 14), was recorded unexpectedly in the Regional Survey Area (Appendix 2C), and may occur in the Development Envelope. This record represents a modest range extension of about 30km, with the next nearest records of this species on NatureMap from around Lake Cronin (DPAW 2007-). The South Coast Gecko is common within its range.

5.2.1 Reptiles of Conservation Significance

There are three reptiles of conservation significance that have the potential to occur in the area. Each species is listed and discussed below.

Conservation Significance 2

Woma (southwest sub-population) *Aspidites ramsayi*
This species is listed as Priority 1 by DBCA.

Lake Cronin Snake *Paroplocephalus atriceps*
This species is listed as Priority 3 by DBCA.

The **Woma** is a large ground-dwelling python that occurs widely across arid and semi-arid Australia. The disjunct southwest subpopulation is listed as Priority 1. This sub-population is not well-known and extremely rare, Bush et al. (2007) reporting that the last known wheatbelt sighting of this species was in 1989. While in other regions the Woma occurs in a variety of habitats, in the wheatbelt and goldfields this species occurs mainly on sandplains (Bush *et al*. 2007). Sandplain habitats are present in the Regional Survey Area (*pers. obs.),* and Mallee Woodlands on sands occur along the Development Envelope access road (Figure 11). The four records of this species on DBCA's Threatened and Priority Fauna Database are undated historical records (Figure 12, Appendix 7), and there are no recent sightings of this species reported from the region. The Woma appears likely to be locally extinct, but if present may occur on sands.

The **Lake Cronin Snake** is known from very few localities in the semi-arid southern interior of Western Australia (Storr *et al*. 2002). The Lake Cronin Snake has been recorded from areas of woodland (including Salmon Gum woodlands) and tall shrubland and, although not known to have declined, this species may be threatened by clearing for agriculture and mining (Cogger *et al*. 1993, Bush *et al*. 2007). Most of the records of this species on DBCA's Threatened and Priority Fauna Database are from Lake Cronin and around Cosmic Boy Mine, to the south of the Development Envelope (Figure 12, Appendix 7). However, there is also a record from Jilbadji Nature Reserve to the north, so the distribution of this species is likely to overlap the Development Envelope. Although not recorded during the fauna survey, the Lake Cronin Snake potentially occurs in any of the woodland or shrubland habitats in the Development Envelope.

Conservation Significance 3

Spotted Knob-tail Gecko *Nephrurus stellatus*
This gecko species has a restricted distribution.

The **Spotted Knob-tail Gecko** has a restricted distribution, occurring between Mt Holland and Bungalbin Hill (Bush *et al*. 2007). According to Bush *et al*. (2007), it favours mallee woodlands with hummock grass in sandplain habitats, and it has been recorded nearby in Jilbadji Nature Reserve by Keighery *et al*. (1995). This species was recorded in the Regional Survey Area in

sandplain shrubland habitat (Appendix 2C, Plate 15). The Spotted Knob-tail Gecko may occur in shrubland or mallee woodlands on sands in the Development Envelope.

Plate 15. The Spotted Knob-tail Gecko (*Nephrurus stellatus*), trapped in the Regional Survey Area.

5.3 Birds

There are 110 species of bird that potentially occur in the Development Envelope (Appendix 5C). The Development Envelope is in the south-western interzone, on the transition between the southwest (Bassian) and arid (Eremaean) regions, and the diverse bird assemblage reflects this. There is a suite of species present that have a south-western distribution and are on the north-eastern limit of their range in the Development Envelope, including Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and the Spotted Pardalote (*Pardalotus punctatus*). A second suite of species occurs mainly in arid regions and are at their south-western limit in the Development Envelope, such as the White-fronted Honeyeater (*Purnella albifrons*) and Redthroat (*Pyrrholaemus brunneus*). Some species are more common in the open habitats created after fire, while others favour the dense vegetation of long-unburnt habitats (Fox *et al*. 2016). The bird assemblage in burnt areas is likely to change over time, as the vegetation continues to recover.

A total of 77 birds were observed in the Development Envelope, equating to about 70% of the predicted species (Table 10, Appendix 5C). Additional species were recorded in the Regional Survey Area, (within 10 km of the Development Envelope), and are also likely to occur. These are the Hooded Robin (*Melanodryas cucullata*), Black-eared Cuckoo (*Chrysococcyx osculans*), Little Eagle (*Heiraaetus morphnoides*), Varied Sittella (*Daphoenositta chrysoptera*), Black-faced Woodswallow (*Artamus cinereus*) and White-winged Triller (*Lalage tricolor*).

The Black Swan (*Cygnus atratus*) was recorded flying overhead, but is unlikely to use habitat in the Development Envelope. Water is present in various small dams in the Development Envelope, as well as in pools around the base of the Earl Grey waste dump and bund wall, which some waterbirds are likely to use on occasion. As this is not significant waterbird habitat, waterbirds were not included among the list of species in Appendix 5 unless observed in the Development Envelope. A single waterbird species, the Grey Teal (*Anas gracilis*) was observed on several occasions (Table 10, Appendix 5C, 8).

As the bird surveys at trapping sites were carried out in different months across two different years, they cannot be directly compared. However, some general inferences have been drawn based on a combination of the bird survey results and the ecology of birds in the region.

Honeyeaters were very common with several species commonly occurring at all sites (Table 10). Honeyeaters and the Purple-crowned Lorikeet (*Parvipsitta porphyrocephala*) move to take advantage of seasonal flowering resources. These species are likely to fluctuate in abundance, both seasonally and between years, and are likely to be abundant in the Development Envelope when the shrublands or eucalypt canopy is flowering.

While many bird species occur across open woodlands, mallee woodlands and shrublands, others are more dependent on a single habitat. Some favour woodland habitats, such as the Rufous Treecreeper (*Climacteris rufus*) and Yellow-plumed Honeyeater (*Ptilotula ornata*). Where there are hollows in the larger eucalypts, birds such as owls, parrots, pardalotes and the Tree Martin (*Petrochelidon nigricans*) are likely to use these for nesting. Occasional hollow-bearing eucalypts are present in the mallee woodlands and many potential nesting hollows are present where there are Salmon Gums.

The Development Envelope supports a suite of small insectivores that forage on the ground and mid-levels (Table 10). A few of these, such as the Australian Pipit (*Anthus australis*), favour open areas and are relatively uncommon. Open patches in the woodlands are favoured by robins, which perch in the mid-storey and forage on the ground. A dense cover of shrubs is favoured by the Shy Heathwren (*Hylacola cauta*), Blue-breasted Fairy-wren (*Malurus pulcherrimus),* Southern Scrub-robin (*Drymodes brunneopygia*) and Copperback Quail-thrush (*Cinclosoma clarum*). These and other species nest in dense vegetation, some, such as the Southern Scrub-Robin, on the ground and many, such as the Inland Thornbill (*Acanthiza apicalis*), within a metre of the ground (Plate 16). These nests can be vulnerable to feral predators, (foxes and cats), when dense habitats are fragmented.

Plate 16. Inland Thornbill (left) and Southern Scrub-robin (right) nests in the Development Envelope.

Table 10. Birds recorded at each site or opportunistically in the Development Envelope.

Bird species	Frequency of occurrence (n = 7) at each site														Opportunistic
	Sampled Nov/Dec 2016						Sampled Oct 2017								
	1	2	3	4	5	6	13	14	15	16	17	18	19	20	
Birds of Prey															
Australian Kestrel															x
Brown Falcon				1				2				1			
Collared Sparrowhawk															x
Peregrine Falcon (CS1)															x
Spotted Harrier															x
Square-tailed Kite			x												
Wedge-tailed Eagle															x
Whistling Kite															x
Waterbirds															
Grey Teal															x
Granivores															
Australian Ringneck								3	3		1			3	
Brush Bronzewing	4				1	3	1		1	1		1			
Common Bronzewing					x								1		
Elegant Parrot					1										
Galah											x				
Regent Parrot		1	1			1									
Inland Western Rosella (CS2)			1					2	x						
Nectarivores (honeyeaters & lorikeets)															
Brown Honeyeater	2							1	1	1		4		5	
Brown-headed Honeyeater	2	2	2		4	4	6	2	2		4		1	1	
Purple-crowned Lorikeet							1	4		3	4	2	7		
Purple-gaped Honeyeater	1	3	4	2	2	2	1		1			1	3		
Red Wattlebird		1		1		2	3	1	6		2	2	3	1	
Singing Honeyeater								1	1	1			1	1	
Spiny-cheeked Honeyeater	2		1	1	1	2		1	1		1	1	1	1	
Tawny-crowned Honeyeater	2				2										
White-cheeked Honeyeater														2	
White-eared Honeyeater	4	3		2	2	4		5	5	3	4	1	4	1	
White-fronted Honeyeater	4	2	2	1	4	2			5	1	2	5	4	1	
Yellow-throated Miner										1					
Insectivores – aerial foragers															
Dusky Woodswallow															x
Rainbow Bee-eater (CS1)														2	
Tree Martin			1	1			1								
Welcome Swallow															x
White-backed Swallow				1											

Table 10. (cont.)

Bird species	Frequency of occurrence (n = 7) at each site														Opportunistic
	Sampled Nov/Dec 2016						Sampled Oct 2017								
	1	2	3	4	5	6	13	14	15	16	17	18	19	20	
Insectivores – understorey to midstorey foragers															
Australian Pipit								x			1				
Blue-breasted Fairy-wren	1		5	6	4	2		1	1	4		3	2	2	
Copperback Quail-thrush										1				1	
Grey Fantail											x				
Inland Thornbill	4		4	4	2	3	2	2		2		4		2	
Jacky Winter								1			1			x	
Painted Button-quail														1	
Red-capped Robin		2	1						1	1		1			
Redthroat					2									1	
Shy Heathwren	2	2	5		2	x		1				1	1	1	
Southern Scrub-robin	5	4	4	5	5	6	1	4	1	4	4	7	6	6	
Western Yellow Robin		1				2	2	3	2						
White-browed Babbler		1	1			1			3	1		1		1	
White-browed Scrubwren					1									1	
Willie Wagtail							1	1	1						
Yellow-rumped Thornbill							1	1							
Insectivores – midstorey to canopy foragers															
Crested Bellbird	4	2	4		1		1	1	2	2	1	2	1	2	
Fan-tailed Cuckoo										1					
Gilbert's Whistler															x
Grey Shrike-thrush	1	4	5	1	2		2	5	3	2	2	4		4	
Horsfield's Bronze-cuckoo	3			2	2		1					1			
Pallid Cuckoo								1							
Restless Flycatcher															x
Rufous Whistler														1	
Western Gerygone								1	2						
Western Golden Whistler	4	4	3	1	1		6	2	3	1		2	2		
Mistletoebird															x
Insectivores – eucalypt canopy specialists															
Spotted Pardalote	2	2	1		2	2									
Striated Pardalote		1					1	7	4	4	5				
Weebill	1	3	2	4	2	6	7	7	8	4	6	5	5	2	
Large predator/insectivores															
Australian Raven							1	3	2		1	1		3	
Black-faced Cuckoo-shrike			1		1			1	3		1				
Grey Butcherbird				x			1		1	1					
Grey Currawong			1			2	5	2	2	2	3		1		
Sacred Kingfisher															x

Table 10. (cont.)

Bird species	Frequency of occurrence (n = 7) at each site														Opportunistic
	Sampled Nov/Dec 2016						Sampled Oct 2017								
	1	2	3	4	5	6	13	14	15	16	17	18	19	20	
Nocturnal birds															
Australian Owlet-Nightjar															x
Southern Boobook															x
Spotted Nightjar															x
Tawny Frogmouth							1								
Large ground-dwelling birds															
Emu		x						1			1				
Malleefowl (CS1)			x								x				
Total species:	**18**	**18**	**22**	**16**	**22**	**17**	**21**	**30**	**27**	**21**	**21**	**21**	**15**	**26**	**17**

5.3.1 Birds of Conservation Significance

There are six bird species of conservation significance that have the potential to occur in the Development Envelope, five of CS1 and one of CS2. Each is listed and discussed below. Records of conservation significant birds from this fauna survey are presented in Figures 13 - 16.

Several birds listed on database searches in the area (Appendices 6 and 7) have been omitted from Appendix 5C and the discussion below. Records of Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) are likely to be old records prior to taxonomic changes, that should be attributed to Carnaby's Black-Cockatoo, as Baudin's Black-Cockatoo is restricted to the deep southwest and does not occur in the area. The Hooded Plover (*Charadrius rubricollis*), Curlew Sandpiper (*Calidris ferruginea*) and Sharp-tailed Sandpiper (*Calidris acuminata*) are shorebirds that may occasionally occur on claypans and salt lakes in the region, a habitat that is absent from the Development Envelope. The Night Parrot (*Pezoporus occidentalis*) is an extremely rare species for which suitable habitats (spinifex grasslands and chenopod shrublands) are absent from the Development Envelope.

Conservation Significance 1

Malleefowl *Leipoa ocellata*
This species is listed under Schedule 3 (Vulnerable) of the WC Act and as Vulnerable under the EPBC Act.

Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*
This cockatoo is listed under Schedule 2 (Endangered) of the WC Act and as Endangered under the EPBC Act.

Peregrine Falcon *Falco peregrinus*
This falcon is listed under Schedule 7 (other specially protected fauna) of the WC Act.

Rainbow Bee-eater *Merops ornatus*
This species is listed under Schedule 5 (Migratory birds under international agreement) of the WC Act.

Fork-tailed Swift *Apus pacificus*
This species is listed under Schedule 5 (Migratory birds under international agreement) of the WC Act and as migratory under the EPBC Act.

The **Malleefowl** is a bird of dense shrublands, mulga woodlands and mallee woodlands, and used to be common in the southern arid and semi-arid areas of Western Australia (Johnstone and Storr 1998). In order to construct their nest mounds, the Malleefowl needs leaf litter on sandy substrates (Garnett and Crowley 2010). The mounds are usually constructed intermittently by a pair of birds between autumn and spring. Between early spring and mid to late summer, 15 - 25 eggs are laid in the mound by the female, while the male continues to tend the mound. The chicks emerge between November and January (sometimes as late as March), and as they receive no parental care, chick mortality can be high (Benshemesh 2007).

As Malleefowl nest on the ground, the eggs and flightless chicks are vulnerable to predation by feral predators. However, the main threat to Malleefowl is habitat loss and the fragmentation and degradation of remaining habitat, as well as the death of adults on roads (Benshemesh 2007, Garnett *et al*. 2011). Fire can have a significant impact on populations, by killing adult birds, causing local extinctions in fragmented habitats and causing a cessation in breeding activity for many years after a fire (Benshemesh 2007).

There are many records of Malleefowl within the 90km search area surrounding the Development Envelope on DBCA's Threatened and Priority Fauna Database, many of them recent, (Figure 12, Appendix 7) though these records do not distinguish between sightings of birds and mounds. Malleefowl are likely to occur throughout the woodlands and shrublands of the region. The Malleefowl was recorded opportunistically in both the Development Envelope and regional survey area (Figure 13, Appendix 8).

Plate 17. Malleefowl recorded on a camera trap in the Regional Survey Area.

A total of 51 Malleefowl mounds were recorded during the fauna survey, four active, eight recently active and 39 old mounds, with an additional ten instances of mound attempts that were not used for nesting (Plate 17, Figure 14, 15 and Appendix 9). Of these, two active, four recently active and 31 old mounds were within the Development Envelope, and one recently active mound (MM-61) was just outside the edge of the Development Envelope on the borefields road. It should be noted that the distribution of mounds in Figure 14 is influenced by the level of survey carried out in various areas. Where areas were intensively searched (see Figure 8) the inventory of mounds is likely to be near-complete. The remaining areas, including almost all of the Regional Survey Area, were only sampled opportunistically so it is likely that many mounds remain unrecorded.

All four active mounds found were in unburnt habitat, and all were alongside existing tracks. Of the recently active mounds, all but one was in unburnt habitat, and six of the eight were adjacent to existing tracks. All mound attempts were records of birds digging into soil mounded up by track formation, and it appears that these soil mounds may be attractive for nest sites. Old mounds were often overgrown with woody shrubs and trees, (see photos, Appendix 9) and though Malleefowl are unlikely to re-use these old mounds once overgrown, they indicate areas suitable for breeding. Malleefowl will often breed in the same general area year after year, and new mounds may be constructed or mounds re-used.

Plate 18. Active Malleefowl mound MM-03 in the Development Envelope, October 2016 (top) and September 2017 (bottom).

Adult Malleefowl have been found to range over one to many square kilometres, and these home ranges overlap (Benshemesh 2007). It is likely that all vegetation in the Development Envelope is foraging habitat for Malleefowl, though open woodlands (e.g. Salmon Gum woodland) are less suitable compared to mallee woodland and shrublands (Parsons 2008). Breeding habitat in the Development Envelope is indicated in Figure 15. Breeding habitat is absent from areas of heavy clay soils, but is otherwise widespread in the Development Envelope. Within the potential breeding habitat area, suitable sites for mound-building are likely to be patchy, with mounds were generally found in or on the edges of patches of tall shrubland with a gravelly sand substrate (Appendix 9). Areas of long-unburnt mallee woodland and shrublands are likely to be regionally important for maintaining Malleefowl populations, particularly in the context of widespread fires in the region and the length of time it takes for burnt areas to return to conditions suitable for breeding. Breeding habitat in burnt areas is unlikely to be used again until after the vegetation has regenerated sufficiently to provide leaf litter for use in nest construction.

Carnaby's Black-Cockatoo is endemic to the southwest of Western Australia, and has declined due to loss of breeding habitat in the wheatbelt and foraging habitat along the west coast (Johnstone and Storr 1998). Carnaby's Black-Cockatoo prefers to breed in smooth-barked eucalypts such as Salmon Gum (Johnstone and Storr 1998). This species feeds on the seeds of eucalypts and proteaceous vegetation, as well as a range of other seeding species including *Allocasuarina* spp. (Johnstone and Storr 1998). There are several records of this species on DBCA's Threatened and Priority Fauna Database, mostly from surveys around Cosmic Boy Mine, but also at Hatters Hill and Flying Fox Mine (Figure 12, Appendix 7). Although the Development Envelope is on the very eastern limits of the known range of this species, Carnaby's Black-Cockatoo potentially breeds in Salmon Gum woodlands, with potential foraging habitat in the surrounding eucalypt woodlands and shrublands.

The **Peregrine Falcon** is a widespread bird of prey that globally has a very large range and a very large population that appears to be secure (BirdLife International 2016). In Western Australia the population is secure, though this species may experience reductions at a local level due to human disturbance at nesting sites (Debus 1998). The Peregrine Falcon nests mainly on ledges on cliffs or rocky outcrops, and it may also use tall trees (Johnstone and Storr 1998). This species often takes advantage of man-made structures such as abandoned open pits or quarries. The Peregrine Falcon was recorded in the Development Envelope and Regional Survey Area during the fauna surveys (Figure 16), where it potentially nests in the existing open pits.

The **Rainbow Bee-eater** is a common species that migrates south in summer to breed. It is widespread in Western Australia and was recorded in both the Development Envelope and Regional Survey Area during the fauna surveys (Figure 16). The Rainbow Bee-eater is likely to forage anywhere over the Development Envelope, but is only likely to breed where there are lighter soils in which to burrow, potentially breeding alongside tracks or in open patches in shrublands or woodlands. As the Rainbow Bee-eater has an extremely large range and an extremely large population size that does not appear to be declining (BirdLife International 2017), it is unlikely that the Development Envelope is of particular significance for this species.

The **Fork-tailed Swift** is a non-breeding visitor to Australia between September and April (Boehm 1962). While it can be common further north, in southwest Australia this species is generally scarce (Johnstone and Storr 1998). The bird is primarily observed foraging for insects in proximity to cyclonic weather (Boehm 1962). This species has been recorded in the region on DBCA's Threatened and Priority Fauna Database (Appendix 7). Although a migratory species, the Fork-tailed Swift has a large range and a large population that appears to be stable (Birdlife International 2017). In Western Australia, the Fork-tailed Swift is largely aerial and it is unlikely that the Development Envelope is of particular significance for this species.

Conservation Significance 2

Inland Western Rosella *Platycercus icterotis xanthogenys*
This species is listed as Priority 4 by DBCA.

The **Inland Western Rosella** is endemic to southern Western Australia. The population of this species is thought to be declining in the western wheatbelt due to clearing, but stable in the western woodlands (Garnett and Crowley 2000). Although still a Priority species, the Inland Western Rosella was not listed in the 2010 Action Plan for Australian Birds as the population is considered too large and the decline too slow to be designated as Near Threatened (Garnett *et al*. 2011). This species occurs in eucalypt and Casuarina woodlands, nesting in tree hollows (Johnstone and Storr 1998). The Inland Western Rosella was commonly recorded in the Development Envelope and Regional Survey Area during the fauna surveys (Table 10, Figure 16), and is also known from records in the area (Figure 12, Appendix 7). Mallee woodlands and shrublands are unlikely to provide significant breeding habitat as they generally lack large trees that may contain hollows. Habitats with tall, hollow-bearing eucalypts, such as Salmon Gum, are potential breeding habitat. The Inland Western Rosella is likely to forage in both woodlands and shrublands.

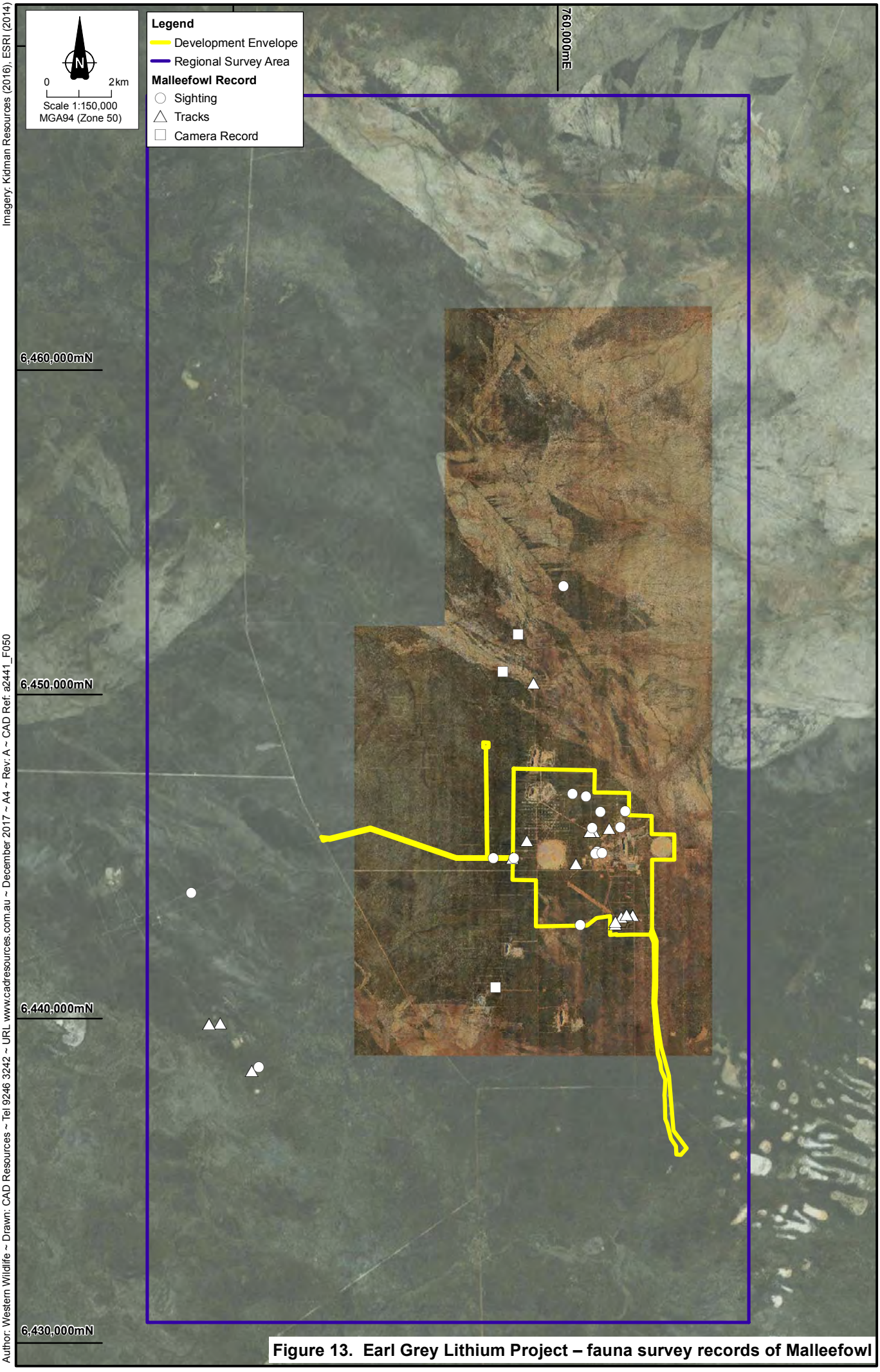
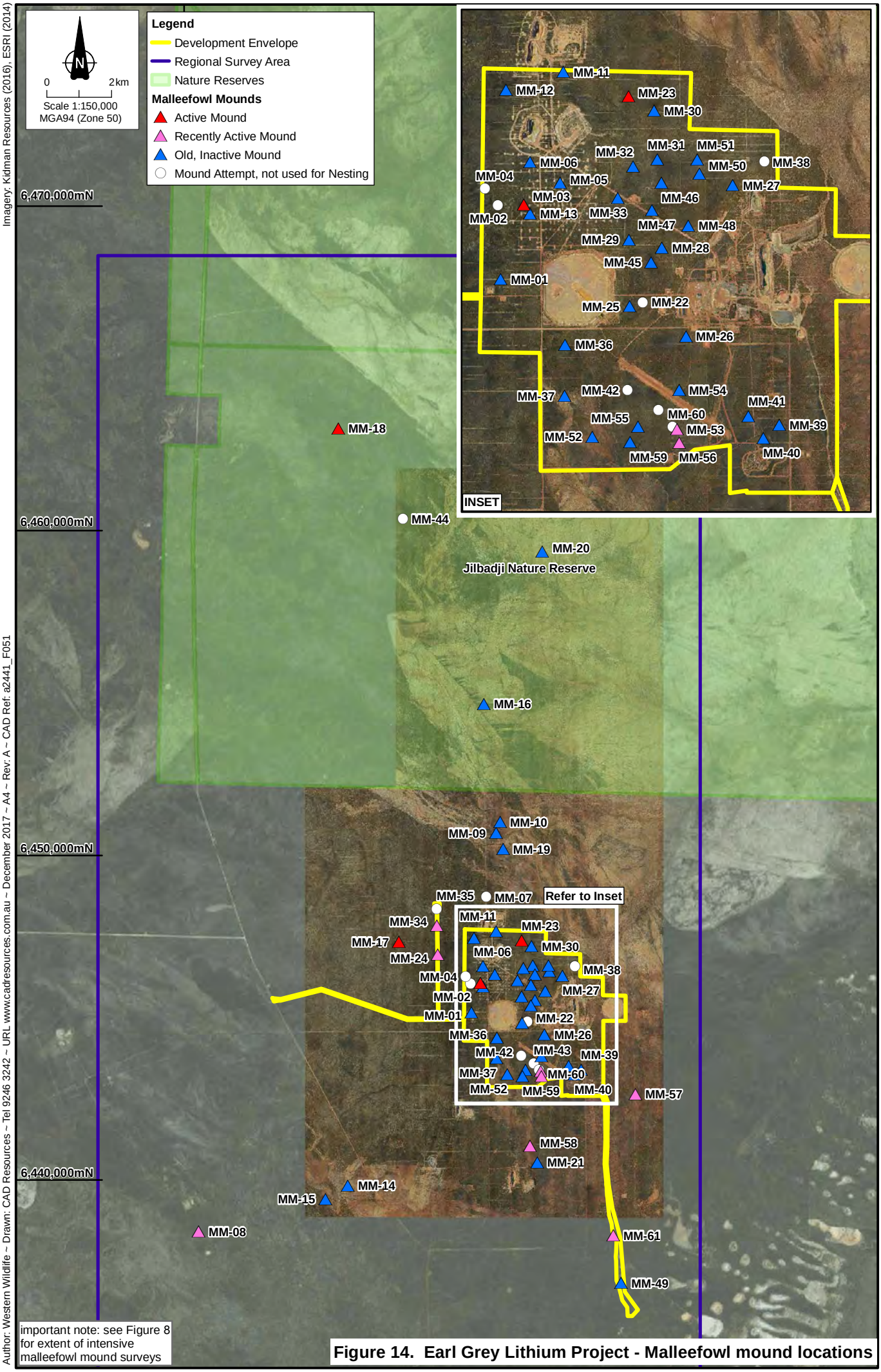


Figure 13. Earl Grey Lithium Project – fauna survey records of Malleefowl



important note: see Figure 8 for extent of intensive malleefowl mound surveys

Figure 14. Earl Grey Lithium Project - Malleefowl mound locations

Imagery: Kidman Resources (2016), ESRI (2014)

Author: Western Wildlife ~ Drawn: CAD Resources ~ Tel 9246 3242 ~ URL www.cadresources.com.au ~ December 2017 ~ A4 ~ Rev: A ~ CAD Ref: a2441_F051

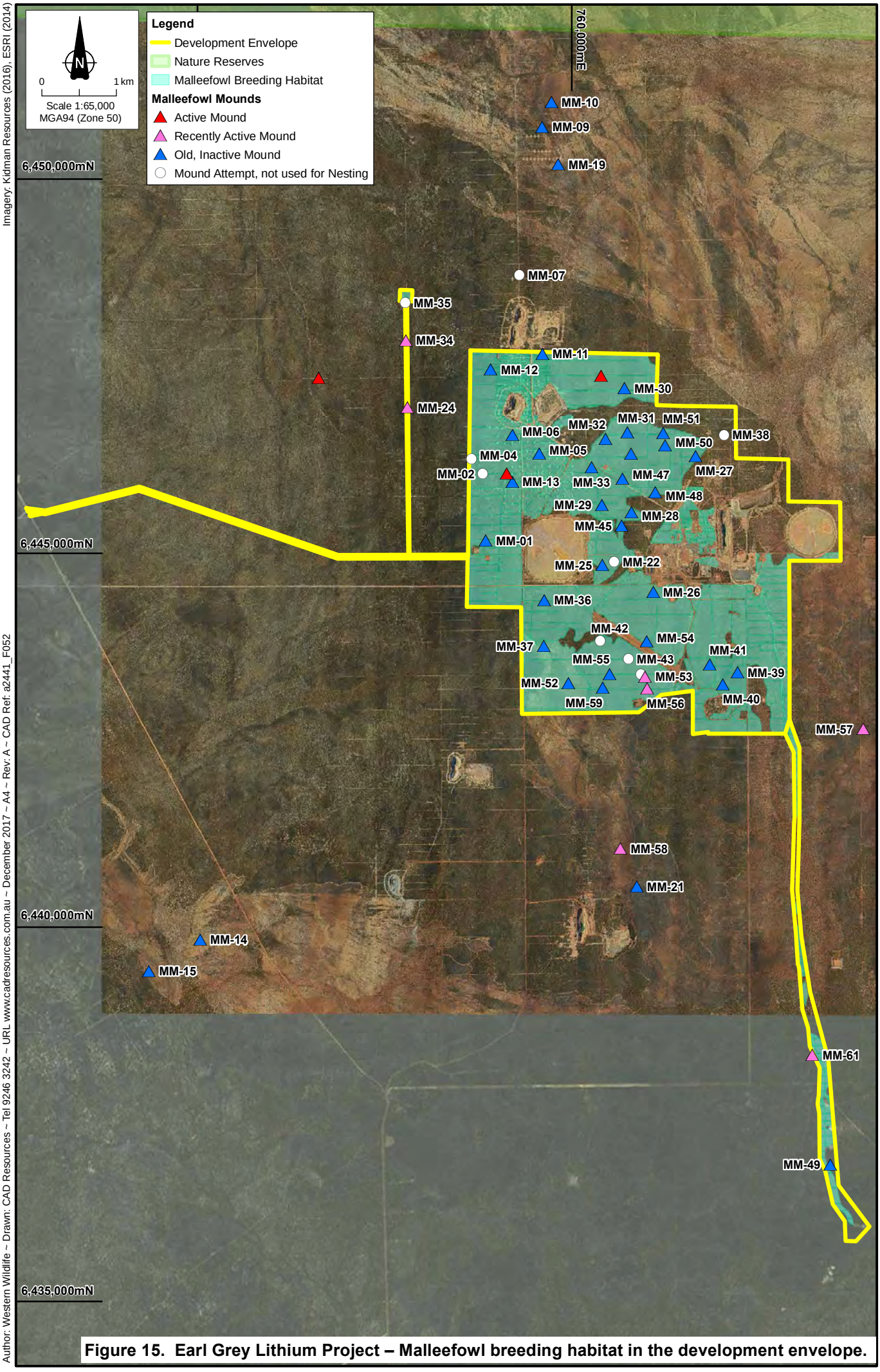


Figure 15. Earl Grey Lithium Project – Malleefowl breeding habitat in the development envelope.

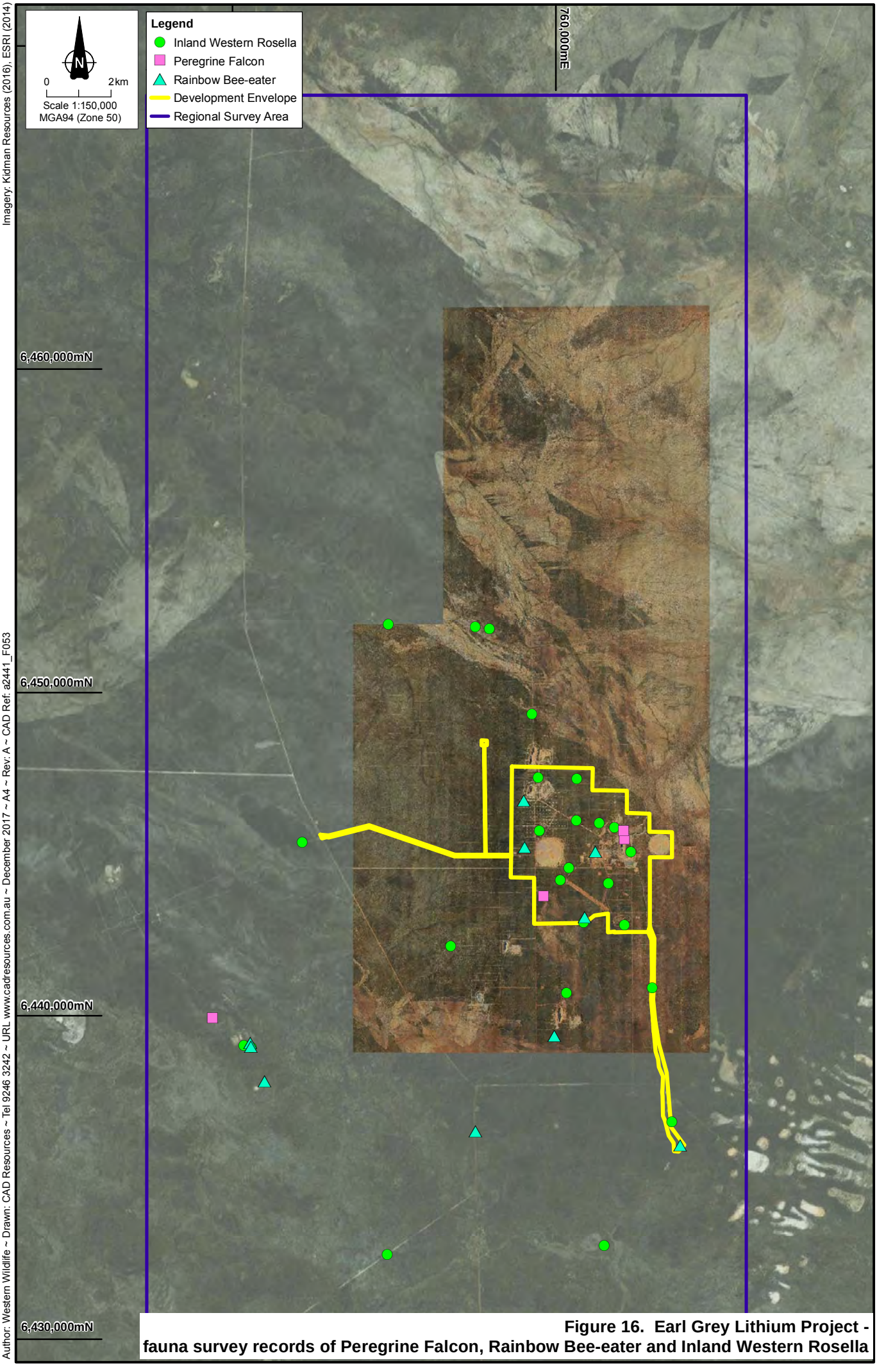


Figure 16. Earl Grey Lithium Project - fauna survey records of Peregrine Falcon, Rainbow Bee-eater and Inland Western Rosella

5.4 Mammals

There are 32 mammals with the potential to occur in the Development Envelope, of which 27 are native and five are introduced (Appendix 5D). A total of 19 mammals (16 native and three introduced) were recorded in the Development Envelope during the fauna surveys (Table 11, Appendix 5D). Unlike birds and reptiles, the mammal assemblage is primarily Bassian, with the distribution of most species extending into the southwest, rather than into the arid zone. Exceptions to this are some bat species and the Ooldea Dunnart (*Sminthopsis ooldea*), which have inland distributions.

Three dasyurid marsupials were recorded, with the Chuditch (*Dasyurus geoffroii*) particularly common at some sites in 2016 (Table 11, Figure 16). Note that Chuditch captures were specifically avoided during the October 2017 survey due to consideration of the breeding season. The Chuditch is further discussed in section 5.4.1. The Little Long-tailed Dunnart (*Sminthopsis dolichura*) and White-tailed Dunnart (*Sminthopsis granulipes*) were trapped in a both woodland and shrubland habitats (Plate 19). A further three dasyurids, the Southern Ningaui (*Ningaui yvonnae*), Gilbert's Dunnart (*Sminthopsis gilberti*) and Ooldea Dunnart (*Sminthopsis ooldea*) were caught about 10 km to the southwest in 2016 (Appendix 2C), and are also likely to occur in the Development Envelope.

The Western Pygmy Possum (*Cercartetus concinnus*) was recorded at most sites, and is likely to be common in woodlands and shrublands (Plate 19). This small arboreal mammal is highly mobile, moving to take advantage of seasonal flowering resources. The Western Pygmy Possum feeds on pollen, nectar and insects, and hence favours habitats with a dense, floristically diverse understorey (Van Dyck and Strahan 2008).

Plate 19. Western Pygmy Possum (left) and White-tailed Dunnart (right).

Two native mice species were recorded in the Development Envelope. The Ash-grey Mouse (*Pseudomys albocinereus*) was recorded on a single occasion. This species favours heaths and mallee shrublands on sandy soils, and is likely to occur in these habitats across the Development Envelope. Mitchell's Hopping Mouse (*Notomys mitchelli*) was recorded at four sites and on camera traps both within and outside the Development Envelope (Table 11, Appendix 10). Mitchell's Hopping Mouse is likely to be a common inhabitant of mallee woodlands and shrublands on sandy soils.

Many of the native species likely to occur are bats. Six species of bat were positively identified in the Development Envelope using call analysis (Table 11, Appendix 11). One further species, the Inland Broad-nosed Bat (*Scotorepens balstoni*) was recorded 10 km to the southwest in the in 2016 (Appendix 2C), and is also likely to occur. Some bat species, such as *Nyctophilus* spp., cannot be distinguished on call, so their presence could not be confirmed. In 2017, calls of *Vespadelus spp*. were also unable to be determined to species level, though one or the other occurred at all sites (Appendix 11). Bats are likely to forage throughout the Development Envelope, and during the day bats roost in tree hollows, crevices in mature trees and under loose bark.

Table 11. Mammal captures at each site and opportunistic records in the Development Envelope..

Mammal species	Site														Opportunistic
	Sampled Nov/Dec 2016						Sampled Oct 2017								
	1	2	3	4	5	6	13	14	15	16	17	18	19	20	
Echidnas															
Tachyglossus aculeatus															x
Dasyurid marsupials															
Dasyurus geoffroii (CS1)	1	6	4	3	4	12	1	C		C	C		C	C	
Sminthopsis dolichura	1	1	1					1							
Sminthopsis granulipes	5	1		8	2							3			
Kangaroos and wallabies															
Macropus fuliginosus															x
Macropus irma (CS2)														C	x
Pygmy possums															
Cercartetus concinnus	1	2	2	2		1	3	1			1	2	1	1	
Bats															
Austronomus australis	x	x	x	x	x	x		x	x	x	x		x	x	
Chalinolobus gouldii	x		x	x		x	x	x	x	x	x	x	x	x	
Chalinolobus morio							x	x	x		x				
Scotorepens balstoni															
Ozimops kitcheneri	x	x	x	x	x	x	x	x	x			x		x	
Vespadelus regulus				x	x	x									
Vespadelus baverstocki		x	x												
Native mice and rats															
Notomys mitchelli			5		6			C			2				
Pseudomys albocinereus					1										
Introduced Mammals															
Mus musculus	1														
Felis catus									x						x
Vulpes vulpes															x
Total species:	**8**	**7**	**8**	**7**	**7**	**6**	**5**	**8**	**5**	**3**	**6**	**4**	**4**	**6**	**5**

Note: X = observed opportunistically or a bat recorded on call. C = species observed on camera trap used in lieu of cage traps, October 2017. Numbers may include individuals captured more than once over successive days.

A single House Mouse (*Mus musculus*) was trapped, and four other feral animals were recorded opportunistically or on camera traps (Table 11, Appendices 8 and 10). Of the feral predators, foxes and dogs appeared relatively uncommon, with most records from camera traps in Van Uden and burnt areas in Jilbadji Nature Reserve (Figure 18, Appendix 10), suggesting these species may prefer open habitats. Cats were more widely distributed and occurred in a range of habitats, including dense shrublands (Figure 18, Appendix 10).

5.4.1 Mammals of Conservation Significance

There are four mammal species of conservation significance that have the potential to occur in the Development Envelope, two of CS1 and two of CS2. Each is listed and discussed below. Records of conservation significant mammals from this fauna survey are presented in Figure 17. There are four mammals listed on database searches in the area that have been omitted from Appendix 5D and the discussion below. The Bilby (*Macrotis lagotis*) and Numbat (*Myrmecobius fasciatus*) are locally extinct, represented only by historical records (Appendix 7). The Black-flanked Rock Wallaby (*Petrogale lateralis lateralis*) was recorded from South Yilgarn in 2007 (Appendix 7), but this species only inhabits rocky outcrops, a habitat absent from the Development Envelope. The Western Mouse (*Pseudomys occidentalis*) has not been recorded further north than Hatters Hill and Dragon Rocks Nature Reserve (Appendix 7), about 90 km south of the Development Envelope, and is not known to occur in the area.

Conservation Significance 1

Chuditch *Dasyurus geoffroii*
This species is listed under Schedule 3 (Vulnerable) of the WC Act and as Vulnerable under the EPBC Act.

Red-tailed Phascogale *Phascogale calura*
This species is listed under Schedule 6 (Conservation Dependent) of the WC Act and as Vulnerable under the EPBC Act.

The **Chuditch** used to occur across much of the continent, but is now restricted to the southwest of Western Australia. Although they used to occupy a range of habitats, the majority of Chuditch now occur in the Jarrah forest with some wheatbelt/goldfields populations in drier woodlands, heath and mallee shrublands (Van Dyck and Strahan 2008; Orrell and Morris 1994). In 1981, the Chuditch was not recorded in Jilbadji Nature Reserve during a comprehensive fauna survey and considered by Keighery *et al*. (1995) to be locally extinct or at least very rare in the region. Up until recently, there were only occasional records of the Chuditch from the wheatbelt and goldfields, with this population estimated at 2,000 mature individuals (Woinarski *et al*. 2014, DoEE 2016). However, Chuditch have been recorded recently in Forrestania on DBCA's Threatened and Priority Fauna Database, mostly in association with the Cosmic Boy Mine (Figure 12, Appendix 7).

In 2009, Chuditch at the Cosmic Boy Mine were subject to a study of their spatial and dietary requirements (Rayner *et al*. 2011). This included radio-tracking two females and four males to determine home range size and daytime refuge sites, trapping along transects with traps 200 m apart to determine population density and scat analysis to determine diet. As the Cosmic Boy Mine is within the same bioregion, situated about 55km to the south, the results are likely to be relevant to the Earl Grey Lithium Project.

Chuditch were recorded both in the Development Envelope and the Regional Survey Area (Figure 17 and 18). Note that the distribution of Chuditch records in Figures 17 and 18 are influenced by sampling effort.

Overall, Chuditch were recorded on 24 of the 42 camera traps set in the Development Envelope and 29 of the 94 camera traps in the Regional Survey Area (Plate 20, Figure 18, Appendix 10). As Chuditch are highly mobile, it is likely that the same individual may be recorded across more than one camera trap. However, it does indicate that Chuditch are distributed across a large area, though notably unrecorded from parts of the Regional Survey Area (Figure 18). It is difficult to ascertain why Chuditch remain unrecorded in some areas, though it may be the effects of fire, as there are large areas that are recovering after recent fires, or the presence of feral predators, or some combination of the two.

Plate 20. Chuditch recorded on camera traps W7-0 (top left), N3-0 (top right), W14-5 (bottom left) and N1-3 (bottom right).

In the medium-term, fire is thought to act in a similar manner to clearing, in that it homogenises the habitat, destroys den logs, removes protective cover and reduces prey biomass, particularly large invertebrates (DEC 2012). Few individuals were trapped at either Site 9 (recently burnt) or Site 7 (small unburnt patch surrounded by recently burnt area), and all three were young (Table 12). In addition, proportionally more Chuditch were recorded on camera traps in unburnt habitats than burnt ones (Table 13), though it should be noted that fewer camera traps were set in burnt habitats. It may be that while recently burnt areas are not generally suitable for adult Chuditch, young will disperse through them in search of their own home range.

The Cosmic Boy Mine Chuditch population was found to have a density nearly three times lower than that in the Jarrah forest, of about 0.039 individuals/km^2 (Rayner *et al*. 2011, Woinarski *et al*. 2014). This would equate to about one individual per 2,564 ha or less than one individual in the entire 1,993 ha Development Envelope. Although the cage trap layout in this survey was not designed to measure population density, the findings clearly demonstrate a higher population density than this, with 18 individuals (of which ten were adults) captured in a relatively small area across Survey Area A, Survey Area B and Prince of Wales (Figure 17, Table 12). In 2017, the North and South transects were established using traps 200 m apart, as at Cosmic Boy. On these transects ten Chuditch were trapped, of which four were adults.

Table 12. Chuditch caught in the Development Envelope and Regional Survey Area.

Chuditch			Number of captures at each site*											Distance moved between trap sites (m)
			Development envelope							Regional				
Individual	Age	Sex	1	2	3	4	5	6	13	7	9	North	South	
1	Adult	F		1										-
2	Adult	F		2										-
3	Adult	F	1				2	1						803 + 803 + 806 (Sites 5 → 1 → 5 → 6)
4	Young	F						2						-
5	Young	F						2		1				3,170 (Site 6 → 7)
6	Young	F									1			-
7	Adult	M		1	1			1						685 + 2,160 (Sites 2 → 3 → 6)
8	Young	M				2								-
9	Young	M				1		1						650 (Site 4 → 6)
10	Young	M						2						-
11	Adult	M						1						-
12	Adult	M			2									-
13	Adult	M						2						-
14	Adult	F					1							-
15	Young	M		1	1									685 (Site 3 → 2)
16	Adult	M					1							-
17	Adult	F		1										-
18	Young	F								1				-
19	Adult	F							1					-
20	Young	M											1	-
21	Adult	F										2		600 (Site N20 → N17)
22	Young	M											2	400 (Site S21 → S19)
23	Young	F										1		-
24	Adult	F										1		-
25	Adult	F										2		2,400 (Site N35 → N47)
26	Young	M										1		-
27	Young	F										1		-
28	Young	M										1		-
29	Young	M											1	-
Total captures:			**1**	**6**	**4**	**3**	**4**	**12**	**1**	**2**	**1**	**9**	**4**	
Total individuals:			**1**	**5**	**3**	**2**	**3**	**8**	**1**	**2**	**0**	**7**	**3**	

* For sites 1-6, 8 and 9: two cage traps per site, open for eight nights. For site 13: accidental capture in Elliott trap. For sites 'north' and 'south', 50 cage traps per site open for four nights.

Excluding captures in Elliott traps, trap success in 2016 was 16% (31 captures in 192 cage trap-nights) and in 2017, trap success on the North and South transects in the Regional Survey Area (Figure 9 and 17) was 3% (13 captures in 400 cage trap-nights). This is much higher than the average trap success of 0.8% obtained at Cosmic Boy Mine (Rayner *et al*. 2011).

The low population density at the Cosmic Boy Mine was attributed to the lower rainfall (and therefore lower productivity) in the region compared to Jarrah forest, and to a lesser extent, the presence of feral predators. Annual rainfall at Mt Holland is likely to be similar, or even lower, than that at Cosmic Boy Mine, so it is uncertain why the population density of Chuditch at Mt Holland appears higher. However, at Mt Holland Chuditch appeared more common than feral predators, with the incidence of Chuditch on camera traps much higher at 39.0%, compared to feral predators such as foxes (3.7%), cats (8.1%) and dogs (1.5%), despite the fact that the bait used in front of the cameras should be attractive to feral predators. Chuditch populations are known to increase in response to fox control (Woinarski *et al*. 2014). It may be that a combination of low numbers of foxes and areas of dense unburnt habitat that provide cover from foxes and other feral predators, allows for higher density Chuditch populations. However, this hypothesis remains untested.

Chuditch are highly mobile, and typically have large home-ranges (Woinarski *et al*. 2014). In the study at Cosmic Boy Mine, the average distance travelled between consecutive refuge sites was 500 m for females and 3.3 km for males, with the maximum distance travelled 1.5 km for females and 4.5 - 12 km for males (Rayner *et al*. 2011). Males were found to occur across large core home ranges averaging 2,125 ha which overlapped with other males and females. Females inhabited a smaller core home range of 189 ha (Rayner *et al*. 2011). The core home range describes the area contained by den locations, and the actual area over which individuals can range is much higher (DEC 2012).

Table 13. Number of Chuditch recorded on camera traps in each habitat type.

Habitat		Number of camera traps and percentage with Chuditch recorded		
		Burnt	**Unburnt**	**Totals**
Open woodland	Total number of traps:	7	16	23
	Traps with Chuditch:	1 (14%)	4 (25%)	5 (22%)
Mallee woodland	Total number of traps:	9	60	69
	Traps with Chuditch:	4 (44%)	28 (47%)	32 (46%)
Shrubland	Total number of traps:	4	40	44
	Traps with Chuditch:	-	15 (37%)	15 (34%)
All habitats	**Total number of traps:**	**20**	**116**	**136**
	Traps with Chuditch:	**5 (25%)**	**47 (38%)**	**52 (38%)**

Although home range was not determined, eight of the Chuditch in this study were recorded at more than one site. Straight-line distances between traps ranged from 400 m to 3.17 km (Table 12), the latter being a young female who travelled the distance in a single night, indicative of dispersal. Adults caught across several sites indicate that these sites are within their home range, if not their core home range. It is possible, given the large number of Chuditch recorded, that Chuditch at Mt Holland have smaller core home ranges, perhaps as low as those in Jarrah forest; 410 ha for males and 90 ha for females (Serena and Soderquist 1989).

The Chuditch was recorded in a range of habitats across the Development Envelope and Regional Survey Area, including mallee woodlands, open woodlands and shrublands (Table 13). At Cosmic Boy Mine, Chuditch mostly found daytime shelter in hollow logs, rock crevices and old White-browed Babbler (*Pomatostomus superciliosus*) nests, with some usage of burrows, timber/ concrete waste piles and pipes (Rayner *et al*. 2011). In the Development Envelope Chuditch are likely to use similar refuge sites. Though the availability of hollow logs is low in mallee woodland and shrublands compared to areas of open woodland, there are patches of open woodland in the region that are likely to provide shelter for this wide-ranging species. Mt Holland lacks rocky outcrops, but rock crevices are likely to be available in some abandonment bund walls (Plate 21) and other man-made structures. As Chuditch use up to 180 different dens sites within their core home range (Woinarski *et al*. 2014), no particular den site is likely to be significant.

The current major threats to Chuditch are land clearing (including fragmentation of continuous habitat), predation by and competition with feral predators (foxes and cats) and deliberate and accidental mortality from poisoning, trapping, illegal shooting or road kills (DEC 2012).

Plate 21. Abandonment bund on Bounty North open pit - potential den sites for Chuditch.

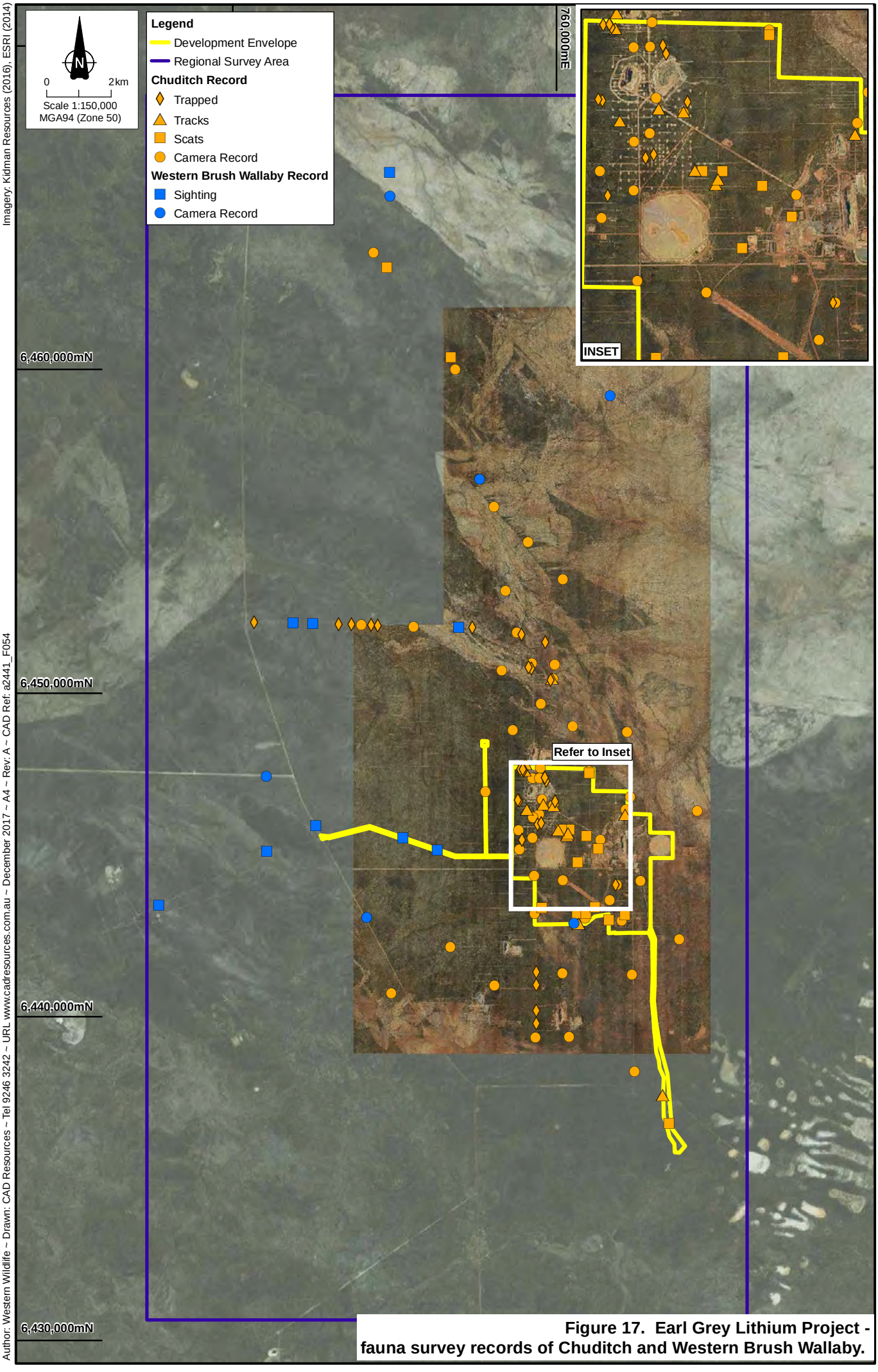


Figure 17. Earl Grey Lithium Project - fauna survey records of Chuditch and Western Brush Wallaby.

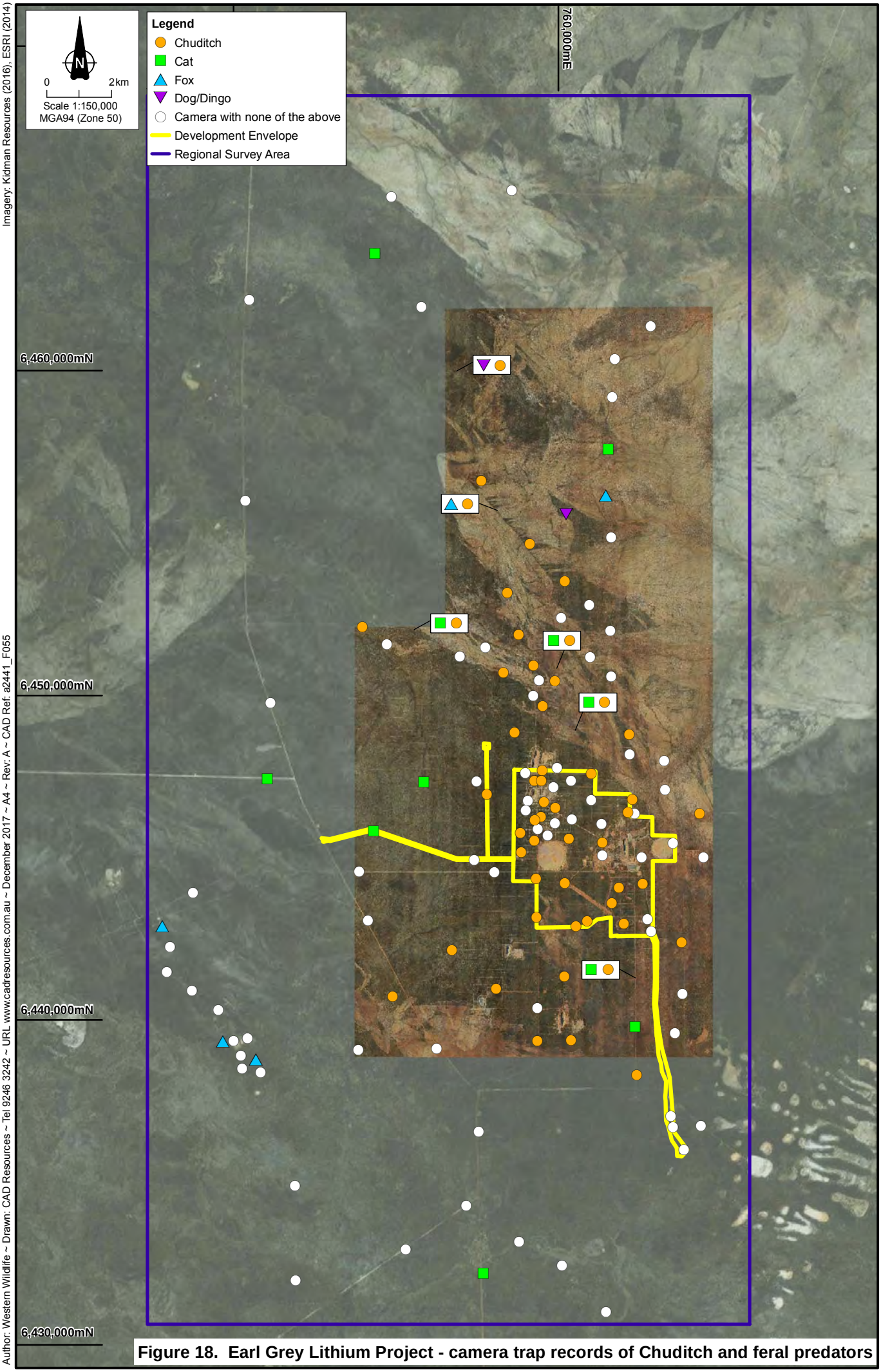


Figure 18. Earl Grey Lithium Project - camera trap records of Chuditch and feral predators

The **Red-tailed Phascogale** has declined in numbers and in range, and is generally restricted to woodlands. It favours Wandoo or York Gum woodlands with Rock Sheoak (*Allocasuarina huegeliana*), but it also is known to occur in shrublands and mosaics of woodlands and shrublands (Woinarski *et al*. 2014). There is a record of this species from 10 km south of Marvel Loch in 1998 on DBCA's Threatened and Priority Fauna Database (Figure 12, Appendix 7), about 50 km north of the Development Envelope, with the remaining records from granite outcrops. Most of records of the Red-tailed Phascogale on NatureMap (DPAW 2007-) are to the west of the Development Envelope. Though the Red-tailed Phascogale may potentially occur in the Development Envelope, it is considered that the likelihood is low. Although there are shrublands with *Allocasuarina*, these generally do not occur in conjunction with the hollow-bearing trees that this species shelters in, and no phascogales were caught despite trapping with Elliott traps in this habitat.

Conservation Significance 2

Western Brush Wallaby *Macropus irma*
This species is listed as Priority 4 by DBCA.

Central Long-eared Bat *Nyctophilus major tor*
This species is listed as Priority 4 by DBCA.

The **Western Brush Wallaby** is endemic to the southwest of Western Australia and occurs in open forests or woodlands (Van Dyck and Strahan 2008). The home-range size of this species has been estimated at about 9.9 ha for males and 5.3 ha for females (Bamford and Bamford 1999), so the Development Envelope potentially supports many individuals. There are several records of the Western Brush Wallaby in Forrestania in 1998, 2005 and 2006, as well as a record from Jilbadji Nature Reserve in 1999 on DBCA's Threatened and Priority Fauna Database (Figure 12, Appendix 7). This species was observed opportunistically and on camera traps (Plate 22) both in the Development Envelope and Regional Survey Area (Figure 17, Appendices 8 and 10). The Western Brush Wallaby is likely to occur in shrubland and woodland habitats of the Development Envelope.

Plate 22. Western Brush Wallaby (*Macropus irma*) recorded at camera W01-4.

The **Central Long-eared Bat** is widespread across the arid south of Australia, and though thought to have a population of substantially more than 10,000 individuals, the reliability of this estimate is low (Woinarski *et al*. 2014). Although only known from 15 localities in Western Australia, it is considered locally common in the Coolgardie Bioregion (Duncan *et al*. 1999). It occurs in eucalypt woodlands with a tall shrub understorey and around granite outcrops, roosting beneath bark, in tree crevices or in the foliage of trees (Duncan *et al*. 1999, Van Dyck and Strahan 2008). Current threats to this species are inferred, and include habitat loss and fragmentation or inappropriate fire regimes leading to a loss of habitat and/or roost sites (Woinarski *et al*. 2014). The Central Long-eared Bat is known from Jilbadji Nature Reserve (Duncan *et al*. 1999) and may occur in the Salmon Gum and mallee woodlands of the Development Envelope.

5.5 Summary of Conservation Significant Fauna

Thirteen species of conservation significance have the potential to occur in the Development Envelope. These are summarised in Table 14.

According to database records and published information, the Development Envelope may support seven vertebrate species of Conservation Significance 1:

- Malleefowl (*Leipoa ocellata*)
- Peregrine Falcon (*Falco peregrinus*)
- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris)*
- Fork-tailed Swift (*Apus pacificus*)
- Rainbow Bee-eater *(Merops ornatus*)
- Chuditch (*Dasyurus geoffroii*)
- Red-tailed Phascogale (*Phascogale calura*)

Of these, the Malleefowl, Peregrine Falcon, Rainbow Bee-eater and Chuditch were recorded during the fauna survey.

The Malleefowl was widely recorded (including active mounds and sightings of birds) and is likely to forage in most habitats but breed in shrublands or woodlands on gravelly sands. The Chuditch was also commonly recorded, occurring in most habitats and at high densities compared to Chuditch elsewhere in the bioregion. For both species habitat loss, habitat fragmentation and feral predators are recognized as current threats. Large-scale fires are also likely to impact these species, resulting in loss of den sites and prey for Chuditch, loss of leaf-litter for Malleefowl to build their mounds and invasion of feral predators into the open habitats created by fire.

As the Chuditch and Malleefowl have substantial populations in the Development Envelope and are of high conservation significance (both listed as Vulnerable under the EPBC Act), they are key species to protect.

Both the Rainbow Bee-eater and Fork-tailed Swift are migratory species. However, their populations are large and stable, so changes to the Development Envelope are unlikely to have significant impacts on these species. The Peregrine Falcon is likely to nest in the open pits and forage in open areas. This species is only likely to be locally impacted if a nest site were disturbed, as its population is large and secure.

Carnaby's Black-Cockatoo is on the eastern limit of it range in the area. Although it may occur in the woodlands and shrublands of the Development Envelope, the presence of this species remains unconfirmed. If present, open woodlands (particularly of Salmon Gum) are potential breeding habitat and would be of high significance. Surrounding areas of woodlands and shrublands are potentially foraging habitat. The Red-tailed Phascogale is relatively unlikely to be present due to lack of its favoured habitat.

Database records and published information indicate that the Development Envelope may also support five species of Conservation Significance 2:

- Lake Cronin Snake (*Paroplocephalus atriceps*)
- Woma (*Aspidites ramsayi*)
- Inland Western Rosella (*Platycercus icterotis xanthogenys*)
- Western Brush Wallaby (*Macropus irma*)
- Central Long-eared Bat (*Nyctophilus major tor*)

Of these, the Inland Western Rosella and Western Brush Wallaby were recorded during the fauna survey. Although not recorded, both the Central Long-eared Bat and Lake Cronin Snake are moderately likely to occur as the habitats in the Development Envelope are suitable and the area is within the known range of these species. The Woma is likely to be locally extinct in the region.

The one species of Conservation Significance 3 that may occur is the:

- Spotted Knob-tail Gecko (*Nephrurus stellatus*)

This species was recorded in the Regional Survey Area during the fauna survey.

Table 14. Summary of conservation significant (CS) fauna.

Key: Mig = Migratory, En = Endangered, Vu = Vulnerable, S = Schedule, P = Priority

Species	Status				Records	Habitat preferences	Likely habitat use in the Development Envelope						Likelihood of occurrence
							Mallee woodland			Salmon Gum woodland	Shrubland		
	Level of Conservation Significance	EPBC Act	WC Act	DBCA Priority			On sands	On clay-loams	On sandy clays		On flats	On laterite rises	
REPTILES													
Paroplocephalus atriceps **Lake Cronin Snake**	CS2			P3	Nearby at Lake Cronin & Jilbadji Nature Reserve (Appendix 8)	Woodlands & shrublands.	✓	✓	✓	✓	✓	✓	Moderate
Aspidites ramsayi **Woma (southwest popn)**	CS2			P1	Historical records to the north at Marvel Loch and Yellowdine (Appendix 8)	Sandplains.	✓				✓		Low
Nephrurus stellatus **Spotted Knob-tail Gecko**	CS3				Recorded in Regional Survey Area.	Mallee woodlands on sandplains.	✓				✓		High
BIRDS													
Leipoa ocellata **Malleefowl**	CS1	Vu	S3		Active and recently active mounds recorded in the Development Envelope & Regional Survey Area. Birds sighted in the Development Envelope and Regional Survey Area.	Acacia thickets, mallee woodlands and shrublands with leaf litter. Also forages in adjacent habitats.	✓	✓	✓	✓	✓	✓	Known to occur
Calyptorhynchus latirostris **Carnaby's Black-Cockatoo**	CS1	En	S2		Nearby at Cosmic Boy and Flying Fox Mines (Appendix 8).	Forages in eucalypt woodlands and proteaceous vegetation, breeds in large eucalypt hollows, particularly Salmon Gum.	✓	✓	✓	✓	✓	✓	Low

Table 14. (cont.)

Species	Status				Records	Habitat preferences	Likely habitat use in the Development Envelope						Likelihood of occurrence
							Mallee woodland			Salmon Gum woodland	Shrubland		
	Level of Conservation Significance	EPBC Act	WC Act	DBCA Priority			On sands	On clay-loams	On sandy clays		On flats	On laterite rises	
Falco peregrinus **Peregrine Falcon**	CS1		S7		Recorded in Development Envelope & Regional Survey Area.	Variety of habitats, nests in tall trees, cliffs, open pits.	✓	✓	✓	✓	✓	✓	Known to occur
Apus pacificus **Fork-tailed Swift**	CS1	Mig	S5		Recorded in Forrestiana (Appendix 8).	Overfly any habitat.	✓	✓	✓	✓	✓	✓	Moderate
Merops ornatus **Rainbow Bee-eater**	CS1		S5		Recorded in Development Envelope & Regional Survey Area.	Forages in a variety of habitats, breeds in sandy areas.	✓	✓	✓	✓	✓	✓	Known to occur
Platycercus icterotis xanthogenys **Inland Western Rosella**	CS2			P4	Recorded in Development Envelope & Regional Survey Area.	Eucalypt woodlands. Nests in tree hollows.	✓	✓	✓	✓	✓	✓	Known to occur
MAMMALS													
Dasyurus geoffroyii **Chuditch**	CS1	Vu	S2		Recorded in Development Envelope & Regional Survey Area.	Forests, woodlands & shrublands, denning in hollow logs, babbler nests, burrows or rock crevices.	✓	✓	✓	✓	✓	✓	Known to occur
Phascogale calura **Red-tailed Phascogale**	CS1	En	S6		Nearby (Appendix 8).	Wandoo or York Gum woodlands with a Rock Sheoak understorey. Sometimes other shrublands or woodlands.					✓	✓	Low

Table 14. (cont.)

Species	Status				Records	Habitat preferences	Likely habitat use in the Development Envelope						Likelihood of occurrence
							Mallee woodland			Salmon Gum woodland	Shrubland		
	Level of Conservation Significance	EPBC Act	WC Act	DBCA Priority			On sands	On clay-loams	On sandy clays		On flats	On laterite rises	
Macropus irma **Western Brush Wallaby**	CS2			P4	Recorded in Development Envelope & Regional Survey Area.	Woodlands & shrublands, sheltering in dense vegetation.	✓	✓	✓		✓	✓	Known to occur
Nyctophilus major tor **Central Long-eared Bat**	CS2			P4	Known from Jilbadji Nature Reserve (Duncan *et al.* 1999)	Woodlands, roosting in tree hollows and crevices.	✓	✓	✓	✓			Moderate

6. Potential Impacts on Fauna

6.1 Potential Impacts

Potential impacts may be on conservation significant fauna species, or on faunal assemblages in general. The following are a list of generic impacts that are associated with mining and mining infrastructure:

- Direct mortality of fauna
- Habitat loss
- Increased habitat fragmentation
- Increased disturbance to fauna (e.g. noise and light)
- Increased feral fauna
- Changed fire regimes

These are discussed in the sections below, along with potential impacts on conservation significant fauna. The potential impacts are likely to be small on a regional scale, as only a small area of fauna habitat is likely to be disturbed within a very large tract of intact habitat. On a local scale, impacts will be high within the mine footprint, as most fauna habitats will be cleared within this area. Impacts on adjacent habitats may be minimised by implementing mitigation strategies during the planning and operation of the mine. Recommendations on minimising potential impacts have been given below.

6.1.1 Direct Mortality of Fauna

Some direct mortality of fauna is unavoidable, particularly when clearing vegetation. Mortalities can be minimised by restricting vegetation disturbance to the minimum possible. Fauna most at risk of direct mortality are those with limited mobility, such as reptiles, frogs, small mammals, dependent young or nocturnal species. Avoiding clearing during late winter and spring (where possible), will aid in minimising mortality of young birds in nests. The Rainbow Bee-eater (CS1) may nest along tracks in shrublands and mallee woodlands on sand, and young birds in burrows would be vulnerable to direct mortality.

When in operation, vehicles and heavy machinery may cause fauna mortalities, though many species are likely to avoid human activity. Road mortalities are undesirable both from a fauna welfare point of view as well as driver safety. Reptile species that bask on roads, larger mammals (such as kangaroos) and birds that forage on road edges are particularly at risk. In general, road mortalities are unlikely to negatively impact the conservation status of a fauna species, unless the fauna population was small or otherwise fragile. However, conservation significant species that are at risk of road mortalities include the Malleefowl (CS1), Chuditch (CS1), Lake Cronin Snake (CS2) and Western Brush Wallaby (CS2). The Malleefowl is at risk as it is a large bird that forages on the ground, and if the male is attending an active mound near a road, he may often be on or near the road. Chuditch may come into contact with vehicles when attracted to food waste in camps, foraging along roads or eating other road kill (DEC 2012). They may also become inadvertently trapped in steep-sided containers (e.g. skips or large bins) when in search of food, and these should be kept securely lidded to avoid mortalities. Many records of the Lake Cronin Snake are from inadvertent mortalities on mine sites in the area (Bush *et al*. 2007).

Uncapped drill holes are a source of direct mortality for reptiles and small mammals. These species may be attracted to the drill hole as shelter, but perish when they are unable to climb out. Conservation significant species that may be potentially affected are the Chuditch (CS1), Lake Cronin Snake (CS2) and Spotted Knob-tail (CS3).

6.1.2 Habitat Loss

Mining will result in habitat loss, though this can be minimised by situating infrastructure on existing cleared or disturbed areas. Any habitat loss in the Development Envelope is likely to include loss of habitat for conservation significant fauna, as many species occur in all the habitats present.

Malleefowl (CS1) breeding habitat in the Development Envelope is patchy, often occurring as small areas of dense shrubland on gravelly sands within a matrix of more open mallee woodlands. Two active and four recently active mounds were recorded in the Development Envelope. It is likely that other active mounds are present in the Regional Survey Area and that the habitats surrounding the mounds are used for foraging, as these birds range over a large area. It is unlikely that Malleefowl currently breed in recently burnt parts of the Development Envelope, as they generally don't breed until at least six but more usually up to 17 years after extensive fires (Benshemesh 2007). However, these areas will return to breeding habitat in the future, at which time birds may return to inactive mounds or construct new mounds. Protecting active and recently active mounds and minimising clearing will minimise any long-term impact on Malleefowl breeding habitat.

Carnaby's Black-Cockatoo (CS1) breeds in large hollows in eucalypts, which are generally absent from the mallee woodlands and shrublands in the Development Envelope. Salmon Gum woodlands are potential breeding habitat. However, Carnaby's Black-Cockatoo is on the far eastern limit of its range in the area and is uncertain whether it is present at all, let alone as a breeding species. The Inland Western Rosella (CS2) and Central Long-eared Bat (CS2) also breed in tree hollows, albeit smaller ones than cockatoos. Retaining large hollow-bearing eucalypts protects breeding and roosting habitat for many fauna species as well as conservation significant species. If Carnaby's Black-Cockatoo was found to be nesting, these areas would be highly significant. Areas of foraging habitat (eucalypt woodlands and proteaceous shrublands) in close proximity to breeding areas are also significant, though less so in a relatively continuous area of habitat compared with highly fragmented habitats (e.g. in the wheatbelt) where foraging resources are scarce.

Chuditch (CS1) are likely to occur throughout the Development Envelope and in all habitats, though they may be temporarily absent in areas that have been recently and extensively burnt. Individual Chuditch use many denning sites, so are unlikely to be significantly impacted by the loss of a particular den site. All Chuditch breeding or foraging habitat in the area is considered 'critical habitat' for this species, and clearing, including the creation of new gaps in an otherwise homogenous habitat area, is regarded as a current threat to this species (DEC 2012).

6.1.3 Habitat Fragmentation

In an un-fragmented landscape fauna are free to move, allowing gene-flow between populations and the capacity to move to take advantage of dispersed or temporary resources such as food or nesting sites. Habitat fragmentation occurs when a large contiguous area of native vegetation is broken up into smaller patches. These patches can be large or small, and can exhibit varying degrees of linkage. Fauna are better able to persist in a modified landscape when vegetation patches are large and there are more links between patches. The Development Envelope is within the Great Western Woodlands, a landscape of generally continuous woodlands and shrublands, and the relative intactness of these habitats is a key value of the area.

As the habitats in the region are continuous, rather than fragmented (as they are in the wheatbelt region), the potential impacts of habitat fragmentation are likely to be local, as the mining development is not likely to significantly increase habitat fragmentation in the region. Fauna will still be able to move through the landscape on all sides of the mining development. Locally, habitat fragmentation potentially impacts fauna by exacerbating other threats, particularly feral predators, by providing access into habitats that were previously dense and difficult to traverse. To some extent, these impacts are already present in the Development Envelope due to the presence of roads and existing exploration tracks.

6.1.4 Increased Disturbance to Fauna and Fauna Habitats

Disturbance to fauna can be due to noise, movement or light, and includes examples such as the use of heavy machinery, workshop noises, road lighting, and the presence of people or vehicles. Disturbance to fauna may result in fauna avoiding an area, e.g. due to excessive noise, and therefore being unable to utilise an area of available habitat. Fauna may also experience increased stress and/or expend extra energy in avoidance behaviours. Opening new areas for exploration and mining also creates the potential for degradation of habitats adjacent to operations. Habitat degradation can occur when feral predators are allowed increased access due to the creation of open patches within the habitat (as discussed in the section below), or when weeds proliferate on habitat edges.

Some disturbance is inevitable, but can be reduced by minimising work at night that requires lights (where practicable) and preventing weed invasion.

6.1.5 Increased Feral Fauna

Feral fauna, particularly feral predators such as the fox, cat and wild dogs, can negatively impact native species. Predation by feral cats and foxes are both recognised as key threatening processes under the EPBC Act. An increase in human activity can lead to an increase in feral predators, as these species potentially thrive in modified landscapes with additional water sources, food from rubbish tips and increased access in the form of tracks and roads. Conservation significant species that are likely to be negatively impacted by increased feral predators include the Malleefowl (CS1), including chicks and eggs, and Chuditch (CS1).

6.1.6 Changed Fire Regimes

The impact of fire on many fauna species is not well understood, and some fire, particularly small, cool burns creating a mosaic of different fire ages, can be beneficial. However, it is generally accepted that large, unplanned hot bushfires are generally undesirable, as they substantially change fauna habitats on a large scale. Conservation significant fauna such as the Malleefowl (CS1) and Chuditch (CS1) are negatively impacted by fire. Mining activities potentially cause accidental fires, though this risk is generally low and unplanned fires can be caused by road accidents, lightning or arson.

6.2 Recommendations

The following recommendations are general in nature. They are provided with the aim of minimising or mitigating impacts on native fauna during the planning phase, particularly any impacts on the Malleefowl and Chuditch. The Malleefowl and Chuditch are both listed as Vulnerable under the EPBC Act. Both species have been recorded in the Development Envelope and are likely to occur in most habitats.

- *Minimise habitat loss in the planning phase by using existing cleared or disturbed lands and minimising the mine footprint.*
- *Protect active Malleefowl mounds from disturbance.*
- *Where practicable, restrict vehicle speed limits on roads adjacent to active Malleefowl mounds.*
- *Protect mature eucalypt trees with hollows where practicable.*
- *Where possible, avoid clearing during late winter and spring, to avoid mortalities of young birds in nests.*

- *Appropriately dispose of food waste so it does not attract Chuditch or feral predators (foxes and cats). Where containers (e.g. skip bins) are used, ensure they are securely lidded to avoid Chuditch being fatally trapped.*

- *Prohibit feeding of any fauna on site.*

- *Ensure all drill holes are securely capped to prevent fauna becoming fatally trapped.*

- *Where appropriate, carry out re-vegetation once mining activities are complete, to restore fauna habitats.*

- *Ensure that site inductions include adequate environmental education for all personnel involved. This includes ensuring personnel can recognise and report species of conservation significance such as the Malleefowl.*

- *Where practicable, reduce disturbance to nocturnal fauna by minimising work at night.*

- *Prevent the introduction of weeds by washing down muddy vehicles and machinery prior to use on site.*

- *Consider control of foxes and feral cats in and around the Development Envelope.*

- *Implement a fire management plan with the aim of protecting areas of long-unburnt habitat.*

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8. Appendices

Appendix 1. Weather Data October 2016 – November 2017

Field trips (including time with cameras deployed in the field) shaded in grey. Data from Bureau of Meteorology (2017), Hyden and Southern Cross Airport weather stations.

Date	Hyden			Southern Cross			Date	Hyden			Southern Cross		
	Temp (°C)		Rain (mm)	Temp (°C)		Rain (mm)		Temp (°C)		Rain (mm)	Temp (°C)		Rain (mm)
	Min	Max		Min	Max			Min	Max		Min	Max	
Oct 2016							Nov 2016						
1	10.4	16	0	9.4	20.4	0	1	7.6	26.5	0	9.1	27.1	0
2	3.6	17.8	3	3.9	18.3	0.6	2	8.2	32.7	0	11.2	32	0
3	4.1	21.8	0.1	1.4	21.8	0	3	8.8	34.3	0	10.5	36.3	0
4	5.7	22.4	0	5.2	25	0	4	13.1		0	14.4	33.5	0
5	4.2	23	0	4.1	30.6	0	5			0	15.3	37.9	0
6	6.4	25.5	0	3.3	28.1	0	6		34.5	0	20.3	38.1	0
7	7.6	29.8	0	9.4	31.3	0	7	7.2	25.2	0	11.8	25.9	0
8	12		0.3	18.3	24.2	0	8	8.3	29.7	0	9.8	30	0
9		19.3	5.8	7.5	19.9	4.4	9	10.8	26.7	0	9.9	27.8	0
10	1.5	21	0.2	2	21.4	0	10	8.3	27	0	7.2	25.9	0
11		25.3	0	4.6	24.9	0	11	8.8	24	0	9.4	24.3	0
12	6.8	30.2	0	8.7	29.9	0	12	7.6	26.3	0	6.7	25.7	0
13	14	35.2	0	11.7	35.7	0	13	6.1	30.7	0	9.7	29.2	0
14	13.4	26.4	0	14	27.9	0	14	11.6	35.3	0	11	34	0
15	7.9	17.8	1	9.3	18	0.2	15	17.8	39.6	0	19.6	38.6	0
16	4.5	21.9	0	4.4	21	0.2	16	17.4	28.1	1.4	18.1	30	2
17	4.4	22	0	3.1	23.5	0	17	9.5	25.7	2.4	13.1	25.5	0
18	4.3	22.2	0	6.3	22.9	0.2	18	8.5	31.5	0	10.9	30.1	0
19	3.5	24.7	0	4.4	27.2	0	19	12.2	37.1	0	13.8	36.3	0
20	9.3	18.9	0	7.9	19.7	0	20	14	27.3	0	14	28.5	0
21	0	21.7	0	2.6	21.2	0	21	5.6	25.5	0	7.6	25.4	0
22	6		0	8.3	26.2	0	22	8	29.4	0	12	29.3	0
23		35.6	0	10	35	0	23	11.6	32.8	0	15.2	31.5	0
24	11.5	29	0	15.7	30.7	0	24	13	33	0	14.8	32.1	0
25	8.2	24.3	0	10.8	24.8	0.4	25	11.9	33.5	0	15.8	31.9	0
26	8.5	27.8	0	7.2	28.3	0	26	13.5	37.2	0	18.5	34.9	0
27	6.9	28.5	0	6.6	30.6	0	27	17.4	40.2	0	20	39.7	0
28	8.2	31.1	0	11.4	33.4	0	28	12.4	34.9	0	16.5	37.7	0
29	7.8	24	0	9.7	25.2	0	29	12.3	29.2	0	16.6	33.3	0
30	3.5	22.6	0	7.6	22.7	0	30	10.6	32.1	0	13.3	34	0
31	5	25	0	8.5	26.6	0							

Appendix 1. (cont.)

Date	Hyden			Southern Cross			Date	Hyden			Southern Cross		
	Temp (°C)		Rain (mm)	Temp (°C)		Rain (mm)		Temp (°C)		Rain (mm)	Temp (°C)		Rain (mm)
	Min	Max		Min	Max			Min	Max		Min	Max	
Dec 2016							Jan 2017						
1	10	28.1	0	13.6	29.4	0	1	12.3	32.7	0	12.9	31.5	0
2	9.9	32.9	0	13	32.6	0	2	14	35.4	0	17.6	33.7	0
3	14.1	32.1	0	15.9	33.6	0	3	16.2	38.5	0	19.2	36.7	0
4	12	28.1	0	15.7	28	0	4	18.5	42.1	0	22.5	39.8	0
5	10.4	29	0	12.9	30.3	0	5	22.8	44.2	0	25.2	44.6	0
6	10	32.6	0	13.4	33	0	6	11.5	29.3	0	14	27.9	0
7	12.3	27.9	0	14.7	29.3	0	7	12.1	32.8	0	14.3	34.2	0
8	7.9	31.2	0	9.9	29.8	0	8	13.3	34.6	0	15.2	35.7	0
9	11	36.2	0	15.6	34.6	0	9	13.9	36.2	0	17.3	36.3	0
10	15.7	41.6	0	16.8	40.4	0	10	15.7	40.2	0	19.8	38.7	0
11	20.7	40.6	0	19.9	41.5	0	11	15.7	42.2	0	22.7	40.7	0
12	15.4		9	17.8	20.3	1	12	17.9	30	0	20.1	30.6	0
13	12.5	26	7.2	13.9	24.2	15.8	13	9.5	31.7	0	13.6	32.2	0
14	13.4	28.4	0	12	27.7	0	14	12.6	37.5	0	15.9	35.3	0
15	11.8	33.8	0	14.4	32.7	0	15	13.3	41	0	17	37.8	0
16	15.3	27.6	0	18	30.8	0	16	14.3	32.2	0	20.6	30.6	0
17	11.7	33.5	0	13.2	30.2	1.4	17	13.7	29.6	0	13.8	26	2.2
18	16.1	35.1	0	18.1	36.1	0	18	12.1	34.1	0	14.9	32.9	0
19	13.6	30.8	0	14.6	31.7	0	19	17.3	25.6	0.2	20.7	30.7	0
20	11.3	33.4	0	13.2	33	0	20	10.1	33	0	13.3	33.1	0
21	13.9	40.1	0	18.3	38.1	0	21	13.9	38	0	18.3	37.7	0
22	25.2	36	0	25.7	39.5	0	22	16.9	34.8	0	21.7	37.3	0
23	13.1	39.2	0	16.4	38.9	0	23	8.9	29	0	15	30.5	0
24	15.7	39.3	0	25.2	40.4	0	24	11.3	33.5	0	14.2	33.7	0
25	14.7	29.9	0	17.6	33.1	1.2	25	13.6	38	0	17.9	37.3	0
26	10.9	35.6	0	13	35.8	0	26	18.7		0	18.6	38.4	0
27	13.9	23.8	0	15.5	24.3	0	27		41.5	0	20.4	42.8	0
28	13	25.5	0	13.6	26.1	0	28	15.6	43.5	0	17	41.5	0
29	12.5	30.1	0	9.1	30.1	0	29	23.6	29.1	4.8	23.1	32.2	30.6
30	10.4	33.8	0	12.8	34.1	0	30	15.7	17.2	16	17.2	18.9	9
31	11.5	27.6	0	12.4	30	0	31	13.6	18.7	56.2	16.9	26	31

Appendix 1. (cont.)

Date	Hyden			Southern Cross			Date	Hyden			Southern Cross		
	Temp (°C)		Rain (mm)	Temp (°C)		Rain (mm)		Temp (°C)		Rain (mm)	Temp (°C)		Rain (mm)
	Min	Max		Min	Max			Min	Max		Min	Max	
Feb 2017							Sept 2017						
1	14.4	27.8	14.8	18.8	26.4	12.4	1	7	17.4	4.8	6.3	18.4	0.6
2	15.9	30.6	0.1	18	29.9	0	2	2.6	14.9	1.6	2.7	13.7	1
3	17.6	36.5	0	19.8	36.1	0	3	1	15.4	0	-2	16.7	0
4	17.9	32.8	0	20.2	34.3	0	4	9	17.8	0.4	0.2	18.1	0
5	15.3	26	0	16.7	29.2	0	5	2.9	20	0	2.4	20.7	0
6	13.3	31.2	0	15.2	30.2	0	6	5	24.3	0	4.5	24.1	0
7	19.4	32.7	0	19.5	37	0	7	10.2	26.8	0	10.1	25	0
8	13.9	21.2	8.2	13.9	16.6	20.2	8	11.4	25.8	0.6	13.2	25.2	0
9	11	16.6	29	12.4	21.5	27.8	9	12.5	24.9	0	12.4	24.2	8
10	11.7	25.1	15.8	13.3	34	0	10	7.9	21.2	0	7.4	22.8	0
11	15.6	19.6	42.3	20.4	28	1.2	11	11.4	21.7	0	11.1	21.4	0
12	15.9	23.9	2.6	17.4	25.9	1.2	12	10.4	19	0.6	11.3	18.7	0
13	16.8	32.6	0.2	18	31.7	0	13	-0.5	20.7	0	0.1	20.4	0
14	21.7	34.9	0	20	34.9	0	14	1.7	24.9	0	0.8	25.2	0
15	17.9	26.1	0	20.3	33.1	0	15	11	26.3	1.2	10.5	27.3	0
16	14.9	29.4	0	17.7	32.1	0	16	6	27.9	0	6.6	28.7	0
17	13.4	28.3	0	14.1	31	0	17	12.7	24.6	0	10	25.2	0
18	12.7	30.7	0	14.7	31.5	0	18	6.8	25.4	0	7	26.2	0
19	15	35.4	0	16.9	33.1	0	19	8.3	28.6	0	10.1	33.8	0
20	20.4	33	0	20.2	36.4	0	20	12.7	21.9	3.2	8.2	22.5	0
21	14.9	23.8	0.1	14.3	24.6	0	21	14.3	24.7	0	10.4	26.5	0.2
22	9	24.2	0	7.5	26.1	0	22	10.2	15.6	4.8	12.4	21.9	0.6
23	11.2	30.2	0	13.5	31.4	0	23	6.4	17.8	7	8.6	18	3.4
24	15	33.2	0	17.1	32.8	0	24	5	17	0.9	9.3	20.2	1
25	15.5	35.5	0	17.6	35.9	0	25	7.2	16.4	11	7.5	17.9	7.8
26	18	39	0	19.4	39.6	0	26	7.3	16.8	8.2	7.5	14.5	11
27	17.1	35	0	21.6	38.5	0	27	3.6	16.1	3.7	5.6	15.4	5.8
28	16.2	34.5	0	18.4	37	0	28	5.6	18.2	0	3.5	18	0
							29	3.3	19	0	4	19.6	0
							30	4.5	19.7	0	4.3	20.7	0

Appendix 1. (cont.)

Date	Hyden			Southern Cross			Date	Hyden			Southern Cross		
	Temp (°C)		Rain (mm)	Temp (°C)		Rain (mm)		Temp (°C)		Rain (mm)	Temp (°C)		Rain (mm)
	Min	Max		Min	Max			Min	Max		Min	Max	
Oct 2017							Nov 2017						
1	6.8	23.8	0	7.1	23.1	0	1	11.7	29.5	0	12.7	34.2	0
2	5.5	28.6	0	6.4	29.1	0	2	12.3	22.3	0	11.8	29.4	0
3	12.4	18.8	0.2	9.7	22.1	0	3	11.5	25.5	0	13.4	27.7	0
4	3.6	17.5	0	5.1	18.5	0	4	9.8	28.5	0	12.9	29.7	0
5	6.8	20.9	0	5.7	20.1	0	5	10.2	28.4	0	13.6	28.7	0.8
6	3.9	22.5	0	4.3	23.2	0	6	10.3	29.6	0	13.7	29.5	0
7	8.2	18.1	0	8	18	0	7	12.4	32.9	0	15.9	32.6	0
8	2.6	19.7	0	2.5	19.5	0	8	14.5	33.2	0	16.1	29.9	0
9	3.4	25.3	0	5.6	27.9	0	9	18.5	32	0	17.9		0
10	7.3	21.4	0	6.8	21.9	0	10	14	35	0			2.8
11	2.9	21.4	0	3.9	22.4	0	11	12	37.1	0			0
12	4.3		0	6.6	27.9	0	12	16	23.2	11.4			0
13		32.1	0	12.9	32.3	0	13	14.3	27.9	5.6			0
14	13.7	28	10.2	16.8	28.9	1.8	14	12	24.1	0			0
15	13.2	31.1	0.2	11.9	33.4	0	15	8	28.4	0			0.2
16	15	23	0	16.2	25.8	0	16	13.1	34.6	0			0
17	11.6	23.2	0	12	23.5	0	17	18	35.2	0.4			0.2
18	7.9	21	0.9	10.4	21.3	0	18	15	27	4			0
19	4.6	25	0	8.7	25.5	0	19	12.6	30.9	1.4			0.4
20	8.7	28.9	0	11.5	28.5	0	20	13	30.5	0			0
21	11.3	30.5	0	15.5	28.3	0	21	12.6	26	0			0
22	14.9	24.2	6.4	15.9	30.6	3.4	22	7	27.2	0			0
23	10.8	28.9	6.8	10.3	29.7	0	23	9.2	30	0			0
24	14.3	27.6	0	13.1	29.9	0	24	12.5	34.5	0			0
25	9.4	26.2	0	10.7	28.7	0	25	12	32.4	0			0.2
26	9.3	25.8	0	8.5	27.9	0	26	12.8	36	0			0
27	4.5	21.3	1.2	4.4	21.7	0	27	15.8	34.5	1			0.6
28	9.5	25.9	0	10	27.1	0	28	11.3	27	0			0.4
29	9.7	23	0.2	12.4	23.7	0	29	10.5	26.5	0			0.2
30	5.9	27.3	0	9.2	28.3	0	30	8.5	25	0		24.6	
31	8.2	33	0	9	34	0							

(Note: Data from Southern Cross Airport unavailable for part Novemeber 2017).

Appendix 2. Regional Trapping Sites.

Appendix 2A. Regional trapping site descriptions

Site	Dates opened & closed	Location	Habitat
7	24/11/16 - 2/12/16	Prince of Wales 50H 759233 E 6450754 N	**Mallee woodland/Shrubland**. Mallee eucalypts over mixed *Melaleuca* spp. shrubland on small laterite rise, grading into *Allocasuarina* and *Acacia* spp. tall shrubland on pale gravelly sand. Unburnt patch in a largely burnt area.
8	24/11/16 - 2/12/16	Prince of Wales 50H 759276 E 6449802 N	**Mallee Woodland**. Mallee over mixed *Melaleuca* spp. shrubland on gravelly red clay-loam.
9	25/11/16 - 3/12/16	Prince of Wales 50H 759730 E 6450361 N	**Mallee Woodland**. Mallee woodland over mixed *Melaleuca* spp. shrubland on pale sandy clay. Recently burnt in 2015.
10	25/11/16 - 3/12/16	Van Uden 50H 750567 E 6439052 N	**Open Woodland.** Tall Salmon Gum and Merrit woodland over patchy *Melaleuca pauciflora* and scattered *Eremophila* sp. low shrubs on red gravelly clay-loam. Tree hollows present.
11	25/11/16 - 3/12/16	Van Uden 50H 750469 E 6438277 N	**Mallee Woodland**. Mallee and scattered larger eucalypts over mixed *Melaleuca* spp. and other shrubs (e.g. *Daveisia* sp., *Acacia* sp.) on pale gravelly sand on low rise.
12	26/11/16 - 4/12/16	Van Uden 50H 749456 E 6439815 N	**Sandplain.** A dense mixed shrubland (e.g. *Hakea* spp., *Grevillea* spp., *Melaleuca* spp., *Verticordia* spp.) with sparse low Mallee eucalypts on yellow sandplain.

Appendix 2B. Representative photographs of regional trapping sites

Site 7

Site 8

Site 9

Site 10

Site 11

Site 12

Appendix 2C. Captures and bird observations from regional trapping sites.

Reptile captures and opportunistic records, data from October 2016 – November 2017.

Reptile species	Site								Opportunistic
	Prince of Wales			Van Uden			Regional Chuditch survey		
	7	8	9	10	11	12	North transect	South transect	
Dragons									
Ctenophorus cristatus		x	1	1					
Ctenophorus maculatus						2			
Ctenophorus salinarum									x
Moloch horridus						x			
Pogona minor			1						
Geckoes									
Crenadactylus ocellatus		1	2						
Diplodactylus calcicolus					1				
Diplodactylus granariensis	2	1			2	1			
Gehyra variegata				4					
Hesperoedura reticulata				x					
Lucasium maini				1	2				
Nephrurus stellatus (CS3)						1			
Strophurus spinigerus	1								
Legless lizards									
Delma australis	2								
Delma fraseri			1						
Pygopus lepidopodus				1					
Skinks									
Cryptoblepharus buchananii				2					
Ctenotus schomburgkii		2	10	1					
Ctenotus uber	1	3	6						
Egernia richardi				4	1				
Lerista distinguenda				2		1			
Liopholis multiscutata									x
Menetia greyii	1		3	3		1			
Morethia butleri		1	1	2					
Morethia obscura			1	12	4	2			
Tiliqua occipitalis					1			1	
Tiliqua rugosa							1		x
Monitors or goannas									
Varanus gouldii							3	2	
Varanus rosenbergi	1			1				1	
Pythons									
Morelia spilota								1	
Elapid snakes									
Pseudonaja affinis									x
Simosolaps bertholdi						1			
Total species:	6	6	9	13	6	8	2	4	5

X = observed opportunistically and numbers may include individuals captured more than once over successive days.

Bird observations, Oct – Dec 2016.

Bird Species	Site						Opportunistic	Bird Species	Site						Opportunistic
	Prince of Wales			Van Uden					Prince of Wales			Van Uden			
	7	8	9	10	11	12			7	8	9	10	11	12	
Brown Falcon					x			Crested Bellbird	2	2	4		1	2	
Collared Sparrowhawk							x	Fan-tailed Cuckoo							x
Little Eagle				4				Gilbert's Whistler							x
Peregrine Falcon (CS1)						1		Golden Whistler	3	2	1		2		
Square-tailed Kite							x	Grey Shrike-thrush	3	4		6	4	1	
Wedge-tailed Eagle							x	Horsfield's Bronze-cuckoo						1	
Whistling Kite							x	Restless Flycatcher							x
Grey Teal							x	Rufous Treecreeper				6			
Australian Ringneck	2			2				Varied Sittella							x
Brush Bronzewing	1	2	2		1			White-winged Triller							x
Common Bronzewing				2				Mistletoebird							x
Elegant Parrot	2	1	3					Spotted Pardalote	1	4	3		1	2	
Painted Button-quail							x	Striated Pardalote		2	2	1	6		
Regent Parrot	1	2	3			1		Weebill	4	6	5		5	4	
Inland Western Rosella (CS2)				4				Brown Honeyeater		1			1	2	
Dusky Woodswallow				6				Brown-headed Honeyeater	1	2			4	2	
Rainbow Bee-eater				1				Purple-crowned Lorikeet	1		2	6	4	2	
Tree Martin				6				Purple-gaped Honeyeater	x	5	1			1	
Welcome Swallow							x	Red Wattlebird	1	2	1	3	4	2	
Australian Pipit							x	Singing Honeyeater							x
Blue-breasted Fairy-wren	2	1	3		2	4		Spiny-cheeked Honeyeater	1	2	4	1		4	
Copperback Quail-thrush		1	1			1		Tawny-crowned Honeyeater	1		1			1	
Hooded Robin							x	White-eared Honeyeater	2	1	3		4	2	
Inland Thornbill	5		4		6	4		White-fronted Honeyeater	1	5	2		2	5	
Jacky Winter							x	Yellow-plumed Honeyeater				6	1		
Painted Button-quail							x	Yellow-throated Miner							x
Red-capped Robin					1			Australian Raven					1		
Redthroat	1		2			1		Black-faced Cuckoo-shrike			2	1	2		
Shy Heathwren	2	1	1			1		Grey Butcherbird	4		1	1	3	1	
Southern Scrub-robin	5	5	3		5	6		Grey Currawong		1		1	1		
Western Yellow Robin	1	2	1	2	1			Spotted Nightjar	x						
White-browed Babbler		2		2	1			Tawny Frogmouth							x
White-browed Scrubwren			1			1		Emu			x			x	
Willie Wagtail			1	3				Malleefowl					x	x	
Yellow-rumped Thornbill							x	**Total species:**	**25**	**23**	**27**	**20**	**26**	**26**	**21**

Mammal captures and opportunistic records, Oct to Dec 2016.

Mammal species	Site								Opportunistic
	Prince of Wales			Van Uden			Regional Chuditch Survey		
	7	8	9	10	11	12	North Transect	South Transect	
Echidnas									
Tachyglossus aculeatus									x
Dasyurid marsupials									
Dasyurus geoffroii (CS1)	2		1				9	4	
Ningaui yvonneae						1			
Sminthopsis dolichura			1	3	2				
Sminthopsis gilberti				1					
Sminthopsis granulipes		1				7			
Sminthopsis ooldea						1			
Kangaroos and wallabies									
Macropus fuliginosus							x		x
Macropus irma (CS2)							x		x
Pygmy possums									
Cercartetus concinnus		2	1	3	5	1			
Bats									
Austronomus australis	x	x	x	x	x	x			
Chalinolobus gouldii		x	x	x	x	x			
Scotorepens balstoni				x	x				
Ozimops kitcheneri	x	x	x	x	x	x			
Vespadelus regulus	x	x	x	x	x	x			
Vespadelus baverstocki		x		x	x	x			
Native mice and rats									
Notomys mitchelli					1	11			
Introduced Mammals									
Mus musculus								x	
Canis lupus / dingo				x					
Felis catus									x
Oryctolagus cuniculus			x						
Vulpes vulpes									x
Total species:	**4**	**7**	**8**	**10**	**9**	**10**	**3**	**2**	**5**

Appendix 3. Camera Trap Locations and Habitat

Appendix 3A. Location and Habitat for All Camera Traps

Note DE = Development envelope, RSA = Regional survey area. Note that all cameras target Chuditch except W02-7, W08-7 and W22-7.

Survey	Camera	Zone	Easting	Northing	Burnt or Unburnt	Habitat	Date deployed	Date retrieved	Location	Trap-nights
1	N01-0	50	759916	6446523	Unburnt	Shrubland	10/10/2016	15/10/2016	DE	5
1	N02-0	50	759372	6445879	Unburnt	Mallee woodland	10/10/2016	15/10/2016	DE	5
1	N03-0	50	759561	6446710	Unburnt	Shrubland	10/10/2016	15/10/2016	DE	5
1	N04-0	50	759906	6446062	Unburnt	Mallee woodland	10/10/2016	15/10/2016	DE	5
1	W02-0	50	759063	6446760	Unburnt	Shrubland	10/10/2016	15/10/2016	DE	5
1	W03-0	50	759006	6446455	Unburnt	Shrubland	10/10/2016	15/10/2016	DE	5
1	W04-0	50	758856	6445164	Unburnt	Shrubland	10/10/2016	15/10/2016	DE	5
1	W05-0	50	759677	6445674	Unburnt	Mallee woodland	10/10/2016	15/10/2016	DE	5
1	W06-0	50	758836	6445766	Unburnt	Mallee woodland	10/10/2016	15/10/2016	DE	5
1	W07-0	50	759475	6446260	Unburnt	Mallee woodland	10/10/2016	15/10/2016	DE	5
1	W08-0	50	759268	6445519	Unburnt	Shrubland	10/10/2016	15/10/2016	DE	5
1	W09-0	50	759274	6446155	Unburnt	Shrubland	10/10/2016	15/10/2016	DE	5
2	N01-1	50	759522	6449665	Burnt	Mallee woodland	22/11/2016	26/11/2016	RSA	4
2	N01-2	50	762417	6438295	Unburnt	Mallee woodland	26/11/2016	30/11/2016	RSA	4
2	N01-3	50	758080	6440960	Unburnt	Shrubland	30/11/2016	4/12/2016	RSA	4
2	N02-1	50	759224	6449993	Burnt	Mallee woodland	22/11/2016	26/11/2016	RSA	4
2	N02-2	50	762342	6441296	Unburnt	Mallee woodland	26/11/2016	30/11/2016	RSA	4
2	N02-3	50	761656	6443600	Unburnt	Mallee woodland	30/11/2016	4/12/2016	DE	4
2	N03-1	50	758986	6447610	Unburnt	Mallee woodland	22/11/2016	26/11/2016	DE	4
2	N03-2	50	762742	6443096	Unburnt	Mallee woodland	26/11/2016	30/11/2016	DE	4
2	N03-3	50	763595	6439595	Unburnt	Mallee woodland	30/11/2016	4/12/2016	RSA	4
2	N04-1	50	759268	6447365	Unburnt	Mallee woodland	22/11/2016	26/11/2016	DE	4

Appendix 3A. (cont.)

Survey	Camera	Zone	Easting	Northing	Burnt or Unburnt	Habitat	Date deployed	Date retrieved	Location	Trap-nights
2	N04-2	50	759352	6440369	Unburnt	Mallee woodland	26/11/2016	30/11/2016	RSA	4
2	N04-3	50	759352	6439366	Unburnt	Mallee woodland	30/11/2016	4/12/2016	RSA	4
2	W01-1	50	762358	6446368	Unburnt	Mallee woodland	29/11/2016	4/12/2016	RSA	5
2	W02-1	50	759955	6450865	Burnt	Mallee woodland	22/11/2016	26/11/2016	RSA	4
2	W02-2	50	759318	6444356	Unburnt	Mallee woodland	26/11/2016	30/11/2016	DE	4
2	W02-3	50	761366	6445468	Unburnt	Mallee woodland	30/11/2016	4/12/2016	DE	4
2	W03-1	50	759967	6447772	Unburnt	Shrubland	22/11/2016	26/11/2016	RSA	4
2	W03-2	50	750256	6438504	Unburnt	Open woodland (Merrit & Salmon Gum)	26/11/2016	30/11/2016	RSA	4
2	W03-3	50	747943	6441491	Unburnt	Mallee woodland	30/11/2016	4/12/2016	RSA	4
2	W04-1	50	759402	6450464	Unburnt	Mallee woodland	22/11/2016	26/11/2016	RSA	4
2	W04-2	50	750230	6438902	Unburnt	Open woodland (Merrit & Salmon Gum)	26/11/2016	30/11/2016	RSA	4
2	W04-3	50	748038	6442244	Unburnt	Shrubland	30/11/2016	4/12/2016	RSA	4
2	W05-1	50	759505	6447687	Unburnt	Mallee woodland	22/11/2016	26/11/2016	DE	4
2	W05-2	50	750431	6439438	Unburnt	Mallee woodland	26/11/2016	30/11/2016	RSA	4
2	W05-3	50	749667	6439356	Unburnt	Mallee woodland	30/11/2016	4/12/2016	RSA	4
2	W06-1	50	759845	6447174	Unburnt	Shrubland	22/11/2016	26/11/2016	DE	4
2	W06-2	50	749997	6439367	Unburnt	Mallee woodland	26/11/2016	30/11/2016	RSA	4
2	W06-3	50	748717	6440909	Unburnt	Shrubland	30/11/2016	4/12/2016	RSA	4
2	W07-1	50	759483	6447368	Unburnt	Mallee woodland	22/11/2016	26/11/2016	DE	4
2	W07-2	50	750833	6438387	Unburnt	Mallee woodland	26/11/2016	30/11/2016	RSA	4
2	W07-3	50	747801	6442892	Unburnt	Mallee woodland	30/11/2016	4/12/2016	RSA	4
2	W08-1	50	759903	6450455	Burnt	Mallee woodland	22/11/2016	26/11/2016	RSA	4
2	W08-2	50	750687	6438785	Unburnt	Open woodland (Merrit & Salmon Gum)	26/11/2016	30/11/2016	RSA	4
2	W08-3	50	749529	6440319	Unburnt	Shrubland	30/11/2016	4/12/2016	RSA	4
2	W09-1	50	759236	6450923	Unburnt	Mallee woodland	22/11/2016	26/11/2016	RSA	4

Appendix 3A. (cont.)

Survey	Camera	Zone	Easting	Northing	Burnt or Unburnt	Habitat	Date deployed	Date retrieved	Location	Trap-nights
2	W09-2	50	759328	6443180	Unburnt	Mallee woodland	26/11/2016	30/11/2016	DE	4
2	W09-3	50	760898	6443050	Unburnt	Shrubland	30/11/2016	4/12/2016	DE	4
2	W10-1	50	761608	6451983	Unburnt	Mallee woodland	29/11/2016	4/12/2016	RSA	5
2	W11-1	50	762187	6448791	Unburnt (next to burnt)	Mallee woodland	29/11/2016	4/12/2016	RSA	5
2	W12-1	50	762862	6442728	Unburnt	Mallee woodland	29/11/2016	4/12/2016	DE	5
2	W13-1	50	762609	6444198	Unburnt	Mallee woodland	29/11/2016	4/12/2016	DE	5
2	W14-1	50	761624	6450581	Unburnt	Mallee woodland	29/11/2016	4/12/2016	RSA	5
2	W15-1	50	762198	6448189	Unburnt	Mallee woodland	29/11/2016	4/12/2016	RSA	5
2	W16-1	50	762288	6446789	Unburnt	Mallee woodland	29/11/2016	4/12/2016	RSA	5
2	W17-1	50	760427	6446171	Unburnt	Mallee woodland	29/11/2016	4/12/2016	DE	5
3	W01-4	50	757634	6456613	Unburnt (next to burnt)	Mallee woodland	18/01/2017	9/02/2017	RSA	22
3	W01-5	50	758783	6451858	Unburnt	Open woodland (gimlet)	10/02/2017	24/02/2017	RSA	14
3	W02-4	50	758074	6455755	Unburnt (next to burnt)	Shrubland	18/01/2017	9/02/2017	RSA	22
3	W02-5	50	756879	6460002	Unburnt	Shrubland	11/02/2017	24/02/2017	RSA	13
3	W03-4	50	760986	6451174	Unburnt (next to burnt)	Mallee woodland	18/01/2017	11/02/2017	RSA	24
3	W03-5	50	761747	6460364	Burnt	Shrubland	11/02/2017	24/02/2017	RSA	13
3	W04-4	50	760087	6452380	Burnt	Shrubland	18/01/2017	9/02/2017	RSA	22
3	W04-5	50	760201	6453532	Unburnt	Mallee woodland	9/02/2017	24/02/2017	RSA	15
3	W05-4	50	756968	6451204	Unburnt (next to burnt)	Shrubland	19/01/2017	10/02/2017	RSA	22
3	W05-5	50	755589	6452055	Unburnt (next to burnt)	Shrubland	10/02/2017	24/02/2017	RSA	14
3	W06-4	50	763828	6440809	Unburnt	Open woodland (gimlet)	19/01/2017	8/02/2017	RSA	20
3	W06-5	50	763803	6442406	Unburnt (next to burnt)	Mallee woodland	8/02/2017	23/02/2017	RSA	15
3	W07-4	50	758432	6453158	Unburnt	Open woodland (gimlet)	18/01/2017	9/02/2017	RSA	22
3	W07-5	50	761546	6457583	Burnt	Mallee woodland	11/02/2017	24/02/2017	RSA	13
3	W08-4	50	755862	6447328	Unburnt	Shrubland	20/01/2017	8/02/2017	RSA	19

Appendix 3A. (cont.)

Survey	Camera	Zone	Easting	Northing	Burnt or Unburnt	Habitat	Date deployed	Date retrieved	Location	Trap-nights
3	W08-5	50	758652	6448854	Unburnt	Shrubland	8/02/2017	24/02/2017	RSA	16
3	W09-4	50	754725	6451569	Unburnt (next to burnt)	Mallee woodland	19/01/2017	10/02/2017	RSA	22
3	W09-5	50	753973	6452106	Unburnt	Mallee woodland	10/02/2017	24/02/2017	RSA	14
3	W10-4	50	754136	6443064	Unburnt	Shrubland	17/01/2017	8/02/2017	RSA	22
3	W10-5	50	757483	6447340	Unburnt	Shrubland	8/02/2017	23/02/2017	RSA	15
3	W11-4	50	758031	6444548	Unburnt	Mallee woodland	17/01/2017	7/02/2017	RSA	21
3	W11-5	50	764472	6445019	Burnt	Open woodland (Merrit)	7/02/2017	23/02/2017	RSA	16
3	W12-4	50	754313	6445816	Unburnt	Shrubland	17/01/2017	8/02/2017	DE	22
3	W12-5	50	753870	6444571	Unburnt	Shrubland	8/02/2017	23/02/2017	RSA	15
3	W13-4	50	756721	6442154	Unburnt	Mallee woodland	19/01/2017	7/02/2017	RSA	19
3	W13-5	50	763288	6447100	Burnt	Mallee woodland	7/02/2017	23/02/2017	RSA	16
3	W14-4	50	760188	6441343	Burnt	Open woodland	17/01/2017	7/02/2017	RSA	21
3	W14-5	50	760391	6439382	Unburnt	Open woodland (gimlet)	7/02/2017	23/02/2017	RSA	16
3	W15-4	50	753838	6439082	Unburnt	Shrubland	16/01/2017	8/02/2017	RSA	23
3	W15-5	50	762361	6439787	Burnt	Open woodland	8/02/2017	23/02/2017	RSA	15
3	W16-4	50	764353	6446345	Burnt	Mallee woodland	17/01/2017	7/02/2017	RSA	21
3	W16-5	50	756254	6439127	Burnt	Mallee woodland	8/02/2017	23/02/2017	RSA	15
3	W17-4	50	763261	6447987	Burnt	Shrubland	17/01/2017	7/02/2017	RSA	21
3	W17-5	50	754893	6440726	Unburnt	Mallee woodland	10/02/2017	24/02/2017	RSA	14
3	W18-4	50	761633	6454862	Burnt	Open woodland (Salmon Gum)	18/01/2017	11/02/2017	RSA	24
3	W18-5	50	761463	6456159	Burnt	Mallee woodland	11/02/2017	24/02/2017	RSA	13
3	W19-4	50	759122	6454666	Unburnt (next to burnt)	Shrubland	18/01/2017	9/02/2017	RSA	22
3	W19-5	50	760239	6455577	Unburnt	Shrubland	9/02/2017	24/02/2017	RSA	15
3	W20-4	50	757757	6451482	Unburnt	Shrubland	19/01/2017	10/02/2017	RSA	22
3	W20-5	50	762849	6461372	Burnt	Open woodland (Salmon Gum)	11/02/2017	24/02/2017	RSA	13

Appendix 3A. (cont.)

Survey	Camera	Zone	Easting	Northing	Burnt or Unburnt	Habitat	Date deployed	Date retrieved	Location	Trap-nights
3	W21-4	50	760955	6452774	Unburnt	Shrubland	18/01/2017	11/02/2017	RSA	24
3	W21-5	50	761672	6459185	Burnt	Shrubland	11/02/2017	24/02/2017	RSA	13
3	W22-4	50	760511	6448976	Unburnt (next to burnt)	Mallee woodland	19/01/2017	8/02/2017	RSA	20
3	W22-5	50	758312	6450709	Unburnt (next to burnt)	Mallee woodland	10/02/2017	24/02/2017	RSA	14
4	W01-6	50	750369	6456000	Unburnt	Mallee woodland	20/09/2017	7/10/2017	RSA	17
4	W02-6	50	748756	6443930	Unburnt	Mallee woodland	19/09/2017	7/10/2017	RSA	18
4	W03-6	50	751036	6447426	Unburnt	Mallee woodland	20/09/2017	7/10/2017	RSA	17
4	W04-6	50	754863	6465348	Unburnt (next to burnt)	Shrubland (on sand)	20/09/2017	7/10/2017	RSA	17
4	W05-6	50	750482	6462187	Unburnt	Shrubland (on sand)	20/09/2017	7/10/2017	RSA	17
4	W06-6	50	761480	6431003	Unburnt	Open woodland (Salmon Gum)	20/09/2017	7/10/2017	RSA	17
4	W07-6	50	751135	6449780	Unburnt	Shrubland	20/09/2017	7/10/2017	RSA	17
4	W08-6	50	760117	6432432	Unburnt	Mallee woodland	19/09/2017	7/10/2017	RSA	18
4	W09-6	50	755784	6461958	Unburnt	Shrubland (on sand)	20/09/2017	7/10/2017	RSA	17
4	W10-6	50	757175	6434288	Unburnt	Mallee woodland	19/09/2017	7/10/2017	RSA	18
4	W12-6	50	751892	6434898	Unburnt	Mallee woodland	19/09/2017	7/10/2017	RSA	18
4	W14-6	50	751913	6431974	Unburnt	Open woodland (gimlet)	19/09/2017	7/10/2017	RSA	18
4	W15-6	50	764394	6436746	Unburnt	Mallee woodland (on sand)	19/09/2017	7/10/2017	RSA	18
4	W16-6	50	751880	6466751	Unburnt	Shrubland	20/09/2017	7/10/2017	RSA	17
4	W17-6	50	755309	6432936	Unburnt	Open woodland (gimlet)	19/09/2017	7/10/2017	RSA	18
4	W18-6	50	757548	6436570	Unburnt	Open woodland	19/09/2017	7/10/2017	RSA	18
4	W19-6	50	758566	6465564	Unburnt (next to burnt)	Open woodland (gimlet)	20/09/2017	7/10/2017	RSA	17
4	W20-6	50	754345	6463605	Unburnt	Shrubland	20/09/2017	7/10/2017	RSA	17
4	W21-6	50	758795	6433168	Unburnt	Mallee woodland	19/09/2017	7/10/2017	RSA	18
4	W22-6	50	757689	6432201	Unburnt	Shrubland (on sand)	19/09/2017	7/10/2017	RSA	18
5	W02-7	50	760397	6447376	Unburnt	Shrubland (MM-23)	8/10/2017	13/10/2017	DE	5

Appendix 3A. (cont.)

Survey	Camera	Zone	Easting	Northing	Burnt or Unburnt	Habitat	Date deployed	Date retrieved	Location	Trap-nights
5	W03-7	50	763470	6437040	Unburnt	Dam, Open woodland	8/10/2017	13/10/2017	DE	5
5	W04-7	50	763530	6436697	Unburnt	Open woodland (Site 15)	8/10/2017	13/10/2017	DE	5
5	W05-7	50	763874	6435999	Burnt	Borefields Dam	8/10/2017	13/10/2017	DE	5
5	W06-7	50	757409	6444929	Unburnt	Shrubland (Site 18)	8/10/2017	13/10/2017	DE	5
5	W07-7	50	761360	6445072	Unburnt	Camp	8/10/2017	13/10/2017	DE	5
5	W08-7	50	757806	6446951	Unburnt	Shrubland (MM-24)	10/10/2017	13/10/2017	DE	3
5	W10-7	50	761013	6447586	Unburnt	Mallee woodland (Site 16)	8/10/2017	13/10/2017	DE	5
5	W12-7	50	762149	6446387	Unburnt	Mallee woodland (Site 17)	8/10/2017	13/10/2017	DE	5
5	W14-7	50	760327	6445576	Unburnt	Mallee woodland (Site 19)	8/10/2017	13/10/2017	DE	5
5	W15-7	50	761016	6446770	Unburnt	Shrubland	8/10/2017	13/10/2017	DE	5
5	W16-7	50	762569	6445005	Unburnt (next to burnt)	Mallee woodland	8/10/2017	13/10/2017	DE	5
5	W17-7	50	763528	6445447	Burnt	Open woodland (Salmon Gum)	8/10/2017	13/10/2017	DE	5
5	W18-7	50	760207	6444213	Unburnt	Mallee woodland (Site 14)	8/10/2017	13/10/2017	DE	5
5	W19-7	50	760555	6442890	Unburnt	Shrubland (Site 20)	8/10/2017	13/10/2017	DE	5
5	W20-7	50	761868	6444077	Unburnt	Open woodland (Site 13)	8/10/2017	13/10/2017	DE	5
5	W21-7	50	762021	6442960	Unburnt	Shrubland	8/10/2017	13/10/2017	DE	5
5	W22-7	50	761331	6446038	Unburnt	Open woodland - in front of hollow	8/10/2017	10/10/2017	DE	2

Appendix 3B. Additional Vegetation Data Collected by Mattiske Consulting for Camera Traps Set in January - February 2017

Vegetation Description	Photograph
Site: W01.4 **Location:** 757632 mE, 6456612 mN **Soil and Topography:** Orange sandy clay with surface ironstone pebbles and some crusting on flats **Structural:** *Eucalyptus flocktoniae* subsp. *flocktoniae*, *Eucalyptus cylindriflora* mid open mallee woodland over *Melaleuca* ?*condylosa, Melaleuca* ?*lateriflora, Daviesia benthamii* subsp. *acanthoclona* mid open shrubland over *Microcybe multiflora* subsp. *multiflora* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W02.4 **Location:** 758074 mE, 6455755 mN **Soil and Topography:** Cream-orange sandy clay with ironstone and laterite surface pebbles on flats **Structural:** *Eucalyptus burracoppinensis*, *Eucalyptus* ?*oleosa* mid open mallee woodland over *Melaleuca pauperiflora* subsp. *pauperiflora*, *Allocasuarina acutivalvis* mid open shrubland over *Drummondita hassellii* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W03.4 **Location:** 760986 mE, 6451174mN **Soil and Topography:** Light orange sandy clay on flats **Structural:** *Eucalyptus oleosa* subsp. *oleosa* mid open mallee woodland over *Melaleuca hamata, Melaleuca* sp., *Hakea erecta* tall open shrubland over *Baeckea elderiana, Hibbertia exasperata* low sparse heathland. **Associated species:** *Lepidosperma sanguinolentum* **Condition:** Excellent	
Site: W04.4 **Location:** 760087 mE, 6452380 mN **Soil and Topography:** Light orange sandy clay with ironstone surface pebbles, flat **Structural:** *Eucalyptus burracoppinensis, Codonocarpus cotinifolius*, *Hakea* sp., low sparse mallee shrubland over *Grevillea* ?*pterosperma*, *Acacia* sp., *Melaleuca* spp. mid open shrubland over *Gastrolobium spinosum* low sparse heathland. **Associated species:** *Santalum* sp. **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W05.4 **Location:** 756968 mE, 6451204mN **Soil and Topography:** Light orange sandy clay, flay **Structural:** *Eucalyptus burracoppinensis*, *Eucalyptus* ?*aequioperta* mid open mallee woodland over *Allocasuarina acutivalvis*, *Acacia yorkrakinensis* subsp. *acrita*, *Hakea francisiana* low open shrubland over *Melaleuca pauperiflora* subsp. *pauperiflora*, *Baeckea elderiana*, *Drummondita hassellii* mid sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W06.4 **Location:** 763828 mE, 6440809 mN **Soil and Topography:** Orange sandy clay with some surface ironstone pebbles **Structural:** *Eucalyptus salubris*, *Eucalyptus* ?*polita*, *Eucalyptus* sp. mid woodland over *Melaleuca quadrifaria*, *Melaleuca pauperiflora* subsp. *fastigiata*, *Exocarpos aphyllus* tall open shrubland. **Associated species:** N/A **Condition:** Excellent	
Site: W07.4 **Location:** 758432 mE, 6453158 mN **Soil and Topography:** Orange-brown sandy clay with some surface crusting, flat **Structural:** *Eucalyptus salubris*, *Eucalyptus capillosa* subsp. *polyclada* mid open mallee woodland over *Melaleuca pauperiflora* subsp. *pauperiflora*, *Exocarpos aphyllus*, *Dodonaea stenozyga* mid open shrubland over *Microcybe multiflora* subsp. *multiflora* low sparse shrubland. **Associated species:** N/A **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W08.4 **Location:** 755862 mE, 6447328 mN **Soil and Topography:** Light cream-orange sandy clay with some small ironstone and quartz surface pebbles, flat **Structural:** *Allocasuarina spinosissima* and *Acacia fragilis* mid open shrubland over *Melaleuca* sp., *Baeckea elderiana*, *Beaufortia schaueri* low sparse heathland. **Associated species:** *Melaleuca hamata, Hakea erecta, Lepidosperma sanguinolentum* **Condition:** Excellent	
Site: W09.4 **Location:** 754725 mE, 6451569 mN **Soil and Topography:** Light orange sandy clay, flat **Structural:** *Eucalyptus eremophila* and *Eucalyptus* sp. mid mallee woodland over *Melaleuca acuminata* subsp. *acuminata*, *Melaleuca eleuterostachya*, *Melaleuca* sp. low open shrubland over *Acacia merrallii* low sparse shrubland. **Associated species:** N/A **Condition:** Excellent	
Site: W10.4 **Location:** 754136 mE, 6443064 mN **Soil and Topography:** Orange-cream sandy clay with some laterite pebbles, flat **Structural:** *Eucalyptus* ?*rigidula* low open mallee woodland over *Melaleuca hamata*, *Hakea erecta*, *Allocasuarina spinosissima* mid open shrubland over *Melaleuca johnsonii*, *Beaufortia schaueri*, *Verticordia plumosa* var. *brachyphylla* low sparse heathland. **Associated species:** *Leucopogon* sp. **Condition:** Excellent	
Site: W11.4 **Location:** 758031 mE, 6444548 mN **Soil and Topography:** Orange-brown sandy clay, flat **Structural:** *Eucalyptus salubris, Eucalyptus capillosa* subsp. *polyclada*, *Eucalyptus incrassata* mid mallee woodland over *Melaleuca acuminata* subsp. *acuminata*, *Melaleuca* ?*hamata*, *Melaleuca* sp. mid open shrubland over *Dodonaea bursariifolia* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W12.4 **Location:** 754313 mE, 6445816 mN **Soil and Topography:** Orange sandy clay with some lateritic pebbles, flat **Structural:** *Eucalyptus ceratocorys*, *Eucalyptus burracoppinensis*, *Eucalyptus oleosa* subsp. *oleosa* mid open mallee woodland over *Allocasuarina spinosissima*, *Petrophile stricta*, *Hakea erecta* mid open shrubland over *Petrophile merrallii*, *Beaufortia schaueri*, *Verticordia pritzelii* low open heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W13.4 **Location:** 756721 mE, 6442154 mN **Soil and Topography:** Pale orange sandy clay, flat **Structural:** *Eucalyptus eremophila, Eucalyptus* sp. mid open mallee woodland over *Melaleuca thyoides*, *Melaleuca sapientes*, *Melaleuca* ?*sheathiana* mid shrubland. **Associated species:** *Exocarpos aphyllus* **Condition:** Excellent	
Site: W14.4 **Location:** 760188 mE, 6441343 mN **Soil and Topography:** Orange sandy clay, flat **Structural:** *Eucalyptus* ?*polita*, *Eucalyptus* ?*longicornis*, *Eucalyptus prolixa* low woodland over *Melaleuca cliffortioides*, *Melaleuca lanceolata*, *Beyeria sulcata* var. *brevipes* tall open shrubland over *Dodonaea stenozyga*, *Olearia muelleri*, *Senna artemisioides* subsp. *filifolia* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W15.4 **Location:** 753838 mE, 6439082 mN **Soil and Topography:** Sandy gravel with laterite, slope **Structural:** *Eucalyptus* ?*rigidula*, *Eucalyptus incrassata* mid open mallee woodland over *Santalum acuminatum*, *Acacia* ?*fragilis*, *Melaleuca hamata* mid shrubland over *Melaleuca johnsonii*, *Hakea erecta*, *Hibbertia exasperata* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W16.4 **Location:** 764353 mE, 6446345 mN **Soil and Topography:** Orange sandy clay with some ironstone pebbles, flat **Structural:** *Eucalyptus* spp. mid isolated mallee trees over *Melaleuca* spp., *Acacia* sp. mid sparse shrubland over *Daviesia argillacea*, *Dodonaea stenozyga* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W17.4 **Location:** 763261 mE, 6447987 mN **Soil and Topography:** Orange sandy clay with surface ironstone pebbles, flat **Structural:** *Eucalyptus* sp. mid open mallee woodland over *Hakea* sp., *Acacia* spp., *Allocasuarina* sp. mid sparse shrubland over *Grevillea* sp., *Dampiera eriocephala*, *Gastrolobium spinosum* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W18.4 **Location:** 761633 mE, 6454862 mN **Soil and Topography:** Orange sandy clay, flat **Structural:** *Eucalyptus salmonophloia*, *Eucalyptus* sp. mid woodland over *Acacia merrallii*, *Acacia erinacea* low open shrubland. **Associated species:** N/A **Condition:** Excellent	
Site: W19.4 **Location:** 759122 mE, 6454666 mN **Soil and Topography:** Orange-cream sandy clay with laterite and ironstone surface pebbles, flat **Structural:** *Eucalyptus burracoppinensis*, *Eucalyptus* sp., *Santalum acuminatum* low open mallee woodland over *Acacia fragilis*, *Acacia yorkrakinensis* subsp. *acrita*, *Allocasuarina acutivalvis* mid open shrubland over *Leucopogon* sp., *Baeckea elderiana*, *Hibbertia exasperata* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W20.4 **Location:** 757757 mE, 6451482 mN **Soil and Topography:** Pale orange-yellow sandy clay, flat **Structural:** *Eucalyptus burracoppinensis*, *Eucalyptus* ?*oleosa*, *Santalum acuminatum* low mallee woodland over *Allocasuarina acutivalvis*, *Melaleuca pungens*, *Hakea erecta* mid open shrubland over *Baeckea elderiana* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W21.4 **Location:** 760955 mE, 6452774 mN **Soil and Topography:** Orange sandy clay with surface ironstone pebbles, flat **Structural:** *Acacia fragilis* and *Allocasuarina spinosissima* tall open shrubland over *Grevillea didymobotrya* subsp. *didymobotrya*, *Hakea erecta*, *Baeckea elderiana* mid heathland. **Associated species:** *Melaleuca* ?*condylosa*, *Hibbertia exasperata* **Condition:** Excellent	
Site: W22.4 **Location:** 760511 mE, 6448976 mN **Soil and Topography:** Orange sandy clay with ironstone surface pebbles, slope **Structural:** *Eucalyptus eremophila* and *Eucalyptus prolixa* mid open mallee woodland over *Melaleuca eleuterostachya*, *Melaleuca lateriflora*, *Daviesia scoparia* mid heathland. **Associated species:** *Melaleuca* ?*condylosa* **Condition:** Excellent	
Site: W16.5 (CAM01) **Location:** 756254 mE, 6439127 mN **Soil and Topography:** Orange sandy clay, flat **Structural:** *Eucalyptus* ?*oleosa*, *Eucalyptus* ?*griffithsii*, *Eucalyptus* ?*calycogona* low open mallee woodland over *Melaleuca* sp. mid sparse shrubland over *Austrostipa hemipogon*, *Podolepis capillaris*, *Lobelia* sp. low sparse forbland. **Associated species:** N/A **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W12.5 (CAM02) **Location:** 753870 mE, 6444571 mN **Soil and Topography:** Orange sandy clay with laterite surface pebbles, slight slope **Structural:** *Eucalyptus oleosa* subsp. *oleosa*, *Eucalyptus burracoppinensis* low open mallee woodland over *Allocasuarina spinosissima*, *Hakea erecta*, *Petrophile stricta* mid shrubland over *Beaufortia schaueri*, *Verticordia plumosa* var. *brachyphylla*, *Melaleuca cordata* low open heathland. **Associated species:** *Leucopogon* sp., *Lepidosperma sanguinolentum* **Condition:** Excellent	
Site: W17.5 (CAM03) **Location:** 754893 mE, 6440726 mN **Soil and Topography:** Orange sandy clay with some surface crusting, flat **Structural:** *Eucalyptus* ?*calycogona*, *Eucalyptus cylindriflora*, *Eucalyptus* ?*tenuis* mid mallee woodland over *Daviesia benthamii* subsp. *acanthoclona*, *Daviesia argillacea*, *Melaleuca eleuterostachya* mid open shrubland over *Boronia inornata* subsp. *leptophylla*, *Acacia merrallii* low sparse heathland. **Associated species:** *Callitris* sp. **Condition:** Excellent	
Site: W14.5 (CAM04) **Location:** 760391 mE, 6439382 mN **Soil and Topography:** Orange-red sandy clay, flat **Structural:** *Eucalyptus* ?*tenuis*, *Eucalyptus prolixa* mid open mallee forest over *Santalum acuminatum*, *Dodonaea stenozyga*, *Daviesia scoparia* mid open shrubland over *Acacia camptoclada*, *Acacia erinacea* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W11.5 (CAM05) **Location:** 764472 mE, 6445019 mN **Soil and Topography:** Orange sandy clay with ironstone pebbles, flat **Structural:** *Eucalyptus flocktoniae* subsp. *flocktoniae* low open woodland over *Melaleuca pauperiflora* subsp. *fastigiata*, *Eremophila ionantha*, *Eremophila dempsteri* mid open shrubland over *Acacia erinacea*, *Asteraceae* sp. low sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W13.5 (CAM06) **Location:** 763288 mE, 6447100 mN **Soil and Topography:** Orange sandy clay, flat **Structural:** *Eucalyptus* spp. mid open mallee woodland over *Melaleuca* spp., *Acacia* sp. mid open shrubland over *Poaceae* sp. low sparse grassland and *Lepidosperma sanguinolentum* low sparse sedgeland. **Associated species:** N/A **Condition:** Excellent	
Site: W04.5 (CAM07) **Location:** 760201 mE, 6453532 mN **Soil and Topography:** Orange sandy clay with laterite pebbles, flat **Structural:** *Eucalyptus eremophila* mid mallee woodland over *Melaleuca eleuterostachya*, *Melaleuca lateriflora*, *Daviesia scoparia* mid shrubland over *Melaleuca* ?*condylosa* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W19.5 (CAM08) **Location:** 760239 mE, 6455577 mN **Soil and Topography:** Orange-cream sandy clay, flat **Structural:** *Eucalyptus* ?*oleosa, Eucalyptus* sp. low open mallee woodland over *Santalum* sp., *Allocasuarina acutivalvis*, *Melaleuca hamata* mid open shrubland over *Melaleuca* ?*condylosa*, *Baeckea elderiana*, *Thryptomene kochii* mid open heathland. **Associated species:** N/A **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W05.5 (CAM09) **Location:** 761546 mE, 6457583 mN **Soil and Topography:** Orange sandy clay, flat **Structural:** *Eucalyptus* spp. low open mallee woodland over *Santalum* sp., *Melaleuca* ?*condylosa*, *Melaleuca eleuterostachya* mid open shrubland over *Acacia merrallii* low isolated heath shrubs. **Associated species:** N/A **Condition:** Excellent	
Site: W21.5 (CAM10) **Location:** 761672 mE, 6459185 mN **Soil and Topography:** Orange sandy clay, flat **Structural:** *Eucalyptus* spp. low open mallee woodland over *Melaleuca* spp. low open shrubland. **Associated species:** N/A **Condition:** Excellent	
Site: W03.5 (CAM11) **Location:** 761747 mE, 6460364 mN **Soil and Topography:** Light orange sandy clay, flat **Structural:** *Eucalyptus* sp. low mallee woodland over *Allocasuarina acutivalvis*, *Acacia yorkrakinensis* subsp. *acrita*, *Acacia* sp. mid open shrubland over *Melaleuca* sp., *Baeckea elderiana* low sparse heathland. **Associated species:** *Hakea* sp. **Condition:** Excellent	
Site: W20.5 (CAM12) **Location: 762849 mE, 6461372 mN** **Soil and Topography:** Orange sandy clay, flat **Structural:** *Eucalyptus salmonophloia*, *Eucalyptus* sp. mid open woodland over *Acacia merrallii*, *Acacia erinacea* low open shrubland. **Associated species:** N/A **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W18.5 (CAM13) **Location:** 761463 mE, 6456159 mN **Soil and Topography:** Orange sandy clay, flat **Structural:** *Eucalyptus* spp. low open mallee woodland over *Melaleuca* spp., *Santalum* sp., *Acacia* sp. mid open shrubland over *Dodonaea stenozyga* low sparse heathland. **Associated species:** *Exocarpos aphyllus* **Condition:** Excellent	
Site: W15.5 (CAM14) **Location:** 762361 mE, 6439787 mN **Soil and Topography:** Orange sandy clay, flat **Structural:** *Eucalyptus salubris*, *Eucalyptus* sp. low woodland over *Melaleuca* spp., *Exocarpos aphyllus* mid open shrubland over *Dodonaea stenozyga*, *Acacia merrallii* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W06.5 (CAM15) **Location:** 763803 mE, 6442406 mN **Soil and Topography:** Orange sandy clay with ironstone pebbles, flat **Structural:** *Eucalyptus* spp. mid open mallee woodland over *Allocasuarina acutivalvis*, *Acacia fragilis*, *Santalum* sp. tall shrubland. **Associated species:** N/A **Condition:** Excellent	
Site: W01.5 (CAM16) **Location:** 758783 mE, 6451858 mN **Soil and Topography:** Orange-brown sandy clay with ironstone pebbles, flat **Structural:** *Eucalyptus salubris*, *Eucalyptus* sp. low woodland over *Melaleuca quadrifaria*, *Melaleuca* sp., *Exocarpos aphyllus* open shrubland over *Microcybe multiflora* subsp. *multiflora*, *Dodonaea bursariifolia* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W05.5 (CAM17) **Location:** 755589 mE, 6452055 mN **Soil and Topography:** Light orange sandy clay, flat **Structural:** *Eucalyptus* sp., *Santalum acuminatum* low open mallee woodland over *Melaleuca hamata*, *Acacia* ?*beauverdiana*, *Melaleuca acuminata* subsp. *acuminata* mid open shrubland over *Baeckea elderiana* low sparse heathland. **Associated species:** *Lepidosperma sanguinolentum* **Condition:** Excellent	
Site: W09.5 (CAM18) **Location:** 753973 mE, 6452106 mN **Soil and Topography:** Pale orange sandy clay, flat **Structural:** *Eucalyptus griffithsii*, *Eucalyptus* sp. low open mallee woodland over *Melaleuca eleuterostachya*, *Melaleuca* spp. mid open shrubland over *Acacia merrallii* low sparse heathland. **Associated species:** N/A **Condition:** Excellent	
Site: W22.5 (CAM19) **Location:** 758312 mE, 6450709 mN **Soil and Topography:** Orange-brown sandy clay with ironstone pebbles, flat **Structural:** *Eucalyptus eremophila*, *Eucalyptus* spp. mid open mallee woodland over *Melaleuca lateriflora*, *Melaleuca eleuterostachya*, *Melaleuca halmaturorum* mid shrubland over *Dodonaea stenozyga* low sparse heathland. **Associated species:** *Exocarpos aphyllus* **Condition:** Excellent	
Site: W08.5 (CAM20) **Location:** 758652 mE, 6448854 mN **Soil and Topography:** Light orange sandy clay with surface pebbles, flat **Structural:** *Eucalyptus* spp. low open mallee woodland over *Acacia* ?*beauverdiana*, *Allocasuarina acutivalvis*, *Melaleuca pauperiflora* subsp. *pauperiflora* tall shrubland over *Melaleuca cordata*, *Baeckea elderiana*, *Drummondita hassellii* mid sparse heathland. **Associated species:** N/A **Condition:** Excellent	

Appendix 3B (cont.)

Vegetation Description	Photograph
Site: W10.5 (CAM21) **Location:** 757483 mE, 6447340 mN **Soil and Topography:** Pale orange sandy clay with some small laterite pebbles, flat **Structural:** *Eucalyptus* ?*polita* low open mallee woodland over *Allocasuarina acutivalvis*, *Hakea francisiana*, *Acacia* ?*beauverdiana* tall shrubland over *Darwinia* sp. Karonie (K. Newbey 8503), *Baeckea elderiana*, *Hibbertia exasperata* low sparse heathland. **Associated species:** *Melaleuca eleuterostachya*, *Melaleuca pauperiflora* subsp. *pauperiflora*, *Melaleuca hamata* **Condition:** Excellent	
Site: W02.5 (CAM22) **Location:** 756879 mE, 6460002 mN **Soil and Topography:** Light orange-yellow sandy clay with laterite pebbles, flat **Structural:** *Eucalyptus burracoppinensis* low open mallee woodland over *Allocasuarina spinosissima*, *Acacia yorkrakinensis* subsp. *acrita*, *Melaleuca* sp. mid shrubland over *Drummondita hassellii*, *Verticordia plumosa* var. *brachyphylla*, *Melaleuca cordata* low open heathland. **Associated species:** *Petrophile stricta*, *Hakea erecta*, *Baeckea elderiana* **Condition:** Excellent	

Appendix 4. Cage Trap Transect Locations and Habitat.

Site	Zone	Easting	Northing	Burnt/Unburnt	Habitat
N.01	50H	750458	6452208	Unburnt	Mid shrubland of *Allocasuarina* and *Acacia* over low *Melaleuca* shrubland.
N.02	50H	750658	6452198	Unburnt	Sparse Mallee woodland over mid shrubland of *Allocasuarina*, *Hakea* and *Acacia* over low *Melaleuca* shrubland.
N.03	50H	750855	6452192	Unburnt	Sparse Mallee woodland over mid shrubland of *Allocasuarina*, *Hakea* and *Melaleuca* over low *Melaleuca* shrubland.
N.04	50H	751056	6452197	Unburnt	Sparse Mallee woodland over mid shrubland of *Allocasuarina* and *Hakea* over low *Melaleuca* shrubland.
N.05	50H	751254	6452192	Unburnt	Sparse Mallee woodland over mid shrubland of *Allocasuarina* and *Hakea* over low *Melaleuca* shrubland.
N.06	50H	751453	6452187	Unburnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina* and *Hakea* over low *Melaleuca* shrubland.
N.07	50H	751653	6452178	Unburnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Hakea* and *Acacia* over low *Melaleuca* shrubland.
N.08	50H	751854	6452176	Unburnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Acacia* and *Melaleuca* over low *Melaleuca* shrubland.
N.09	50H	752055	6452170	Unburnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Hakea* and *Melaleuca* over low *Melaleuca* shrubland.
N.10	50H	752256	6452165	Unburnt	Tall shrubland of *Allocasuarina* and *Acacia* over low *Melaleuca* shrubland.
N.11	50H	752455	6452162	Burnt	Tall shrubland of *Allocasuarina*.
N.12	50H	752654	6452153	Burnt	Tall shrubland of *Allocasuarina* and *Banksia*.
N.13	50H	752855	6452151	Burnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina* and *Hakea*.
N.14	50H	753053	6452145	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.15	50H	753266	6452141	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.16	50H	753467	6452133	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.17	50H	753668	6452127	Burnt (edge of unburnt)	Mallee woodland over mixed *Melaleuca* shrubland.
N.18	50H	753870	6452125	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.19	50H	754072	6452119	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.20	50H	754269	6452112	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.21	50H	754472	6452107	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.22	50H	754674	6452107	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.23	50H	754878	6452099	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland. Minor drainage.
N.24	50H	755078	6452092	Unburnt	Mallee woodland over shrubland of *Melaleuca*, *Acacia* and scattered Quandong. Minor drainage.
N.25	50H	755279	6452090	Unburnt	Sparse Mallee woodland over shrubland of *Melaleuca*, *Acacia* and scattered Quandong and *Callitris*. Minor drainage.

Appendix 4. (cont.)

Site	Zone	Easting	Northing	Burnt/Unburnt	Habitat
N.26	50H	755480	6452083	Unburnt	Sparse Mallee woodland over shrubland of *Melaleuca*, *Acacia* and scattered *Callitris*.
N.27	50H	755680	6452077	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.28	50H	755909	6452070	Burnt	Sparse Mallee woodland over mixed *Melaleuca* shrubland.
N.29	50H	756108	6452062	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.30	50H	756308	6452060	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.31	50H	756512	6452056	Burnt	Sparse low Mallee woodland over tall shrubland of *Acacia*, *Banksia* and *Allocasuarina*.
N.32	50H	756739	6452053	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.33	50H	756971	6452045	Burnt	Mallee woodland over mixed *Melaleuca* shrubland with scattered *Acacia* and *Allocasuarina*.
N.34	50H	757189	6452036	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.35	50H	757394	6452033	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.36	50H	757595	6452028	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.37	50H	757800	6452016	Burnt (edge of unburnt)	Mallee woodland over mixed *Melaleuca* shrubland.
N.38	50H	757995	6451949	Burnt (edge of unburnt)	Mallee woodland over mixed *Melaleuca* shrubland.
N.39	50H	758133	6451796	Burnt (edge of unburnt)	Mallee woodland over mixed *Melaleuca* shrubland with scattered *Allocasuarina*.
N.40	50H	758327	6451875	Burnt (edge of unburnt)	Mallee woodland over mixed *Melaleuca* shrubland.
N.41	50H	758533	6451857	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.42	50H	758733	6451851	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.43	50H	758929	6451821	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
N.44	50H	759138	6451793	Burnt	Mallee woodland over mixed *Melaleuca* shrubland with scattered *Allocasuarina* and *Acacia*.
N.45	50H	759340	6451805	Burnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Hakea* and *Acacia*.
N.46	50H	759522	6451727	Burnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Hakea* and *Acacia*.
N.47	50H	759662	6451589	Burnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Hakea* and *Acacia*.
N.48	50H	759793	6451439	Burnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Hakea* and *Acacia*.
N.49	50H	759992	6451424	Burnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Hakea* and *Acacia*.
N.50	50H	760191	6451378	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.

Appendix 4. (cont.)

Site	Zone	Easting	Northing	Burnt/Unburnt	Habitat
S.01	50H	758038	6442163	Unburnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Acacia* and *Hakea*.
S.02	50H	758239	6442159	Unburnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Acacia* and *Banksia*.
S.03	50H	758255	6442354	Unburnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Acacia* and *Hakea*.
S.04	50H	758456	6442366	Unburnt	Sparse Mallee woodland over tall shrubland of *Allocasuarina*, *Acacia* and *Hakea* over low *Melaleuca* shrubland.
S.05	50H	758655	6442374	Unburnt	Sparse Mallee woodland over shrubland of *Allocasuarina* and *Melaleuca* with scattered *Callitris*.
S.06	50H	758858	6442375	Unburnt	Sparse Mallee woodland over shrubland of *Banksia*, *Allocasuarina*, *Acacia*, *Melaleuca* and *Hakea*.
S.07	50H	759059	6442374	Unburnt	Sparse Mallee woodland over shrubland of *Allocasuarina* and *Melaleuca* over low mixed shrubland.
S.08	50H	759261	6442376	Unburnt	Sparse Mallee woodland over shrubland of *Allocasuarina*, *Banksia* and *Acacia* over low mixed shrubland.
S.09	50H	759371	6442199	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.10	50H	759371	6441989	Burnt (edge of unburnt)	Sparse Mallee woodland over shrubland of *Allocasuarina*, *Acacia* and *Melaleuca*.
S.11	50H	759371	6441786	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.12	50H	759374	6441586	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.13	50H	759375	6441386	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.14	50H	759379	6441193	Unburnt	Sparse Mallee woodland over shrubland of *Allocasuarina*, *Acacia* and *Melaleuca*.
S.15	50H	759377	6440992	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.16	50H	759376	6440793	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland with scattered *Allocasuarina* (on edge of shrubland).
S.17	50H	759376	6440590	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.18	50H	759378	6440392	Unburnt	Mallee woodland with scattered Salmon Gum over mixed *Melaleuca* shrubland.
S.19	50H	759378	6440195	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.20	50H	759383	6439999	Unburnt	Sparse Mallee woodland over shrubland of *Allocasuarina, Hakea* and *Melaleuca* with scattered *Callitris*.
S.21	50H	759381	6439797	Unburnt	Sparse Mallee woodland over shrubland of *Allocasuarina, Hakea* and *Melaleuca* over low Melaleuca shrubland.
S.22	50H	759385	6439600	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.23	50H	759386	6439398	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.24	50H	759386	6439190	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.25	50H	759372	6438976	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.

Appendix 4. (cont.)

Site	Zone	Easting	Northing	Burnt/Unburnt	Habitat
S.26	50H	759279	6438777	Burnt	Sparse Mallee woodland over shrubland of *Allocasuarina, Hakea, Acacia* and *Melaleuca.*
S.27	50H	759184	6438599	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.28	50H	759021	6438485	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.29	50H	758850	6438377	Burnt	Open Salmon Gum woodland over Mallee over mixed *Melaleuca* shrubland.
S.30	50H	758666	6438299	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.31	50H	758497	6438208	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.32	50H	758308	6438161	Burnt	Sparse Mallee woodland over shrubland of *Allocasuarina, Acacia* and *Melaleuca.*
S.33	50H	758104	6438157	Burnt	Sparse Mallee woodland over shrubland of *Allocasuarina* and *Melaleuca.*
S.34	50H	757893	6438155	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.35	50H	757702	6438055	Burnt	Sparse Mallee woodland over shrubland of *Melaleuca*, *Hakea* and *Allocasuarina*.
S.36	50H	757572	6437901	Burnt	Open tall ecualypt woodland over Mallee over shrubland of *Hakea*, *Melaleuca* and *Allocasuarina*.
S.37	50H	757552	6437687	Burnt	Tall eucalypt woodland over degraded open *Melaleuca* shrubland.
S.38	50H	757522	6437471	Burnt	Mallee woodland over mixed *Melaleuca* shrubland.
S.39	50H	757489	6437241	Burnt	Mallee woodland over shrubland of *Melaleuca*, *Allocasuarina* and *Acacia*.
S.40	50H	757493	6437025	Burnt	Mallee woodland with scattered tall eucalypts over mixed *Melaleuca* shrubland.
S.41	50H	757499	6436821	Unburnt	Mallee woodland over mixed *Melaleuca* shrubland with scattered Quandong.
S.42	50H	757507	6436622	Unburnt	Open tall eucalypt woodland over Mallee over mixed shrubland of *Dodonaea*, *Melaleuca*, *Eremophila* and Quandong.
S.43	50H	757512	6436416	Unburnt	Open tall eucalypt woodland over Mallee woodland over shrubland of *Melaeuca* and *Eremophila*.
S.44	50H	757516	6436217	Unburnt	Open tall eucalypt woodland over Mallee over mixed shrubland of *Melaleuca*, *Eremophila* and Quandong.
S.45	50H	757523	6436001	Unburnt	Open tall eucalypt woodland over Mallee woodland over shrubland of *Melaeuca*, *Exocarpus* and *Eremophila*.
S.46	50H	757528	6435790	Unburnt	Mallee woodland over shrubland of *Melaeuca*, *Exocarpus* and *Eremophila*.
S.47	50H	757536	6435580	Unburnt	Mallee woodland over shrubland of *Melaeuca*, *Exocarpus* and *Eremophila*.
S.48	50H	757537	6435389	Unburnt	Mallee woodland over shrubland of *Melaeuca* and *Eremophila*.
S.49	50H	757544	6435190	Unburnt	Mallee woodland over shrubland of *Melaeuca*, *Exocarpus* and *Eremophila*.
S.50	50H	757549	6434994	Unburnt	Mallee woodland over shrubland of *Melaeuca* and *Eremophila*.

Appendix 5. Fauna Recorded or Potentially Occurring in the Development Envelope.

Appendix 5A. Frogs

Key to records:
Dev. envelope = species recorded in the Development Envelope, October 2016 – November 2017 by Western Wildlife.
Regional = species recorded in the wider region, October 2016 – November 2017 by Western Wildlife.
WAM = species records from the Western Australian Museum Database (see Table 1).
FSDB = species records from the Fauna Survey Database (see Table 1).
Jilbadji = species recorded in 1980 - 1981 in Jilbadji Nature Reserve (Keighery *et al*. 1995).
Flying Fox = species recorded at Flying Fox Mine in 2005 (Biota 2006).
Spotted Quoll + species recorded on the Spotted Quoll haul road in 2009 (Biota 2010).
DBCA = species records from the DBCAThreatened and Priority Species Database (see Table 1).
EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 1).

Species		Conservation significance	Records								
			Dev. envelope	Regional	WAM	FSDB	Jilbadji	Flying Fox	Spotted Quoll	DBCA	EPBC
Limnodynastidae (ground frogs)											
Western Spotted Frog	*Heleioporus albopunctatus*										
Banjo Frog	*Limnodynastes dorsalis*										
White-footed Trilling Frog	*Neobatrachus albipes*					+					
Kunapalari Frog	*Neobatrachus kunapalari*					+	+				
Humming Frog	*Neobatrachus pelobatoides*				+						
Shoemaker Frog	*Neobatrachus sutor*				+						
Myobatrachidae (ground frogs)											
Bleating Froglet	*Crinia pseudinsignifera*				+	+					
Gunter's Toadlet	*Pseudophryne guentheri*										
Western Toadlet	*Pseudophryne occidentalis*		+		+		+				
Number of frog species:		**9 predicted, 1 recorded**									

Appendix 5B. Reptiles

Key to records:
Dev. envelope = species recorded in the Development Envelope, October 2016 – November 2017 by Western Wildlife.
Regional = species recorded in the wider region, October 2016 – November 2017 by Western Wildlife.
WAM = species records from the Western Australian Museum Database (see Table 1).
FSDB = species records from the Fauna Survey Database (see Table 1).
Jilbadji = species recorded in 1980 - 1981 in Jilbadji Nature Reserve (Keighery *et al*. 1995).
Flying Fox = species recorded at Flying Fox Mine in 2005 (Biota 2006).
Spotted Quoll + species recorded on the Spotted Quoll haul road in 2009 (Biota 2010).
DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 1).
EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 1).

Species		Conservation significance	Records								
			Dev. envelope	Regional	WAM	FSDB	Jilbadji	Flying Fox	Spotted Quoll	DBCA	EPBC
Carphodactylidae (knob-tailed geckoes)											
Spotted Knob-tail	*Nephrurus stellatus*	CS3		+	+		+				
Southern Barking Gecko	*Underwoodisaurus milii*		+		+		+		+		
Diplodactylidae (ground geckos)											
Clawless Gecko	*Crenadactylus ocellatus*		+	+	+		+	+	+		
South Coast Gecko	*Diplodactylus calcicolus*			+							
Wheatbelt Ground Gecko	*Diplodactylus granariensis*		+	+	+		+	+	+		
	Diplodactylus pulcher						+	+			
Reticulated Velvet Gecko	*Hesperoedura reticulata*			+	+		+	+			
Main's Gecko	*Lucasium maini*			+	+		+	+	+		
Goldfield's Spiny-tailed Gecko	*Strophurus assimilis*						+				
Western Spiny-tailed Gecko	*Strophurus spinigerus*			+	+						
Gekkonidae (geckoes)											
Tree Dtella	*Gehyra variegata*		+	+	+		+	+	+		
Bynoe's Gecko	*Heteronotia binoei*						+				
Pygopodidae (legless-lizards)											
	Delma australis		+	+			+	+			
	Delma butleri										
Fraser's Legless Lizard	*Delma fraseri*		+	+	+			+	+		
Burton's Legless-Lizard	*Lialis burtonis*							+	+		
Common Scaly-foot	*Pygopus lepidopodus*		+	+				+			
Agamidae (dragon lizards)											
Eastern Heath Dragon	*Ctenophorus chapmani*				+						
Crested Dragon	*Ctenophorus cristatus*		+	+	+		+	+	+		
Ornate Crevice Dragon	*Ctenophorus ornatus*				+						
Spotted Military Dragon	*Ctenophorus maculatus*		+	+	+		+	+	+		
Salt Pan Dragon	*Ctenophorus salinarum*			+	+		+				
Thorny Devil	*Moloch horridus*		+	+			+	+			
Bearded Dragon	*Pogona minor*		+	+	+		+	+	+		
Scincidae (skinks)											
Fence Skink	*Cryptoblepharus buchananii*		+	+	+		+	+	+		
	Ctenotus atlas		+		+		+				
Odd-striped Ctenotus	*Ctenotus impar*		+		+			+			
	Ctenotus mimetes		+								
	Ctenotus schomburgkii		+	+			+	+	+		
	Ctenotus uber		+	+			+				

Appendix 5B. (cont.)

Species		Conservation significance	Records								
			Dev. envelope	Regional	WA Museum	FSDB	Jilbadji	Flying Fox	Spotted Quoll	DBCA	EPBC
Scincidae (cont.)											
Slender Blue-tongue	*Cyclodomorphus melanops*				+		+				
	Egernia richardi		+	+	+		+	+			
	Hemiergis initialis		+				+	+	+		
	Lerista distinguenda		+	+					+		
	Lerista kingi		+				?				
	Lerista picturata						+	+	+		
	Lerista timida						?				
Desert Skink	*Liopholis inornata*				+						
	Liopholis multiscutata		+								
Dwarf Skink	*Menetia greyii*		+	+			+				
	Morethia butleri		+	+			+				
Dusky Morethia	*Morethia obscura*		+	+	+		+	+	+		
Western Blue-tongue	*Tiliqua occipitalis*		+	+			+				
Bobtail	*Tiliqua rugosa*		+	+				+	+		
Varanidae (monitor-lizards)											
Gould's Monitor	*Varanus gouldii*		+	+	+		+		+		
Southern Heath Monitor	*Varanus rosenbergi*		+	+							
Black-tailed Tree Monitor	*Varanus tristis*										
Pythonidae (Australian pythons)											
Stimson's Python	*Antaresia stimsoni*										
Woma	*Aspidites ramsayi*	CS2			+					+	
Carpet Python	*Morelia spilota*			+							
Typhlopidae (blind-snakes)											
Southern Blind Snake	*Anilios australis*		+					+	+		
Dark-spined Blind Snake	*Anilios bicolor*										
Prong-snouted Blind Snake	*Anilios bituberculatus*		+								
	Anilios hamatus										
	Anilios waitii										
Elapidae (front-fanged snakes)											
Southern Shovel-nosed Snake	*Brachyurophis semifasciatus*						+				
Bardick	*Echiopsis curta*										
Black-naped Snake	*Neelaps bimaculatus*										
Lake Cronin Snake	*Paroplocephalus atriceps*	CS2			+					+	
Gould's Hooded Snake	*Parasuta gouldii*				+			+			
Black-backed Snake	*Parasuta nigriceps*							+			
Mulga Snake	*Pseudechis australis*										
Dugite	*Pseudonaja affinis*		+	+				+	+		
Ringed Brown Snake	*Pseudonaja modesta*										
Gwardar / Western Brown Snake	*Pseudonaja mengdeni*				+						
Jan's Banded Snake	*Simoselaps bertholdi*			+				+	+		
Rosen's Snake	*Suta fasciata*						+				
Number of reptile species:		**67 predicted, 32 recorded**									

Appendix 5C. Birds

Key to records:
Dev. envelope = species recorded in the Development Envelope, October 2016 – November 2017 by Western Wildlife.
Regional = species recorded in the wider region, October 2016 – November 2017 by Western Wildlife.
Birds Aust. = species records from the Birds Australia Atlas Database (see Table 1).
WAM = species records from the Western Australian Museum Database (see Table 1).
FSDB = species records from the Fauna Survey Database (see Table 1).
Jilbadji = species recorded in 1980 - 1981 in Jilbadji Nature Reserve (Keighery *et al*. 1995).
Flying Fox = species recorded at Flying Fox Mine in 2005 (Biota 2006).
Spotted Quoll + species recorded on the Spotted Quoll haul road in 2009 (Biota 2010).
DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 1).
EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 1).

Species	Conservation significance	Records									
		Dev. envelope	Regional	Birds Aust.	WA Museum	FSDB	Jilbadji	Flying Fox	Spotted Quoll	DBCA	EPBC
Dromaiidae (emus)											
Emu *Dromaius novaehollandiae*		+	+	+		+	+	+	+		
Anatidae (ducks, pygmy-geese & swan)											
Black Swan *Cygnus atratus*			+								
Grey Teal *Anas gracilis*		+									
Megapodiidae (mound-builders)											
Malleefowl *Leipoa ocellata*	CS1	+	+	+		+	+		+	+	+
Phasianidae (pheasants and quails)											
Stubble Quail *Coturnix pectoralis*											
Accipitridae (kites, hawks and eagles)											
Black-shouldered Kite *Elanus caeruleus*											
Square-tailed Kite *Hamiostra isura*		+					+	+			
Whistling Kite *Haliastur sphenurus*		+									
Spotted Harrier *Circus assimilis*		+									
Brown Goshawk *Accipiter fasciatus*											
Collared Sparrowhawk *Accipiter cirrocephalus*		+						+			
Wedge-tailed Eagle *Aquila audax*		+		+				+	+		
Little Eagle *Hieraaetus morphnoides*			+	+			+				
Turnicidae (button-quails)											
Painted Button-quail *Turnix varia*		+									
Little Button-quail *Turnix velox*		+							+		
Charadriidae (lapwings and plovers)											
Banded Lapwing *Vanellus tricolor*											
Columbidae (pigeons and doves)											
Common Bronzewing *Phaps chalcoptera*		+	+	+		+		+	+		
Brush Bronzewing *Phaps elegans*		+	+					+			
Crested Pigeon *Ocyphaps lophotes*				+							
Cuculidae (cuckoos)											
Pallid Cuckoo *Cacomantis pallidus*		+					+		+		
Fan-tailed Cuckoo *Cacomantis flabelliformis*		+		+							
Black-eared Cuckoo *Chrysococcyx osculans*			+			+	+				
Horsfield's Bronze-Cuckoo *Chrysococcyx basalis*		+	+			+	+				
Tytonidae (barn owls)											
Eastern Barn Owl *Tyto alba*											

Appendix 5C. (cont.)

Species		Conservation significance	Records									
			Dev. envelope	Regional	Birds Aust.	WA Museum	FSDB	Jilbadji	Flying Fox	Spotted Quoll	DBCA	EPBC
Strigidae (hawk-owls)												
Southern Boobook Owl	*Ninox boobook*		+					+				
Podargidae (frogmouths)												
Tawny Frogmouth	*Podargus strigoides*		+						+			
Caprimulgidae (nightjars)												
Spotted Nightjar	*Eurostopodus argus*		+	+	+			+				
Aegothelidae (owlet-nightjars)												
Australian Owlet-Nightjar	*Aegotheles cristatus*		+		+			+	+			
Apodidae (swifts)												
Fork-tailed Swift	*Apus pacificus*	CS1									+	+
Alcedinidae (forest kingfishers)												
Red-backed Kingfisher	*Todiramphus pyrrhopygius*							+				
Sacred Kingfisher	*Todiramphus sanctus*		+		+							
Meropidae (bee-eaters)												
Rainbow Bee-eater	*Merops ornatus*	CS1	+		+			+	+		+	+
Falconidae (falcons)												
Peregrine Falcon	*Falco peregrinus*	CS1	+		+			+			+	
Australian Hobby	*Falco longipennis*											
Brown Falcon	*Falco berigora*		+	+					+			
Australian Kestrel	*Falco cenchroides*		+	+	+				+			
Cacatuidae (cockatoos)												
Carnaby's Black-Cockatoo	*Calyptorhyncus latirostris*	CS1							+	+	+	
Galah	*Cacatua roseicapilla*		+		+				+			
Psittacidae (lorikeets & parrots)												
Purple-crowned Lorikeet	*Parvipsitta porphyrocephala*		+	+			+	+	+			
Regent Parrot	*Polytelis anthopeplus*		+		+			+	+	+		
Australian Ringneck	*Platycercus zonarius*		+	+	+			+	+	+		
Inland Western Rosella	*Platycercus icterotis*	CS2	+	+	+			+	+		+	
Mulga Parrot	*Platycercus varius*									+		
Elegant Parrot	*Neophema elegans*		+	+	+				+	+		
Climacteridae (treecreepers)												
Rufous Treecreeper	*Climacteris rufus*		+	+				+	+			
Maluridae (fairy-wrens)												
Splendid Fairy-wren	*Malurus splendens*											
Blue-breasted Fairy-wren	*Malurus pulcherrimus*		+	+	+		+	+	+	+		
White-winged Fairy-wren	*Malurus leucopterus*											
Meliphagidae (honeyeaters)												
Red Wattlebird	*Anthochaera carunculata*		+	+	+		+	+	+	+		
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*		+	+	+		+	+	+			
Yellow-throated Miner	*Manorina flavigula*		+	+	+				+			
Purple-gaped Honeyeater	*Lichenostomus cratitius*		+	+		+	+		+			
Singing Honeyeater	*Gavicalis virescens*		+	+			+		+	+		
White-eared Honeyeater	*Lichenostomus leucotis*		+	+			+	+	+	+		
Yellow-plumed Honeyeater	*Ptilotula ornata*		+	+				+	+	+		

Appendix 5C. (cont.)

Species		Conservation significance	Records									
			Dev. envelope	Regional	Birds Aust.	WA Museum	FSDB	Jilbadji	Flying Fox	Spotted Quoll	DBCA	EPBC
Meliphagidae (honeyeaters)												
Brown-headed Honeyeater	*Melithreptus brevirostris*		+	+	+		+	+	+	+		
Brown Honeyeater	*Lichmera indistincta*		+	+	+		+		+	+		
New Holland Honeyeater	*Phylidonyris novaehollandiae*				+							
White-cheeked Honeyeater	*Phylidonyris nigra*		+									
White-fronted Honeyeater	*Purnella albifrons*		+	+	+		+	+	+	+		
Tawny-crowned Honeyeater	*Glyciphila melanops*		+	+			+	+	+			
Pied Honeyeater	*Certhionyx variegatus*							+				
White-fronted Chat	*Epthianura albifrons*							+				
Pardalotidae (pardalotes)												
Spotted Pardalote	*Pardalotus punctatus*		+	+	+				+	+		
Striated Pardalote	*Pardalotus striatus*		+	+	+			+	+			
Acanthizidae (thornbills, gerygones & allies)												
White-browed Scrubwren	*Sericornis frontalis*		+	+								
Shy Heathwren	*Calomanthus cautus*		+	+					+	+		
Redthroat	*Pyrrholaemus brunneus*		+	+	+			+	+			
Weebill	*Smicrornis brevirostris*		+	+	+		+	+	+	+		
Western Gerygone	*Gerygone fusca*		+									
Inland Thornbill	*Acanthiza apicalis*		+	+	+		+	+	+	+		
Chestnut-rumped Thornbill	*Acanthiza uropygialis*				+			+				
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		+	+				+	+			
Pomatostomidae (Australian babblers)												
White-browed Babbler	*Pomatostomus superciliosus*		+	+	+			+	+	+		
Psophodidae (whipbirds, wedgebills and quail-thrush)												
Chestnut (Copper-back) Quail-Thrush	*Cinclosoma clarum*		+	+			+	+	+			
Artamidae (woodswallows)												
Masked Woodswallow	*Artamus personatus*							+				
Black-faced Woodswallow	*Artamus cinereus*			+			+	+	+			
Dusky Woodswallow	*Artamus cyanopterus*		+	+	+			+	+			
Cracticidae (butcherbirds, currawongs & magpie)												
Grey Butcherbird	*Cracticus torquatus*		+	+	+			+	+	+		
Pied Butcherbird	*Cracticus nigrogularis*							+	+			
Australian Magpie	*Cracticus tibicen*								+			
Grey Currawong	*Strepera versicolor*		+	+	+		+	+	+	+		
Campephagidae (cuckoo-shrikes and trillers)												
Ground Cuckoo-shrike	*Coracina maxima*											
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		+	+	+		+	+	+	+		
White-winged Triller	*Lalage tricolor*			+					+			
Neosittidae (sittellas)												
Varied Sittella	*Daphoenositta chrysoptera*			+	+			+				
Oreoicidae (bellbird)												
Crested Bellbird	*Oreoica gutturalis*		+	+			+	+	+	+		

Appendix 5C. (cont.)

Species	Conservation significance	Records									
		Dev. envelope	Regional	Birds Aust.	WA Museum	FSDB	Jilbadji	Flying Fox	Spotted Quoll	DBCA	EPBC
Pachycephalidae (whistlers)											
Crested Shrike-tit *Falcunculus frontatus*											
Gilbert's Whistler *Pachycephala inornata*		+					+				
Western Golden Whistler *Pachycephala occidentalis*		+	+				+	+	+		
Rufous Whistler *Pachycephala rufiventris*		+		+			+		+		
Grey Shrike-thrush *Colluricincla harmonica*		+	+	+		+	+	+	+		
Rhipiduridae (wagtails and fantails)											
Grey Fantail *Rhipidura albiscapa*		+		+			+	+			
Willie Wagtail *Rhipidura leucophrys*		+	+	+			+	+			
Monarchidae (monarchs and flycatchers)											
Magpie-lark *Grallina cyanoleuca*									+		
Restless Flycatcher *Myiagra inquieta*		+									
Corvidae (ravens and crows)											
Australian Raven *Corvus coronoides*		+		+				+	+		
Little Crow *Corvus bennetti*											
Petroicidae (Australian robins)											
Jacky Winter *Microeca fascinans*		+		+			+	+	+		
Hooded Robin *Melanodryas cucullata*			+	+							
Red-capped Robin *Petroica goodenovii*		+	+	+			+		+		
Western Yellow Robin *Eopsaltria australis griseogularis*		+	+			+	+	+	+		
Southern Scrub-robin *Drymodes brunneopygia*		+	+	+		+	+	+	+		
Hirundinidae (swallows)											
White-backed Swallow *Cheramoeca leucosterna*		+		+							
Welcome Swallow *Hirundo neoxena*		+									
Tree Martin *Petrochelidon nigricans*		+	+	+		+	+	+			
Locustellidae (Old World warblers, songlarks & grassbirds)											
Rufous Songlark *Megalurus mathewsi*											
Zosteropidae (white-eyes)											
Silvereye *Zosterops lateralis*				+				+			
Dicaeidae (flower-peckers)											
Mistletoebird *Dicaeum hirundinaceum*		+					+				
Motacillidae (pipits and true wagtails)											
Australian Pipit *Anthus australis*		+					+		+		
Number of bird species:		**110 predicted, 77 recorded**									

Appendix 5D. Mammals.

Key to records:
Dev. envelope = species recorded in the Development Envelope, October 2016 – November 2017 by Western Wildlife.
Regional = species recorded in the wider region, October 2016 – November 2017 by Western Wildlife.
WAM = species records from the Western Australian Museum Database (see Table 1).
FSDB = species records from the Fauna Survey Database (see Table 1).
Jilbadji = species recorded in 1980 - 1981 in Jilbadji Nature Reserve (Keighery *et al*. 1995).
Flying Fox = species recorded at Flying Fox Mine in 2005 (Biota 2006).
Spotted Quoll = species recorded on the Spotted Quoll haul road in 2009 (Biota 2010).
DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 1).
EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 1).
Int. = introduced species.

Species		Conservation significance	Records								
			Dev. envelope	Regional	WAM	FSDB	Jilbadji	Flying Fox	Spotted Quoll	DBCA	EPBC
Tachyglossidae (echidnas)											
Echidna	*Tachyglossus aculeatus*		+	+			+				
Dasyuridae (carnivorous marsupials)											
Chuditch	*Dasyurus geoffroii*	CS1	+	+				+	+	+	
Southern Ningaui	*Ningaui yvonneae*			+			+				
Red-tailed Phascogale	*Phascogale calura*	CS1								+	
Fat-tailed Dunnart	*Sminthopsis crassicaudata*										
Little Long-tailed Dunnart	*Sminthopsis dolichura*		+	+			+				
Gilbert's Dunnart	*Sminthopsis gilberti*			+				+	+		
White-tailed Dunnart	*Sminthopsis granulipes*		+	+			+	+	+		
Ooldea Dunnart	*Sminopsis ooldea*			+							
Burramyidae (pygmy possums)											
Western Pygmy Possum	*Cercartetus concinnus*		+	+			+	+	+		
Macropodidae (kangaroos and wallabies)											
Euro	*Macropus robustus*										
Western Brush Wallaby	*Macropus irma*	CS2	+	+				+		+	
Western Grey Kangaroo	*Macropus fuliginosus*		+	+	+		+	+	+		
Muridae (rodents)											
House Mouse	*Mus musculus*	Int.	+	+			+	+	+		
Mitchell's Hopping-Mouse	*Notomys mitchellii*		+	+			+	+	+		
Bolam's Mouse	*Pseudomys bolami*						+				
Ash-grey Mouse	*Pseudomys albocinereus*		+					+	+		
Sandy Inland Mouse	*Pseudomys hermannsburgensis*						+				
Molossidae (free-tailed bats)											
White-striped Free-tailed Bat	*Austronomus australis*		+	+			+	+			
Western Free-tailed Bat	*Ozimops kitcheneri*		+	+			+				
Inland Free-tailed Bat	*Ozimops petersi*										

Appendix 5D. (cont.)

Species		Conservation significance	Records								
			Dev. envelope	Regional	WAM	FSDB	Jilbadji	Flying Fox	Spotted Quoll	DBCA	EPBC
Vespertilionidae (evening bats)											
Gould's Wattled Bat	*Chalinolobus gouldii*		+	+			+	+			
Chocolate Wattled Bat	*Chalinolobus morio*		+				+	+			
Lesser Long-eared Bat	*Nyctophilus geoffroyi*						+				
Central Long-eared Bat	*Nyctophilus major tor*	CS2					+				
Inland Broad-nosed Bat	*Scotorepens balstoni*			+							
Inland Forest Bat	*Vespadelus baverstocki*		+	+							
Southern Forest Bat	*Vespadelus regulus*		+	+	+		+				
Canidae (dogs and foxes)											
Dingo / Dog	*Canis dingo/lupus*	Int.		+							
Fox	*Vulpes vulpes*	Int.		+		+			+		
Felidae (cats)											
Feral Cat	*Felis catus*	Int.	+	+		+		+	+		
Leporidae (rabbits)											
European Rabbit	*Oryctolagus cuniculus*	Int.	+	+			+	+	+		
Number of mammal species:		**32 predicted, 18 recorded**									

Appendix 6. EPBC Act Protected Matters Search Tool Results

Species listed for the area within a 30km radius of 32°05'37"S, 119°44'53"E.

Species	Status	Author's Comment
Curlew Sandpiper *Calidris ferruginea*	Critically Endangered & Migratory	Unlikely to occur on site - lack of suitable habitat.
Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*	Endangered	Low likelihood of occurrence - study area on or beyond current eastern edge of the range of this species.
Malleefowl *Leipoa ocellata*	Vulnerable & Migratory	Known to occur in the study area.
Night Parrot *Pezoporus occidentalis*	Endangered	Unlikely to occur on site - lack of suitable habitat.
Chuditch *Dasyurus geoffroii*	Vulnerable	Known to occur in the study area.
Red-tailed Phascogale *Phascogale calura*	Vulnerable	Low likelihood of occurrence - lack of favoured habitat types, few records in the region
Fork-tailed Swift *Apus pacificus*	Migratory (marine)	May overfly site.
Grey Wagtail *Motacilla cinerea*	Migratory (terrestrial)	Unlikely to occur on site - lack of suitable habitat.

Appendix 7. DBCA Threatened and Priority Fauna Database Results

Species listed for the area within a 90km radius of 50H 759300 E, 6448700 N.

Key to Method: Sight. = sighting, DS = day sighting, NS = night sighting, DuS = Dusk sighting, DaS = Dawn sighting, Hist. = historical record, Spec. = specimen, Obs. = observational, C/T = caught or trapped, ? = unknown.

Certainty	Method	Count	Locality	Site	Year
***Aganippe castellum* - Tree-stem Trapdoor Spider**					**Priority 4**
WAM	Spec.	1	Marvel Loch		2007
Certain	DS	6	Skeleton Rock	Skeleton Rocks access road east, between Dunbar Rd and King Ingrahm Rd.	2009
Certain	DS	2	Skeleton Rock	Skeleton Rocks east access track, between Dunbar Rd and King Ingrahm Rd.	2009
***Apus pacificus* - Fork-tailed Swift**					**Schedule 5 (Migratory Birds listed under International Agreement)**
Certain	Hist.	1	Forrestania	Site details not provided, unable to verify coordinates.	1976
Certain	Hist.	50	Forrestania	Site details not provided, unable to verify coordinates.	1996
Certain	Hist.	30	Forrestania	Site details not provided, unable to verify coordinates.	1996
Certain	Hist.	30	Forrestania	Site details not provided, unable to verify coordinates.	1996
Certain	Hist.	30	Forrestania	Site details not provided, unable to verify coordinates.	1996
***Aspidites ramsayi* (southwest subpop.) – Woma**					**Priority 1**
WAM	Spec.	1	Ghooli	YELLOWDINE	0
WAM	Spec.	1	Ghooli	YELLOWDINE	0
WAM	Spec.	1	Marvel Loch	MARVEL LOCH	0
WAM	Spec.	1	Yellowdine	KARALEE	0
***Calidris acuminata* - Sharp-tailed Sandpiper**					**Schedule 5 (Birds listed under International Agreement)**
WAM	Spec.	1	Forrestania	Lake Cronin, 2 km N of Saltlake	1978
Moderately	Obs	1	Forrestania		1978
***Calyptorhynchus baudinii* - Baudin's Black-Cockatoo**					**Schedule 2 (Endangered)**
Moderately	Obs	1	Forrestania		1977
Moderately	Obs	1	Forrestania		1978
Moderately	Obs	1	Forrestania		1979
Moderately	Obs	1	Forrestania		1979
Moderately	Obs	1	Forrestania		1981
Moderately	Obs	1	Forrestania		1981
Moderately	Obs	1	Hyden		1980
Moderately	Obs	1	West Holleton		1978
***Calyptorhynchus latirostris* - Carnaby's Black-Cockatoo**					**Schedule 2 (Endangered)**
Certain	?	0	Forrestania	Lake Cronin	1979
Certain	?	0	Forrestania	Emu Rock	1981
Certain	DS	2	Forrestania	25 km W Forrestania Cross Roads	1983
Moderately	Obs	1	Forrestania	Forrestania Mine	2000
Certain	DS	6	Forrestania	Flying Fox nickel sulphide box cut mine East Hyden. FR12	2005
Moderately	Obs.	1	Forrestania	Forrestiana Plot	2006
Certain	C/T	20	Forrestania	DR06 - Diggers South nickel sulphide mine, east of Hyden	2006
Certain	C/T	3	Forrestania	DR10 - Diggers South nickel sulphide mine, east of Hyden	2006
Certain	survey	3	Forrestania	Forrestania, SQH04	2009
Certain	survey	2	Forrestania	Forrestiana, FNO/17 - sighting	2015
Certain	survey	4	Forrestania	Forrestiana, FNO/21 - sighting	2015
Certain	survey	0	Forrestania	Forrestiana, FNO/18 - heard calls	2015
Certain	survey	1	Forrestania	Forrestiana, FNO/16 - sighting	2015
Certain	survey	2	Forrestania	Forrestiana, FNO/20 - sighting	2015

Appendix 7. (cont.)

Certainty	Method	Count	Locality	Site	Year
***Calyptorhynchus latirostris* - Carnaby's Black-Cockatoo**					**Schedule 2 (Endangered)**
Certain	survey	1	Forrestania	Forrestiana, FNO/14 - sighting	2015
Certain	survey	2	Forrestania	Forrestiana, FNO/22 - sighting	2015
Certain	survey	0	Forrestania	Forrestiana, FNO/23 - heard calls	2015
Certain	survey	6	Forrestania	Forrestiana, FNO/24 - sighting	2015
Certain	survey	4	Forrestania	Forrestiana, FNO/25 - sighting	2015
Certain	survey	2	Forrestania	Forrestiana, FNO/26 - sighting	2015
Certain	survey	10	Forrestania	Forrestiana, FNO/15 - sighting	2015
Certain	survey	4	Forrestania	Forrestiana, FNO/19 - sighting	2015
Certain	Sight.	2	Forrestania	Flying Fox	2016
Certain	survey	6	Forrestania	Forrestiana, FNO/30 - sighting	2016
Certain	Sight.	6	Forrestania	Internal Haul Road	2016
Certain	Sight.	2	Forrestania	Cosmic Boy	2016
Certain	Signs	2	Forrestania	Cosmic Boy	2016
Certain	Sight.	10	Forrestania	Cosmic Boy	2016
Certain	Sight.	1	Forrestania	Cosmic Boy	2016
Certain	survey	2	Forrestania	Forrestiana, FNO/28 - heard calls	2016
Certain	survey	10	Forrestania	Forrestiana, FNO/29 - sighting	2016
Certain	Sight.	2	Forrestania	South Ironcap	2016
Certain	survey	2	Forrestania	Forrestiana, FNO/27 - sighting	2016
Certain	DS	0	Hatter Hill	Hatters Hill	1938
Certain	DS	2	Hatter Hill	Road verge within UCL, Hatter Hill	2015
Certain	DS	0	Hyden	Lake O'Connor Road, East Hyden Road	2007
Certain	C/T	4	Varley	DR07 - Diggers South nickel sulphide mine, east of Hyden	2006
Certain	DS	12	West Holleton	S of Gibb Rock	1969
***Charadrius rubricollis* - Hooded Plover**					**Priority 4**
Moderately	survey	1	Holt Rock	SPS019	1998
***Daphnia jollyi* – a waterflea**					**Priority 1**
Moderately	survey	1	Dulyalbin		1997
Certain	?	0	Dulyalbin	Frog Rock	1997
Certain	survey	1	Hyden	Wheatbelt, King_rocks	2010
Certain	survey	1	Hyden	Wheatbelt, Wheeler_Rock	2010
Certain	C/T	0	Marvel Loch	Granite rock pool on Strawberry Rocks	1992
Certain	C/T	0	Moorine Rock	Jilbadgie Rocks	1990
Certain	C/T	0	Mount Hampton	Mt Hampton	1990
Certain	survey	1	Woolocutty	Wheatbelt, Twine_Rock	2010
***Dasyurus geoffroii* – Chuditch**					**Schedule 3 (Vulnerable)**
Certain	C/T	1	Forrestania	Flying Fox nickel sulphide box cut mine East Hyden.FR13	2005
Certain	Dead	1	Forrestania	on the Hyden - Norseman track near the State barrier fence	2009
Certain	C/T	1	Forrestania	On the Hyden-Norseman track near State barrier fence	2009
Certain	Dead	1	Forrestania	Hyden-Norseman track near the state barrier fence (vermin proof fence)	2009
Certain	survey	1	Forrestania	Forrestania, SQH10C	2009
Certain	survey	1	Forrestania	Forrestania, SQH10C	2009
Certain	Dead	1	Forrestania	Cosmic Boy between the Village and Concentrator	2010
Certain	Dead	1	Forrestania		2011
Certain	DS	1	Forrestania	Outside habitation block K18	2011
Certain	Dead	1	Forrestania		2011

Appendix 7. (cont.)

Certainty	Method	Count	Locality	Site	Year
***Dasyurus geoffroii* – Chuditch**					**Schedule 3 (Vulnerable)**
Certain	survey	1	Forrestania	Forrestiana, FNO/39 - sighting	2016
Certain	Sight.	1	Forrestania	Lounge Lizard	2016
Certain	DS	1	Forrestania	U Row	2016
Certain	Sight.	1	Forrestania	Cosmic Boy	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/33 - sighting	2016
Certain	DS	1	Forrestania	T Row	2016
Certain	Sight.	1	Forrestania	Cosmic Boy	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/32 - sighting	2016
Certain	DS	1	Forrestania	outside Recreation Room in Camp	2016
Certain	Sight.	1	Forrestania	Cosmic Boy	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/34 - sighting	2016
Certain	DuS	1	Forrestania	Action Office	2016
Certain	Sight.	1	Forrestania	Cosmic Boy	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/35 - sighting	2016
Certain	DS	1	Forrestania	Cosmic Boy Carpark near Training Room	2016
Certain	Sight.	1	Forrestania	Cosmic Boy	2016
Certain	Sight.	1	Forrestania	Cosmic Boy	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/37 - sighting	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/38 - sighting	2016
Certain	DaS	1	Forrestania	Camp Road	2016
Certain	Sight.	1	Forrestania	Cosmic Boy	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/36 - sighting	2016
Certain	DS	1	Forrestania	Camp - Mill Road	2016
Certain	Sight.	1	Forrestania	Cosmic Boy	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/31 - sighting	2016
Certain	Dead	2	Hyden	East of Hyden, near Kings Rock.	1985
WAM	Spec.	1	West Holleton		1976
Moderately	NS	1	Yellowdine	Site of former Karalee Tavern.	1994
***Falco peregrinus* - Peregrine Falcon**					**Schedule 7 (Other Specially Protected Fauna)**
Moderately	Obs.	1	Forrestania		1981
Certain	DS	1	Forrestania	Lake Cronin	1991
Moderately	Obs.	1	Forrestania	Salmon Gums	1998
Moderately	Obs.	1	Forrestania	Vermin proof fence, Carstairs Road	1999
Moderately	Obs.	1	Holleton	Holleton track	2004
Moderately	Obs.	1	Hyden		1981
Moderately	Obs.	1	Hyden	Emu Rocks	2002
Moderately	Obs.	1	Norseman	Windy Hill camp	2004
***Leipoa ocellata* – Malleefowl**					**Schedule 3 (Vulnerable)**
Moderately	Obs.	1	Dulyalbin	Southern Cross Sth Road	2003
Moderately	Obs.	1	Dulyalbin	Frog Rock	2007
Moderately	Obs.	1	Forrestania		1978
Moderately	Obs.	1	Forrestania		1978
Moderately	Obs.	1	Forrestania		1978
Moderately	Obs.	1	Forrestania		1979
Moderately	Obs.	1	Forrestania	Holland Track	2000
Certain	Signs	0	Forrestania	200m from proposed pipeline	2006
Certain	DS	1	Forrestania	Marvel Loch Forrestania Road, N of South Ironcap Hill.	2006
Certain	C/T	1	Forrestania	DR02 - Diggers South nickel sulphide mine, E of Hyden	2006
Certain	survey	1	Forrestania	Forrestiana, FNO/4 - sighting	2015

Appendix 7. (cont.)

Certainty	Method	Count	Locality	Site	Year
***Leipoa ocellata* – Malleefowl**					**Schedule 3 (Vulnerable)**
Certain	survey	1	Forrestania	Forrestiana, FNO/3 - sighting	2015
Certain	survey	1	Forrestania	Forrestiana, FNO/5 - sighting	2015
Certain	survey	1	Forrestania	Forrestiana, FNO/0 - sighting	2015
Certain	survey	1	Forrestania	Forrestiana, FNO/1 - sighting	2015
Certain	survey	1	Forrestania	Forrestiana, FNO/2 - sighting	2015
Certain	survey	0	Forrestania	Forrestiana, FNO-708 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-682 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-669 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-692 - inactive mound	2016
Moderately	Sight.	1	Forrestania	Flying fox-Spotted quoll Haul Road, near Loung Lizard Waste Dump	2016
Not sure	Sight.	1	Forrestania	Flying Fox	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/6 - sighting	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-662 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-689 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-641 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-696 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-688 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-671 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-626 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-672 - inactive mound	2016
Certain	DS	1	Forrestania	Station 16 Pipeline Rd	2016
Certain	Sight.	1	Forrestania	Sibelius	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/7 - sighting	2016
Certain	DS	1	Forrestania	Corner of SB25 on Pipeline Rd	2016
Certain	Sight.	1	Forrestania	Sibelius	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/8 - sighting	2016
Certain	survey	1	Forrestania	Forrestiana, SB-25 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-663 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-638 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-683 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-620 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-621 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-618 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-617 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-631 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-687 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-636 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-697 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-694 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-632 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-675 - inactive mound	2016
Certain	DS	1	Forrestania	Corner of 14 Pipeline Rd	2016
Certain	Sight.	1	Forrestania	Sibelius	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/9 - sighting	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-674 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-664 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-693 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-695 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-665 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-634 - inactive mound	2016

Appendix 7. (cont.)

Certainty	Method	Count	Locality	Site	Year
***Leipoa ocellata* – Malleefowl**					**Schedule 3 (Vulnerable)**
Certain	survey	0	Forrestania	Forrestiana, FNO-703 - inactive mound	2016
Certain	DS	1	Forrestania	Internal Haul Rd	2016
Certain	Sight.	1	Forrestania	Internal Haul Road	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/11 - sighting	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-635 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-676 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-681 - inactive mound	2016
Certain	Sighti.	1	Forrestania	Cosmic Boy	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-622 - active mound	2016
Certain	survey	1	Forrestania	Forrestiana, FNO-625 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-627 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-600 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-667 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-680 - inactive mound	2016
Certain	DS	2	Forrestania	CB Haul Rd	2016
Certain	Sight.	2	Forrestania	Cosmic Boy	2016
Certain	survey	2	Forrestania	Forrestiana, FNO/10 - sighting	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-670 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-623 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-608 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-686 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-684 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-624 - inactive mound	2016
Certain	Sight.	1	Forrestania	Cosmic Boy	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/13 - sighting	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-619 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-602 - active mound	2016
Certain	survey	1	Forrestania	Forrestiana, FNO/12 - sighting	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-614 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-610 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-637 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-677 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-678 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-673 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-628 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-700 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-710 - active mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-630 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-629 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-707 - inactive mound	2016
Certain	survey	0	Forrestania	Forrestiana, FNO-690 - inactive mound	2016
Certain	survey	0	Hatter Hill	Forrestiana, FNO-691 - inactive mound	2016
Moderately	Obs.	1	Holleton	track	2004
Moderately	Obs.	1	Holleton	Holleton	2004
Moderately	Obs.	1	Holleton	Old Holleton Townsite	2004
Moderately	Obs.	1	Holleton	Holleton Block	2009
Moderately	Obs.	1	Holleton	Old Holleton Townsite	2009
Moderately	Obs.	1	Holleton	Holleton Block Dam	2010
Moderately	Obs.	1	Holleton	Old Holleton Townsite	2010
Moderately	Obs.	1	Holleton	Holleton Road	2010

Appendix 7. (cont.)

Certainty	Method	Count	Locality	Site	Year
***Leipoa ocellata* – Malleefowl**					**Schedule 3 (Vulnerable)**
Moderately	Obs.	1	Holleton	Holleton Road	2010
Moderately	Obs.	1	Hyden		1977
Moderately	Obs.	1	Hyden		1977
Certain	DS	1	Hyden	1.2km W of Graham Rock T/O on Hyden-Norseman Rd	1993
Certain	DS	2	Hyden	Unnamed Nature Reserve 400m NE of the intersection of Sedgewick Rd and Woolocutty Rd	1994
Certain	DS	2	Hyden	Unnamed Nature Reserve at intersection of Sedgewick Rd and Woolocutty Rd	1994
Moderately	Obs.	1	Hyden	Lake King - Hyden Road	1999
Moderately	Obs.	1	Hyden	Lake King - Hyden Road	2001
Moderately	Obs.	1	Hyden	Hyden - Lake King Road	2002
Moderately	Obs.	1	Marvel Loch		1978
Moderately	Obs.	1	Marvel Loch		1980
Moderately	Obs.	1	Marvel Loch	Frog Rock Reserve	2001
Certain	DS	1	Marvel Loch	Southern Cornishman area	2007
Certain	DS	1	Marvel Loch	Parker Rd, ~5.5km NW of Marvel Loch-Forrestania Rd intersection	2008
Certain	DS	2	Mount Hampton	50km S of Moorine Rock	1995
Moderately	Obs.	1	Mount Hampton	Neendojer Rocks Nature Reserve	2002
Moderately	Obs.	1	Mount Hampton	Nr Int N Moorine and Menzie Rd	2006
Certain	survey	0	Mount Holland	Forrestiana, FNO-717 - inactive mound	2016
Certain	survey	0	Mount Holland	Forrestiana, FNO-705 - inactive mound	2016
Certain	survey	0	Mount Holland	Forrestiana, FNO-706 - inactive mound	2016
Certain	survey	0	Mount Holland	Forrestiana, FNO-704 - inactive mound	2016
Moderately	Obs.	1	Norseman		1979
Moderately	Obs.	1	Norseman	Holland Track	1998
Certain	survey	1	Parker Range	Jilbadji Nature Reserve, Cheritons Find	2016
Certain	survey	0	Parker Range	Forrestiana, FNO-713 - inactive mound	2016
Certain	survey	0	Parker Range	Forrestiana, FNO-715 - inactive mound	2016
Certain	survey	0	Parker Range	Forrestiana, FNO-716 - inactive mound	2016
Certain	survey	0	Parker Range	Forrestiana, FNO-712 - inactive mound	2016
Certain	survey	0	Parker Range	Forrestiana, FNO-711 - inactive mound	2016
Certain	survey	0	Parker Range	Forrestiana, FNO-714 - inactive mound	2016
Certain	survey	1	Parker Range	ParkerRange, Texas Tenement, Jilbadji Nature Reserve	2016
Certain	Tracks	0	Skeleton Rock	Skeleton Rock; along eastern fire access track.	2009
Certain	survey	1	Skeleton Rock	GOLDFIELDS, British Hill	2011
Moderately	Obs.	1	South Yilgarn	Hyden - Marvel Loch Road	2000
Certain	DS	0	South Yilgarn	West end of Brennand Road, South Yilgarn	2008
Certain	DS	1	West Holleton	On Soldiers Rd, 3 km E of old barrier fence	1995
Moderately	Obs.	1	West Holleton	Sloss NR	2004
Moderately	Obs.	1	West Holleton	Welsh Nature Reserve	2011
Certain	?	0	Woolocutty	PP Loc.No.2672 just S of Gibb Rock, Hyden	1966
***Macropus irma* - Western Brush Wallaby**					**Priority 4**
Certain	Dead	1	Forrestania		1995
Certain	DS	1	Forrestania	Hyden Norseman Road, 80kms east of Hyden near Nickel Mine	1998
Certain	DS	1	Forrestania	Flying Fox nickel sulphide box cut mine East Hyden.FR09	2005
Certain	Tracks	0	Forrestania	Flying Fox nickel sulphide box cut mine East Hyden.FR24	2006

Appendix 7. (cont.)

Certainty	Method	Count	Locality	Site	Year
***Macropus irma* - Western Brush Wallaby**					**Priority 4**
Certain	Tracks	0	Forrestania	Flying Fox nickel sulphide box cut mine East Hyden.FR26	2006
Certain	Tracks	0	Forrestania	Flying Fox nickel sulphide box cut mine East Hyden.FR21	2006
Certain	C/T	1	Forrestania	DR01- Diggers South nickel sulphide mine, east of Hyden	2006
Certain	C/T	4	Forrestania	Diggers South nickel sulphide mine, east of Hyden	2006
Certain	Dead	1	Forrestania	Internal Haul Road	2016
Certain	DS	3	Holt Rock	Near Holt Rock Siding. Lake Varley Nature Reserve.	1969
Moderately	DS	2	Parker Range	Jilbadji Nature Reserve (C24049)	1999
***Macrotis lagotis* – Bilby**					**Schedule 3 (Vulnerable)**
WAM	Spec.	1	Marvel Loch		0
Moderately	Signs	1	Parker Range	Parker Range	1904
***Merops ornatus* - Rainbow Bee-eater Schedule 5 (Migratory Birds Protected under International Agreement)**					
Certain	Hist.	1	Forrestania	Site details not provided, unable to verify coordinates.	1976
Moderately	Obs.	1	Forrestania		1977
Moderately	Obs.	1	Forrestania		1977
Moderately	Obs.	1	Forrestania		1977
Moderately	Obs.	1	Forrestania		1978
Moderately	Obs.	1	Forrestania		1978
Moderately	Obs.	1	Forrestania		1978
Moderately	Obs.	1	Forrestania		1979
Moderately	Obs.	1	Forrestania		1979
Moderately	Obs.	1	Forrestania		1979
Moderately	Obs.	1	Forrestania		1979
Moderately	Obs.	1	Forrestania		1979
Moderately	Obs.	1	Forrestania		1980
Moderately	Obs.	1	Forrestania		1981
Moderately	Obs.	1	Forrestania		1981
Certain	Hist.	5	Forrestania	Site details not provided, unable to verify coordinates.	1987
Certain	Hist.	2	Forrestania	Site details not provided, unable to verify coordinates.	1988
Certain	Hist.	3	Forrestania	Site details not provided, unable to verify coordinates.	1989
Moderately	Obs.	1	Forrestania	Lake Cronin	1998
Moderately	Obs.	1	Forrestania	Lake Cronin	1999
Moderately	Obs.	1	Forrestania	Lake Cronin	1999
Moderately	Obs.	1	Forrestania	Lake Cronin 1	1999
Moderately	Obs.	1	Forrestania	Lake Cronin 3	1999
Moderately	Obs.	1	Forrestania	Lake Cronin 3	1999
Moderately	Obs.	1	Forrestania	Lake Cronin	2000
Moderately	Obs.	1	Forrestania	Lake Cronin 1	2000
Moderately	Obs.	1	Forrestania	Lake Cronin 1	2000
Moderately	Obs.	1	Forrestania	Lake Cronin 3	2000
Moderately	Obs.	1	Forrestania	Lake Cronin 2	2001
Moderately	Obs.	1	Forrestania	Lake Cronin	2001
Moderately	Obs.	1	Forrestania	Lake Cronin	2001
Moderately	Obs.	1	Forrestania	Lake Cronin 3	2001
Moderately	Obs.	1	Ghooli	Yellowdine - Nevoria Road	2002
Moderately	Obs.	1	Holleton	Old Holleton Townsite	2004
Moderately	Obs.	1	Hyden		1979
Moderately	Obs.	1	Hyden		1980
Moderately	Obs.	1	Hyden		1981

Appendix 7. (cont.)

Certainty	Method	Count	Locality	Site	Year
***Merops ornatus* - Rainbow Bee-eater Schedule 5 (Migratory Birds Protected under International Agreement)**					
Moderately	Obs.	1	Hyden		1981
Moderately	Obs.	1	Hyden	Emu Rock	2000
Moderately	Obs.	1	Hyden	Lake Liddelow, Holland Track	2000
Moderately	Obs.	1	Marvel Loch		1979
Moderately	Obs.	1	Mount Hampton	Mt Hampton	2007
Moderately	Obs.	1	Mount Holland	Forrestania track	2003
Certain	survey	3	Mount Holland	Bushland east of Eastern Wheatbelt , 40km NNE of Hyden	2011
Moderately	Obs.	1	Mount Palmer	Yellowdine area	2003
Moderately	Obs.	1	Norseman		1979
Moderately	Obs.	1	Norseman	The Breakaways	1998
Moderately	Obs.	1	Norseman	Breakaway, Hyden - Norseman Track	1999
Moderately	Obs.	1	Norseman	Round Top Hill	2000
Moderately	Obs.	1	Norseman	Breakaway	2004
Moderately	Obs.	1	Parker Range	Banker - Mt Dam Road	2002
Moderately	Obs.	1	South Yilgarn		1981
Moderately	Obs.	1	Victoria Rock	Centenary Rocks	1998
Moderately	Obs.	1	Victoria Rock	Holland Track	2000
Moderately	Obs.	1	Victoria Rock	Holland Track	2000
Moderately	Obs.	1	Woolocutty	Twine Nature Reserve	2000
Moderately	Obs.	1	Yellowdine	Morlining Rocks	1999
***Myrmecobius fasciatus* - Numbat Schedule 2 (Endangered)**					
WAM	Spec.	1	Ghooli		0
Certain	?	1	Norseman	Halfway to Norseman from Hyden	1961
***Ninox connivens connivens* - Barking Owl (southwest pop) Priority 2**					
Certain	?	2	Woolocutty	PP Loc.No.2672 just S of Gibb Rock, Hyden	1968
***Paroplocephalus atriceps* – Lake Cronin Snake Priority 3**					
WAM	Spec.	1	Forrestania	MIDDLE IRONCAP	1900
WAM	Spec.	1	Forrestania	LAKE CRONIN	1967
WAM	Spec.	1	Forrestania	LAKE CRONIN	1979
WAM	Spec.	1	Forrestania	LAKE CRONIN	1998
Certain	survey	1	Forrestania	FORRESTANIA, Cosmic Boy	2009
WAM	Spec.	1	Forrestania	LAKE CRONIN	2010
Certain	survey	1	Forrestania	FORRESTANIA Cosmic Boy,	2013
Certain	C/T	1	Forrestania	Live Mining Lease M 7700399, Office and Coreyard, 500m from Cosmic Bay Camp & Forrestania Rd intersection	2014
Certain	survey	1	Forrestania	FORRESTANIA Cosmic Boy,	2014
Certain	NS	1	Forrestania	Cosmic Boy	2016
WAM	Spec.	1	Mount Holland	ESE OF MT HOLLAND	1900
WAM	Spec.	1	Norseman	MAGGIE HAYES HILL	1996
Certain	Dead	1	Skeleton Rock	32km north of Hyden-Norseman Rd, along Marvel Lock-Forrestania Rd. Just inside Jilbadgi NR	2007
WAM	Spec.	1	Varley	VARLEY	0
***Petrogale lateralis lateralis* - Black-flanked Rock-wallaby Schedule 2 (Endangered)**					
Certain	DS	0	South Yilgarn	Southern Cross South Road & Cramphorne Road intersection, South Yilgarn	2007

Appendix 7. (cont.)

Certainty	Method	Count	Locality	Site	Year
***Phascogale calura* - Red-tailed Phascogale**				**Schedule 6 (Conservation Dependent Fauna)**	
WAM	Spec.	1	Hyden	DRAGON ROCKS RESERVE	1972
Certain	Dead	1	Hyden	Community Sighting - January. 40km NE of Hyden (Douthe road). King Rock- granite outcrop with dense sheoak + Euc.	2008
Moderately	NS	1	Hyden	January. 40km NE of Hyden (Douthe road). King Rock- granite outcrop with dense sheoak + Euc.	2008
Certain	DS	1	Hyden	Pit on Hyden-Norseman Rd, approx 8km E of intersection w/ Sharps Rd	2016
Certain	Dead	1	Marvel Loch	Marvel Loch (10 km south), WA	1998
***Platycercus icterotis xanthogenys* - Western Rosella (inland ssp)**					**Priority 4**
Certain	DS	0	Forrestania	Rock Hole, immediately north of the Varley Gate, to the south	1983
Certain	DS	3	Forrestania	Lake Cronin	1991
Certain	DS	2	Forrestania	Lake Cronin	1991
Certain	DS	1	Forrestania	Flying Fox nickel sulphide box cut mine East Hyden. FR06	2005
Certain	DS	1	Forrestania	Flying Fox nickel sulphide box cut mine East Hyden.	2005
Certain	DS	7	Forrestania	Flying Fox nickel sulphide box cut mine East Hyden. FR05	2005
Certain	DS	4	Forrestania	Flying Fox nickel sulphide box cut mine East Hyden.FR26	2006
Certain	C/T	1	Forrestania	DR09- Diggers South nickel sulphide mine, east of Hyden	2006
Certain	C/T	2	Forrestania	DR02- Diggers South nickel sulphide mine, east of Hyden	2006
Certain	DS	2	Forrestania	Lake Cronin	2007
Certain	DS	1	Holt Rock	Near Holt Rock Siding. Lake Varley Nature Reserve.	1969
***Pseudomys occidentalis* – Western Mouse**					**Priority 4**
Certain	C/T	1	Forrestania	Dragon Rocks Nature Reserve. Trap I25	1995
Certain	?	0	Hatter Hill	Hatter Hill.	0
WAM	Spec.	1	Hatter Hill	HATTER HILL	0

Appendix 8. Opportunistic Records

See Appendix 6 for scientific names of birds and mammals.

Survey	Date	Species	Location	Notes
4	18/09/2017	Australian Kestrel	Earl Grey TSF	Flew over
2	25/11/2016	Australian Pipit	Mt Holland Camp	Seen
5	11/10/2017	Australian Pipit	Site 14	
1	10 - 15/10/16	Australian Raven	Survey Area A (Earl Grey)	
2	25/11/2016	Australian Raven	Mt Holland Camp	Seen
3	16 - 20/1/17	Australian Raven	Regional Survey Area	
1	10 - 15/10/16	Australian Ringneck	Survey Area A (Earl Grey)	
5	8/10/2017	Australian Ringneck	Borefields	
5	7/10/2017	Black Swan	Airstrip	13 flying overhead
2	23/11/2016	Black-faced Cuckoo-shrike	Site 5	
6	28/11/2017	Black-faced Woodswallow	Jilbadji Nature Reserve (burnt area)	
1	10 - 15/10/16	Blue-breasted Fairywren	Survey Area A (Earl Grey)	
2	23/11/2016	Blue-breasted Fairywren	Prince of Wales, Site 7	Heard
3	16 - 20/1/17	Blue-breasted Fairywren	Regional Survey Area	
2	26/11/2016	Brown Falcon	Access road between VU and Camp	
2	25/11/2016	Brown Falcon	Van Uden, Site 11	Seen
1	10 - 15/10/16	Brown Honeyeater	Survey Area A (Earl Grey)	
2	2/12/2016	Brown Honeyeater	Regional Survey Area (south)	Heard
3	16 - 20/1/17	Brown Honeyeater	Regional Survey Area	
1	10 - 15/10/16	Brown-headed Honeyeater	Survey Area A (Earl Grey)	
2	23/11/2016	Brown-headed Honeyeater	Site 5	
3	16 - 20/1/17	Brush Bronzewing	Regional Survey Area	
5	7/10/2017	Cat	Site 15	flushed out of log
2	26/11/2016	Chuditch	Site 1	Tracks on drill track
2	12/10/2016	Chuditch	Survey Area A (Earl Grey)	tracks
2	13/10/2016	Chuditch	Survey Area A (Earl Grey)	tracks
6	28/11/2017	Chuditch	Development envelope (southern)	Scats
6	28/11/2017	Chuditch	Development envelope (southern)	Scats
6	28/11/2017	Chuditch	Development envelope (southern)	Scats
6	28/11/2017	Chuditch	Development envelope (southern)	Scats
4	14/09/2017	Chuditch	Development envelope	Tracks
4	14/09/2017	Chuditch	Development envelope	Tracks
4	14/09/2017	Chuditch	Development envelope	Scats
4	14/09/2017	Chuditch	Development envelope (central)	Scats
4	14/09/2017	Chuditch	Development envelope (central)	Scats
4	18/09/2017	Chuditch	Development envelope (central)	Scats
4	18/09/2017	Chuditch	Development envelope (central)	Scats
4	18/09/2017	Chuditch	Development envelope (southern)	Scats
4	20/09/2017	Chuditch	Jilbadji Nature Reserve	Scats
4	20/09/2017	Chuditch	Jilbadji Nature Reserve	Scats
5	7/10/2017	Chuditch	Borefields Road	Scats
5	10/10/2017	Chuditch	Borefields Road	Tracks
5	11/10/2017	Chuditch	Development envelope (central)	tracks
5	8/10/2017	Chuditch	Development envelope (north)	Scats
5	11/10/2017	Chuditch	Development envelope (north)	Tracks
5	11/10/2017	Chuditch	Development envelope (southern)	Scats

Appendix 8. (cont.)

Survey	Date	Species	Location	Notes
5	12/10/2017	Chuditch	Development envelope (southern)	Tracks
1	10 - 15/10/16	Collared Sparrowhawk	Survey Area A (Earl Grey)	
2	2/12/2016	Collared Sparrowhawk	Survey Area B (Irish Breakfast)	
2	2/12/2016	Collared Sparrowhawk	Survey Area B (Irish Breakfast)	x 1
1	10 - 15/10/16	Common Bronzewing	Survey Area A (Earl Grey)	
2	2/12/2016	Common Bronzewing	Development envelope	
2	1/12/2016	Common Bronzewing	Site 5	Seen during site pack-up
3	16 - 20/1/17	Common Bronzewing	Regional Survey Area	
1	10 - 15/10/16	Copper-backed Quail-thrush	Survey Area A (Earl Grey)	
2	25/11/2016	Copper-backed Quail-thrush	Site 5	Seen
1	10 - 15/10/16	Crested Bellbird	Survey Area A (Earl Grey)	
3	16 - 20/1/17	Crested Bellbird	Regional Survey Area	
2	26/11/2016	*Cryptoblepharus buchananii*	Van Uden, Site 10	On large gum
1	10 - 15/10/16	*Ctenophorus cristatus*	Survey Area A (Earl Grey)	
2	26/11/2016	*Ctenophorus cristatus*	Prince of Wales, Site 8	
2	27/11/2016	*Ctenophorus cristatus*	Prince of Wales, Site 8	
2	3/12/2016	*Ctenophorus cristatus*	Survey Area A (Earl Grey)	Seen active x3
5	12/10/2017	*Ctenophorus cristatus*	Borefields Road	Spot-lighting
1	10 - 15/10/16	*Ctenophorus maculatus*	Survey Area A (Earl Grey)	
2	1/12/2016	*Ctenophorus maculatus*	Prince of Wales	Seen during Malleefowl surveys
2	29/11/2016	*Ctenophorus maculatus*	Site 4	
2	3/12/2016	*Ctenophorus maculatus*	Survey Area B (Irish Breakfast)	Seen active
5	10/10/2017	*Ctenophorus maculatus*	Development envelope (north)	
2	1/12/2016	*Ctenophorus salinarum*	Prince of Wales	Seen during Malleefowl surveys
2	29/11/2016	*Ctenotus schomburgkii*	Van Uden, Site 9	
3	16 - 20/1/17	*Ctenotus schomburgkii*	Regional Survey Area	
1	10 - 15/10/16	*Delma fraseri*	Survey Area A (Earl Grey)	x 2
5	11/10/2017	*Delma fraseri*	Site 20	
2	29/11/2016	Dog	Prince of Wales, Site 9	
2	30/11/2016	Dog / Dingo	Van Uden, Site 10	
2	2/12/2016	Dusky Woodswallow	Prince of Wales, burnt area	
5	8/10/2017	Dusky Woodswallow	Development envelope (eastern edge)	In burnt area
6	28/11/2017	Dusky Woodswallow	Borefields Road	
5	7/10/2017	Dusky Woodwsallow	Development envelope (north)	
2	29/11/2016	Echidna	Van Uden, Site 11	Old diggings
3	16 - 20/1/17	Echidna	Regional Survey Area	Diggings
5	9/10/2017	Echidna	Site 16	Diggings
2	25/11/2016	*Egernia richardi*	Van Uden, Site 10	Under fallen logs
3	16 - 20/1/17	Elegant Parrot	Regional Survey Area	
6	28/11/2017	Elegant Parrot	Jilbadji Nature Reserve (burnt area)	
1	10 - 15/10/16	Emu	Survey Area A (Earl Grey)	Tracks
2	24/11/2016	Emu	Prince of Wales, Site 9	Tracks and scats
2	3/12/2016	Emu	Prince of Wales, Site 9	6 seen along drill line
2	25/11/2016	Emu	Site 2	Tracks and scats
2	26/11/2016	Emu	Van Uden, Site 12	Tracks and scats

Appendix 8. (cont.)

Survey	Date	Species	Location	Notes
2	27/11/2016	Emu	Van Uden, Site 12	Tracks and scats
2	29/11/2016	Emu	Van Uden, Site 12	
3	16 - 20/1/17	Emu	Regional Survey Area	
5	6/10/2017	Emu	Site 17	Tracks
1	10 - 15/10/16	Fan-tailed Cuckoo	Survey Area A (Earl Grey)	
5	10/10/2017	Galah	Site 17	Feathers, remains
2	3/12/2016	*Gehyra varigata*	Survey Area B (Irish Breakfast)	Found under dead bark
6	28/11/2017	*Gehyra varigata*	Development envelope (southern)	
2	2/12/2016	Gilbert's Whistler	Development envelope (southern)	x 1
2	3/12/2016	Gilbert's Whistler	Development envelope (southern)	x 2
2	30/11/2016	Grey Butcherbird	Regional Survey Area (Van Uden)	
2	28/11/2016	Grey Butcherbird	Site 4	one heard
1	10 - 15/10/16	Grey Currawong	Survey Area A (Earl Grey)	
2	2/12/2016	Grey Currawong	Survey Area B (Irish Breakfast)	
3	16 - 20/1/17	Grey Currawong	Regional Survey Area	
5	9/10/2017	Grey Fantail	Site 17	
1	10 - 15/10/16	Grey Shrike-thrush	Survey Area A (Earl Grey)	
3	16 - 20/1/17	Grey Shrike-thrush	Regional Survey Area	
1	10 - 15/10/16	Grey Teal	Survey Area A (Earl Grey)	
5	10/10/2017	Grey Teal	Borefields	On dam
5	8/10/2017	Grey Teal	Pond near Earl Grey TSF	
2	27/11/2016	*Hesperoedura reticulata*	Van Uden, Site 10	Spot-lighting, x 2 on eucalypt.
2	2/12/2016	Hooded Robin	Prince of Wales, burnt area	x 2
2	23/11/2016	Horsfield's Bronze-cuckoo	Site 5	
3	16 - 20/1/17	Horsfield's Bronze-cuckoo	Regional Survey Area	
1	10 - 15/10/16	Inland Thornbill	Survey Area A (Earl Grey)	
3	16 - 20/1/17	Inland Thornbill	Regional Survey Area	
1	10 - 15/10/16	Inland Western Rosella	Survey Area A (Earl Grey)	
2	19/11/2016	Inland Western Rosella	Regional Survey Area	x 2
2	27/11/2016	Inland Western Rosella	Regional Survey Area	
2	27/11/2016	Inland Western Rosella	Regional Survey Area (Van Uden)	
2	30/11/2016	Inland Western Rosella	Regional Survey Area (Van Uden)	
2	30/11/2016	Inland Western Rosella	Regional, road to Van Uden	
2	1/12/2016	Inland Western Rosella	Survey Area B (Irish Breakfast)	
4	18/09/2017	Inland Western Rosella	Development envelope	Observation
4	13/09/2017	Inland Western Rosella	Development envelope (central)	Observation
4	14/09/2017	Inland Western Rosella	Development envelope (central)	x 2
4	8/10/2017	Inland Western Rosella	Development envelope (central)	Observation
4	15/09/2017	Inland Western Rosella	Development envelope (north)	x 2
4	17/09/2017	Inland Western Rosella	Development envelope (southern)	Observation
4	18/09/2017	Inland Western Rosella	Development envelope (southern)	x 2
4	19/09/2017	Inland Western Rosella	Regional Survey Area (south)	Observation
4	19/09/2017	Inland Western Rosella	Regional Survey Area (south)	Observation
5	5/10/2017	Inland Western Rosella	Borefields Road	x 2
5	8/10/2017	Inland Western Rosella	Development envelope (central)	Observation
5	9/10/2017	Inland Western Rosella	Development envelope (southern)	x 2 birds

Appendix 8. (cont.)

Survey	Date	Species	Location	Notes
6	26/11/2017	Inland Western Rosella	Regional Survey Area (south)	
6	28/11/2017	Inland Western Rosella	Borefields Road	x 2
6	27/11/2017	Inland Western Rosella	Regional Survey Area (north)	
6	29/11/2017	Inland Western Rosella	Regional Survey Area (north)	
6	27/11/2017	Inland Western Rosella	Regional Survey Area (south)	
6	28/11/2017	Inland Western Rosella	Regional Survey Area (north)	
6	29/11/2017	Inland Western Rosella	Regional Survey Area (north)	
2	30/11/2016	Jacky Winter	Borefields Road	1
5	6/10/2017	Jacky Winter	Site 20	
1	10 - 15/10/16	kangaroo/wallaby	Survey Area A (Earl Grey)	Scats and tracks
2	3/12/2016	*Lerista kingii*	Survey Area A (Earl Grey)	Raked from a spoil heap
1	10 - 15/10/16	*Liopholis multiscutata*	Survey Area A (Earl Grey)	
2	26/11/2016	*Liopholis multiscutata*	Prince of Wales, Site 8	
6	28/11/2017	Little Button-Quail	Development envelope (southern)	
2	26/11/2016	Little Eagle	Van Uden, Site 10	Nest
2	27/11/2016	*Lucasium mainii*	Regional Survey Area (Van Uden)	Spot-lighting
2	30/11/2016	Malleefowl	Prince of Wales	Tracks
2	25/11/2016	Malleefowl	Regional Survey Area (Van Uden)	One bird seen (disturbed, flying)
2	26/11/2016	Malleefowl	Regional Survey Area (Van Uden)	Tracks
2	27/11/2016	Malleefowl	Regional Survey Area (Van Uden)	Tracks
2	27/11/2016	Malleefowl	Site 3	Tracks on drill track
2	29/11/2016	Malleefowl	Van Uden, Site 11	Tracks on drill track
4	21/09/2017	Malleefowl	Access road, south of Earl Grey TSF	x 1
4	13/09/2017	Malleefowl	Development envelope	Tracks
4	13/09/2017	Malleefowl	Development envelope	Observation
4	14/09/2017	Malleefowl	Development envelope	Tracks
4	14/09/2017	Malleefowl	Development envelope	Tracks
4	17/09/2017	Malleefowl	Development envelope	Observation
4	18/09/2017	Malleefowl	Development envelope	Observation
4	18/09/2017	Malleefowl	Development envelope	Tracks
4	13/09/2017	Malleefowl	Development envelope (central)	Tracks
4	18/09/2017	Malleefowl	Development envelope (central)	Tracks
4	18/09/2017	Malleefowl	Development envelope (central)	Tracks
4	15/09/2017	Malleefowl	Development envelope (north)	x 1
4	18/09/2017	Malleefowl	Development envelope (southern)	Tracks
4	18/09/2017	Malleefowl	Development envelope (southern)	Tracks
4	19/09/2017	Malleefowl	Development envelope (southern)	Tracks
4	19/09/2017	Malleefowl	Development envelope (southern)	Tracks
4	19/09/2017	Malleefowl	Regional, road to Van Uden	Subadult
5	11/10/2017	Malleefowl	Access road near airstrip	x 1
5	9/10/2017	Malleefowl	Development envelope	Observation
5	7/10/2017	Malleefowl	Development envelope (central)	x 1
5	6/10/2017	Malleefowl	Mt Holland Camp	x 1
5	4/10/2017	Malleefowl	Site 17	x 1, foraging
6	29/11/2017	Malleefowl	Mt Holland Camp	
6	25/07/2016	Malleefowl	Regional Survey Area	One bird seen by botanist

Appendix 8. (cont.)

Survey	Date	Species	Location	Notes
5	4/10/2017	*Menetia greyii*	Site 17	Hand-searched out of leaf litter
5	12/10/2017	*Menetia greyii*	Site 20	Found by hand-searching
2	2/12/2016	Mistletoebird	Survey Area B (Irish Breakfast)	
2	2/12/2016	Mistletoebird	Survey Area B (Irish Breakfast)	x 1
1	10 - 15/10/16	Mitchell's Hopping Mouse	Survey Area A (Earl Grey)	Tracks
3	16 - 20/1/17	Mitchell's Hopping Mouse	Regional Survey Area	Tracks
1	10 - 15/10/16	*Moloch horridus*	Survey Area A (Earl Grey)	
2	1/12/2016	*Moloch horridus*	Van Uden, Site 12	Near pit 3
1	10 - 15/10/16	Painted Button-quail	Survey Area A (Earl Grey)	
2	19/11/2016	Peregrine Falcon	Regional Survey Area	Overflying open pit
2	4/12/2016	Peregrine Falcon	Regional Survey Area	Observation
2	30/11/2016	Peregrine Falcon	Van Uden, Site 12	1, seen during bird survey
4	17/09/2017	Peregrine Falcon	Development envelope (southern)	
2	29/11/2016	*Pogona minor*	Survey Area B (Irish Breakfast)	Seen during Malleefowl surveys.
2	2/12/2016	*Pseudonaja affinis*	Airstrip	
5	13/10/2017	*Pseudonaja affinis*	Access road	crossing road
1	10 - 15/10/16	*Pseudophryne occidentalis*	Survey Area A (Earl Grey)	
2	3/12/2016	*Pseudophryne occidentalis*	Survey Area B (Irish Breakfast)	Spot-lighting, near water
1	10 - 15/10/16	Purple-crowned Lorikeet	Survey Area A (Earl Grey)	
3	16 - 20/1/17	Purple-crowned Lorikeet	Regional Survey Area	
1	10 - 15/10/16	Purple-gaped Honeyeater	Survey Area A (Earl Grey)	Nesting, recently fledged chicks
2	23/11/2016	Purple-gaped Honeyeater	Prince of Wales, Site 7	Heard during site set-up
3	16 - 20/1/17	Purple-gaped Honeyeater	Regional Survey Area	
2	27/11/2016	Rabbit	Prince of Wales, Site 8	Scats sighted during Malleefowl transects
2	24/11/2016	Rabbit	Prince of Wales, Site 9	Scats
1	10 - 15/10/16	Rainbow Bee-eater	Survey Area A (Earl Grey)	
2	25/11/2016	Rainbow Bee-eater	Mt Holland Camp	Seen
2	17/11/2016	Rainbow Bee-eater	Regional Survey Area	
2	25/11/2016	Rainbow Bee-eater	Regional Survey Area (Van Uden)	
2	26/11/2016	Rainbow Bee-eater	Regional Survey Area (Van Uden)	
2	30/11/2016	Rainbow Bee-eater	Rubbish Dump	Heard while placing motion camera.
2	13/10/2016	Rainbow Bee-eater	Survey Area A (Earl Grey)	Oct 2016 survey
2	14/10/2016	Rainbow Bee-eater	Survey Area A (Earl Grey)	Oct 2016 survey
2	26/11/2016	Rainbow Bee-eater	Van Uden, Site 10	Heard
5	11/10/2017	Rainbow Bee-eater	Airstrip	
5	10/10/2017	Rainbow Bee-eater	Borefields	
5	11/10/2017	Rainbow Bee-eater	Site 15	
6	28/11/2017	Rainbow Bee-eater	Regional Survey Area (south)	
3	16 - 20/1/17	Red Wattlebird	Regional Survey Area	
2	1/12/2016	Red-capped Robin	Prince of Wales, burnt area	Flushed during Malleefowl surveys
2	30/11/2016	Red-capped Robin	Regional Survey Area (southern powerline)	x 1
2	3/12/2016	Redthroat	Regional Survey Area	x 1

Appendix 8. (cont.)

Survey	Date	Species	Location	Notes
2	29/11/2016	Redthroat	Van Uden, Site 12	Heard
1	10 - 15/10/16	Regent Parrot	Survey Area A (Earl Grey)	
1	10 - 15/10/16	Restless Flycatcher	Survey Area A (Earl Grey)	
5	7/10/2017	Restless Flycatcher	Development envelope (north)	
6	28/11/2017	Rufous Treecreeper	Borefields Road	in Salmon Gum woodland
1	10 - 15/10/16	Rufous Whistler	Survey Area A (Earl Grey)	
5	10/10/2017	Sacred Kingfisher	Access road near airstrip	
1	10 - 15/10/16	Shy Heathwren	Survey Area A (Earl Grey)	Nesting
2	26/11/2016	Shy Heathwren	Near Site 10 (Regional Survey Area)	Heard
2	25/11/2016	Shy Heathwren	Site 1	Heard
2	23/11/2016	Shy Heathwren	Site 6	Heard during site set-up
2	29/11/2016	Singing Honeyeater	Survey Area B (Irish Breakfast)	Heard during Malleefowl surveys.
3	16 - 20/1/17	Singing Honeyeater	Regional Survey Area	
5	7/10/2017	Southern Boobook	Mt Holland Camp	Heard at night
6	29/11/2017	Southern Boobook	Borefields Road	
1	10 - 15/10/16	Southern Scrub-Robin	Survey Area A (Earl Grey)	Nesting
2	26/11/2016	Southern Scrub-robin	Site 1	1 bird and 1 chick in nest
2	26/11/2016	Southern Scrub-robin	Site 6	1 bird and 1 egg in nest
3	16 - 20/1/17	Southern Scrub-robin	Regional Survey Area	
1	10 - 15/10/16	Spiny-cheeked Honeyeater	Survey Area A (Earl Grey)	
3	16 - 20/1/17	Spiny-cheeked Honeyeater	Regional Survey Area	
4	17/10/2017	Spotted Harrier	Development envelope (southern)	
1	10 - 15/10/16	Spotted Nightjar	Survey Area A (Earl Grey)	
2	27/11/2016	Spotted Nightjar	Access road north of Van Uden	Spot-lighting
2	3/12/2016	Spotted Nightjar	Airstrip	Spot-lighting
2	1/12/2016	Spotted Nightjar	Prince of Wales, burnt area	
2	1/12/2016	Spotted Nightjar	Prince of Wales, burnt area	Flushed during Malleefowl surveys
2	23/11/2016	Spotted Nightjar	Prince of Wales, Site 7	Flushed from ground during day
5	8/10/2017	Spotted Nightjar	Development envelope (central)	
5	9/10/2017	Spotted Nightjar	Development envelope (central)	Flushed during Malleefowl surveys
2	24/11/2016	Spotted Pardalote	Prince of Wales, Site 8	
2	29/11/2016	Square-tailed Kite	Site 3	
2	29/11/2016	Square-tailed Kite	Site 3	Seen
2	29/11/2016	Square-tailed Kite	Site 3	flew over
1	10 - 15/10/16	Striated Pardalote	Survey Area A (Earl Grey)	
1	10 - 15/10/16	*Tadarida australis*	Survey Area A (Earl Grey)	Heard at night
1	10 - 15/10/16	Tawny Frogmouth	Survey Area A (Earl Grey)	
2	3/12/2016	Tawny Frogmouth	Airstrip	Spot-lighting
2	2/12/2016	Tawny-crowned Honeyeater	Survey Area B (Irish Breakfast)	
1	10 - 15/10/16	*Tiliqua occipitalis*	Survey Area A (Earl Grey)	
5	10/10/2017	*Tiliqua occipitalis*	Development envelope (central)	Skull
6	28/11/2017	*Tiliqua occipitalis*	Development envelope (southern)	roadkill
2	26/11/2016	*Tiliqua rugosa*	1.5km west of Mt Holland Camp	
2	27/11/2016	*Tiliqua rugosa*	Near Mt Holland camp	

Appendix 8. (cont.)

Survey	Date	Species	Location	Notes
2	3/12/2016	*Tiliqua rugosa*	On track to Van Uden	
2	3/12/2016	*Tiliqua rugosa*	On track to Van Uden	
2	1/12/2016	*Tiliqua rugosa*	Prince of Wales, burnt area	
2	28/11/2016	*Tiliqua rugosa*	Regional Survey Area (Van Uden)	Crossing track to Van Uden
3	16 - 20/1/17	*Tiliqua rugosa*	Regional Survey Area	
5	6/10/2017	*Tiliqua rugosa*	Near rubbish dump	On road
1	10 - 15/10/16	Tree Martin	Survey Area A (Earl Grey)	
2	25/11/2016	Tree Martin	Van Uden, Site 11	
3	16 - 20/1/17	Tree Martin	Regional Survey Area	
1	10 - 15/10/16	*Varanus gouldii*	Survey Area A (Earl Grey)	
2	26/11/2016	*Varanus gouldii*	Between Forrestania Road and Van Uden	
2	27/11/2016	*Varanus gouldii*	Prince of Wales, burnt area	
3	16 - 20/1/17	*Varanus gouldii*	Regional Survey Area	
5	8/10/2017	*Varanus gouldii*	Development envelope (central)	
2	4/12/2016	Varied Sittella	Van Uden, small clay pan	Sighted while hand-searching
3	16 - 20/1/17	Varied Sittella	Regional Survey Area	
5	10/10/2017	Wedge-tailed Eagle	Development envelope (eastern edge)	over TSF
1	10 - 15/10/16	Weebill	Survey Area A (Earl Grey)	
3	16 - 20/1/17	Weebill	Regional Survey Area	
2	3/12/2016	Welcome Swallow	Mt Holland Camp	x 2
5	9/10/2017	Welcome Swallow	Mt Holland Camp / tanks	
2	1/12/2016	Western Brush Wallaby	Regional, road to Van Uden	Sighted crossing road
2	27/11/2016	Western Brush Wallaby	Regional, road to Van Uden	
3	20/01/2017	Western Brush Wallaby	Jilbadji Nature Reserve (burnt area)	x 3
6	25/11/2017	Western Brush Wallaby	Regional Survey Area	
6	25/11/2017	Western Brush Wallaby	Access road	x 2
6	28/11/2017	Western Brush Wallaby	Regional Survey Area (north)	
6	30/11/2017	Western Brush Wallaby	Regional Survey Area (north)	
6	28/11/2017	Western Brush Wallaby	Regional Survey Area	
6	29/11/2017	Western Brush Wallaby	Regional Survey Area (north)	
3	16 - 20/1/17	Western Golden Whistler	Regional Survey Area	
2	30/11/2016	Western Grey Kangaroo	Access road	
2	4/12/2016	Western Grey Kangaroo	Regional Survey Area	x 1
5	12/10/2017	Western Grey Kangaroo	Borefields Road	Spot-lighting
5	6/10/2017	Western Grey Kangaroo	Site 13	
5	8/10/2017	Western Grey Kangaroo	Site 14	
5	9/10/2017	Western Grey Kangaroo	Site 14	
2	23/11/2016	Western Yellow Robin	Site 6	Heard during site set-up
3	16 - 20/1/17	Western Yellow Robin	Regional Survey Area	
1	10 - 15/10/16	Whistling Kite	Survey Area A (Earl Grey)	
5	11/10/2017	Whistling Kite	Airstrip	
1	10 - 15/10/16	White-browed Babbler	Survey Area A (Earl Grey)	
2	30/11/2016	White-browed Babbler	Rubbish Dump	Seen while placing motion camera.
5	8/10/2017	White-browed Babbler	Development envelope (central)	

Appendix 8. (cont.)

Survey	Date	Species	Location	Notes
3	16 - 20/1/17	White-eared Honeyeater	Regional Survey Area	
1	10 - 15/10/16	White-fronted Honeyeater	Survey Area A (Earl Grey)	
3	16 - 20/1/17	White-fronted Honeyeater	Regional Survey Area	
2	1/12/2016	White-winged Triller	Prince of Wales, burnt area	
2	30/11/2016	White-winged Triller	Regional Survey Area (southern powerline)	x 2
6	28/11/2017	White-winged Triller	Jilbadji Nature Reserve (burnt area)	
1	10 - 15/10/16	Willie Wagtail	Survey Area A (Earl Grey)	
2	25/11/2016	Willie Wagtail	Van Uden, Site 10	
6	28/11/2017	Willie Wagtail	Borefields Road	
6	28/11/2017	Yellow-plumed Honeyeater	Borefields Road	in Salmon Gum woodland
2	30/11/2016	Yellow-rumped Thornbill	Regional Survey Area (southern powerline)	x 2
2	29/11/2016	Yellow-throated Miner	Regional Survey Area (north)	2 heard in burnt area near W10-1

Appendix 9. Malleefowl Mound Locations and Habitat.

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-01 50H 758853 E 6445168 N Development envelope Old mound, unused 10yrs+ Mallee Eucalypt woodland over tall mixed *Acacia* shrubland, on gravelly clay loam.	
Waypoint: Location: Study area: Status: Habitat:	MM-02 50H 758816 E 6446057 N Development envelope Mound attempt, not used. Mallee Eucalypt woodland over mixed *Melaleuca* shrubland, on gravelly loam/sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-03 50H 759130 E 6446065 N Development envelope Active mound (active 2016, 2017), eggshell present Mallee Eucalypt woodland over mixed *Allocasuarina*, *Acacia* and *Melaleuca* shrubland on gravelly sand. Adjacent to track.	
Waypoint: Location: Study area: Status: Habitat:	MM-04 50H 758665 E 6446259 N Development envelope Mound attempt, not used Mallee Eucalypt woodland over mixed myrtaceous shrubland, on gravelly loam/sand. Old trackside spoil heap that has been excavated but not used.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-05 50H 759570 E 6446330 N Development envelope Old mound, unused 10yrs+ Mallee Eucalypt woodland over tall *Allocasuarina* and *Acacia* shrubland, on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-06 50H 759208 E 6446582 N Development envelope Mound attempt, not used Mallee Eucalypt woodland over tall *Allocasuarina* and *Acacia* shrubland, on gravelly sand. Old trackside spoil heap that has been excavated but not used.	
Waypoint: Location: Study area: Status: Habitat:	MM-07 50H 759306 E 6448715 N Regional Mound attempt, not used Mallee Eucalypt woodland over *Melaleuca* shrubland, on gravelly loam. Old trackside spoil heap that has been excavated but not used.	
Waypoint: Location: Study area: Status: Habitat:	MM-08 50H 750445 E 6438409 N Regional (Van Uden) Recently active, eggshell present Tall Eucalypt woodland over sparse tall *Melaleuca* shrubland on red loam. Adjacent to track.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-09 50H 759607 E 6450697 N Regional (Prince of Wales) Old mound, unused 10yrs+ Burnt. Tall shrubland of *Allocasuarina* and *Acacia* on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-10 50H 759731 E 6451028 N Regional (Prince of Wales) Old mound, unused 10yrs+ Burnt. Tall shrubland of *Allocasuarina* and *Acacia* on sandy gravel.	
Waypoint: Location: Study area: Status: Habitat:	MM-11 50H 759611 E 6447668 Development envelope Old mound, unused 10yrs+ Sparse mallee eucalypt woodland over tall shrubland of *Allocasuarina*, and *Melaleuca* on sandy gravel.	
Waypoint: Location: Study area: Status: Habitat:	MM-12 50H 758919 E 6447454 N Development envelope Old mound, unused 10yrs+ Sparse mallee eucalypt woodland over tall shrubland of *Allocasuarina*, and *Melaleuca* on gravelly sand.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-13 50H 759209 E 6445955 N Development envelope Old mound, unused 10yrs+ Sparse mallee eucalypt woodland over tall shrubland of *Allocasuarina*, *Acacia* and *Melaleuca* on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-14 50H 755038 E 6439835 N Regional Old mound, unused 10yrs+ Burnt. Mallee eucalypt woodland over tall shrubland of *Melaleuca* and *Hakea* on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-15 50H 754351 E 6439415 N Regional Old mound, unused 10yrs+ Burnt. Mallee eucalypt woodland over tall shrubland of *Melaleuca* and *Allocasuarina* on red gravelly loam.	
Waypoint: Location: Study area: Status: Habitat:	MM-16 50H 759231 E 6454669 N Regional Old mound, unused 10yrs+ Sparse mallee eucalypt woodland over tall shrubland of *Allocasuarina*, *Acacia* and *Hakea* on pale gravelly sand.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-17 50H 756616 E 6447341 N Regional Active mound (active 2016 only) Sparse mallee eucalypt woodland over tall shrubland of *Allocasuarina*, *Melaleuca* and *Hakea* on pale yellow gravelly sand. Adjacent to track.	
Waypoint: Location: Study area: Status: Habitat:	MM-18 50H 754750 E 6463151 N Regional (Jilbadji Nature Reserve) Active mound (active 2016 only) Sparse mallee eucalypt woodland over tall shrubland of *Allocasuarina* and *Hakea* on pale yellow gravelly sand. Adjacent to track.	
Waypoint: Location: Study area: Status: Habitat:	MM-19 50H 759822 E 6450197 N Regional (Prince of Wales) Old mound, unused 10yrs+ Burnt. Tall shrubland of *Allocasuarina* on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-20 (recorded July 2016) 50H 761037 E 6459357 N Regional Old mound, unused 10yrs+ Burnt. Tall shrubland of *Allocasuarina* and mixed shrubs on gravelly sand.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-21 (recorded July 2014) 50H 760874 E 6440544 N Regional Old mound, unused 10yrs+ Burnt. Mallee eucalypt woodland on pale gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-22 50H 760572 E 6444886 N Development envelope Mound attempt, not used. Mallee eucalypt woodland over *Melaleuca* and *Callitris* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-23 50H 760396 E 6447375 N Development envelope Active (active 2017), eggshell present Mallee eucalypt woodland over *Melaleuca* and *Acacia* shrubland on gravelly sand. Adjacent to track.	
Waypoint: Location: Study area: Status: Habitat:	MM-24 50H 757807 E 6446947 N Development envelope Recently active (2017), eggshell present Tall *Allocasuarina* and *Acacia* shrubland over low *Thyptomene* and *Melaleuca* shrubland on gravelly sand. On track.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-25 50H 760409 E 6444839 N Development envelope Old mound, unused 10yrs+ Mallee eucalypt woodland over *Melaleuca* and *Callitris* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-26 50H 761091 E 6444478 N Development envelope Old mound, unused 25yrs+ Mallee eucalypt woodland over mixed tall *Melaleuca*, *Allocasuarina* and *Hakea* shrubland over low *Melaleuca* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-27 50H 761657 E 6446300 N Development envelope Old mound, unused 25yrs+ Mallee eucalypt woodland over mixed tall *Melaleuca*, *Allocasuarina* and *Hakea* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-28 50H 760801 E 6445544 N Development envelope Old mound, unused 10yrs+ Mallee eucalypt woodland over *Melaleuca* and *Callitris* shrubland on gravelly sand. (Gravel includes quartz).	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-29 50H 760403 E 6445644 N Development envelope Old mound, unused 25yrs+ Mallee eucalypt woodland over *Melaleuca* shrubland with scattered *Allocasuarina* and *Callitris* on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-30 50H 760705 E 6447203 N Development envelope Old mound, unused 25yrs+ Sparse Mallee woodland over tall *Melaleuca* and *Allocasurina* shrubland with scattered *Callitris* over low *Melaleuca* and *Hakea* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-31 50H 760743 E 6446613 N Development envelope Old mound, unused 25yrs+ Sparse Mallee woodland over tall *Acacia*, *Allocasuarina* and *Melaleuca* shrubland over low *Thryptomene*, *Melaleuca* and *Hakea* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-32 50H 760452 E 6446528 N Development envelope Old mound, unused 25yrs+ Sparse Mallee woodland over tall *Acacia*, *Allocasuarina* and *Melaleuca* shrubland with scattered *Callitris* over low *Thryptomene* and *Melaleuca* shrubland on gravelly sand.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-33 50H 760266 E 6446145 N Development envelope Old mound, unused 25yrs+ Sparse Mallee woodland over tall *Acacia*, *Allocasuarina* and *Hakea* shrubland with scattered *Callitris* over low shrubland of *Melaleuca* on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-34 50H 757785 E 6447849 N Development envelope Recently active, eggshell present Sparse Mallee woodland over tall *Melaleuca* and *Allocasurina* shrubland over low *Melaleuca* and *Thryptomene* shrubland on gravelly sand. Adjacent to track.	
Waypoint: Location: Study area: Status: Habitat:	MM-35 50H 757778 E 6448346 N Development envelope Mound attempt, not used Mallee eucalypt woodland over mixed tall *Melaleuca* shrubland with scattered *Acacia*, *Hakea* and *Jacksonia* on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-36 50H 759631 E 6444374 N Development envelope Old mound, unused 10yrs+ Sparse Mallee woodland over tall *Acacia*, *Allocasuarina* and *Melaleuca* shrubland with scattered *Hakea* and *Callitris* over low *Thryptomene* and *Melaleuca* shrubland on gravelly sand.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-37 50H 759627 E 6443757 N Development envelope Old mound, unused 10yrs+ Burnt. Mallee eucalypt woodland over *Melaleuca* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-38 50H 762038 E 6446582 N Development envelope Mound attempt, not used Sparse Mallee woodland over tall *Melaleuca* shrubland with scattered Callitris over low *Melaleuca* shrubland with sedges on sand with sparse gravel. Adjacent to track.	
Waypoint: Location: Study area: Status: Habitat:	MM-39 50H 762219 E 6443405 N Development envelope Old mound, unused 25yrs+ Sparse Mallee woodland over tall *Melaleuca* and *Allocasuarina* shrubland over low *Melaleuca* and *Thryptomene* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-40 50H 762023 E 6443247 N Development envelope Old mound, unused 10yrs+ Mallee eucalypt woodland over mixed tall *Melaleuca* and *Allocasuarina* shrubland over sparse low *Melaleuca* shrubland on gravelly sand.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-41 50H 761846 E 6443513 N Development envelope Old mound, unused 25yrs+ Mallee eucalypt woodland over moderately sparse *Melaleuca* and *Dodonaea* shrubland on gravelly clay-loam on slope.	
Waypoint: Location: Study area: Status: Habitat:	MM-42 50H 760385 E 6443823 N Development envelope Mound attempt, not used Mallee eucalypt woodland over mixed tall *Melaleuca*, *Allocasuarina* and *Hakea* shrubland on gravelly sand. Adjacent to track.	
Waypoint: Location: Study area: Status: Habitat:	MM-43 50H 760761 E 6443585 N Development envelope Mound attempt, not used Mallee eucalypt woodland over mixed tall *Melaleuca*, *Allocasuarina* and *Hakea* shrubland on gravelly sand. Adjacent to track.	
Waypoint: Location: Study area: Status: Habitat:	MM-44 50H 756738 E 6460370 N Development envelope Mound attempt, not used Tall *Allocasurina* and *Melaleuca* shrubland over low *Thyptomene* and *Melaleuca* shrubland on gravelly sand. On track.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-45 50H 760671 E 6445368 N Development envelope Old mound, unused 25yrs+ Mallee eucalypt woodland over mixed tall *Melaleuca*, *Allocasuarina* and *Hakea* shrubland with scattered Quandong over low *Melaleuca* and *Thryptomene* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-46 50H 760797 E 6446329 N Development envelope Old mound, unused 25yrs+ Mallee eucalypt woodland over tall *Melaleuca* shrubland on gravelly loam. Near shrubland edge.	
Waypoint: Location: Study area: Status: Habitat:	MM-47 50H 760682 E 6446000 N Development envelope Old mound, unused 10yrs+, eggshell present Gimlet woodland over mixed tall *Melaleuca* and *Dodonaea* shrubland on gravelly red loam.	
Waypoint: Location: Study area: Status: Habitat:	MM-48 50H 761120 E 6445812 N Development envelope Old mound, unused 25yrs+ Open mallee eucalypt woodland with scattered *Callitris* and *Hakea* tall shrubs over low mixed *Melaleuca* shrubland on gravelly sand.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-49 50H 763460 E 6436828 N Development envelope Old mound, unused 25yrs+ Open eucalypt woodland with mallee woodland over sparse tall *Melaleuca* shrubland on pink gravelly loam.	
Waypoint: Location: Study area: Status: Habitat:	MM-50 50H 761253 E 6446439 N Development envelope Old mound, unused 25yrs+ Sparse Mallee woodland over tall *Allocasuarina* shrubland over low *Melaleuca* and *Thryptomene* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-51 50H 761227 E 6446608 N Development envelope Old mound, unused 25yrs+ Sparse Mallee woodland over tall *Acacia*, *Allocasuarina* and *Hakea* shrubland with scattered Quandong over low *Thryptomene* and *Melaleuca* shrubland on yellow gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-52 50H 759956 E 6443261 N Development envelope Old mound, unused 25yrs+ Mallee eucalypt woodland over mixed tall *Melaleuca*, *Allocasuarina* and *Hakea* shrubland on gravelly sand.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-53 50H 760984 E 6443350 N Development envelope Recently active, eggshell present Sparse Mallee eucalypt woodland over tall shrubland of *Allocasuarina* and *Hakea* with scattered *Banksia* over low *Thryptomene* and *Melaleuca* shrubland in very minor yellow sand drainage.	
Waypoint: Location: Study area: Status: Habitat:	MM-54 50H 761006 E 6443824 N Development envelope Old mound, unused 25yrs+ Low Mallee eucalypt woodland over tall open shrubland of *Acacia*, *Allocasuarina* and *Hakea* with scattered Quandong over low *Melaleuca* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-55 50H 760511 E 6443386 N Development envelope Old mound, unused 10yrs+ Mallee eucalypt woodland over mixed tall *Melaleuca*, *Allocasuarina*, *Hakea* and *Acacia* shrubland over low *Melaleuca* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-56 50H 761010 E 6443191 N Development envelope Recently active, eggshell present Sparse Mallee over tall shrubland of *Allocasuarina*, Acacia, Hakea and Banksia over low *Melaleuca* and *Thyptomene* shrubland on gravelly sand. Adjacent to track.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint: Location: Study area: Status: Habitat:	MM-57 50H 763897 E 6442650 N Regional Recently active, eggshell present Gimlet woodland over mixed tall *Melaleuca* and *Dodonaea* shrubland with scattered Quandong on gravelly red loam in minor drainage.	
Waypoint: Location: Study area: Status: Habitat:	MM-58 50H 760653 E 6441053 N Regional Recently active, eggshell present Burnt. Sparse Mallee woodland over tall *Allocasurina* and *Hakea* shrubland on gravelly sand. Possibly old 'mega mound' or boodie mound.	
Waypoint: Location: Study area: Status: Habitat:	MM-59 50H 760416 E 6443199 N Development envelope Old mound, unused 25yrs+ Sparse Mallee woodland over tall *Acacia*, *Hakea*, *Allocasuarina* and *Melaleuca* shrubland over low *Melaleuca* and *Thyptomene* shrubland on gravelly sand.	
Waypoint: Location: Study area: Status: Habitat:	MM-60 50H 760929 E 6443381 N Development envelope Mound attempt, not used Mallee woodland over tall *Hakea* and *Banksia* shrubland over low *Melaleuca* shrubland on gravelly sand. Adjacent to track.	

Appendix 9. (cont.)

Mound		Photograph
Waypoint:	MM-61	
Location:	50H 763218 E 6438298 N	
Study area:	Regional (close to Borefields Rd)	
Status:	Recently active, eggshell present	
Habitat:	Tall eucalypt and mallee woodland over tall mixed *Melaleuca* shrubland on gravelly loam. Adjacent to track, possibly old trackside spoil.	

Appendix 10. Fauna Recorded on Camera Traps

Note: see Appendix 3 and Figure 9 for camera locations and deployment dates. DE = Development envelope, RSA = Regional survey area.

Camera	Location	Species																									
		Chuditch	Mitchell's Hopping Mouse	Mouse sp.	Western Grey Kangaroo	Western Brush Wallaby	Echidna	Malleefowl	Emu	Spotted Nightjar	Grey Currawong	Common Bronzewing	Brush Bronzewing	Southern Scrub-robin	Crested Bellbird	Chestnut Quail-thrush	Australian Raven	Crested Dragon	Western Bluetongue	Bobtail	Gould's Goanna	Southern Heath Monitor	Rabbit	Dog/Dingo	Cat	Fox
		Dasyurus geoffroii	*Notomys mitchelli*	*Pseudomys/Mus sp.*	*Macropus fuliginosus*	*Macropus irma*	*Tachyglossus aculeatus*	*Leipoa ocellata*	*Dromaius novaehollandiae*	*Eurostopodus argus*	*Strepera versicolor*	*Phaps chalcoptera*	*Phaps elegans*	*Drymodes brunneopygia*	*Oreoica gutteralis*	*Cinclosoma clarum*	*Corvus coronoides*	*Ctenophorus cristatus*	*Tiliqua occipitalis*	*Tiliqua rugosa*	*Varanus gouldii*	*Varanus rosenbergi*	*Oryctolagus cuniculus*	*Canis lupus / dingo*	*Felis catus*	*Vulpes vulpes*
N01-0	DE	x															x										
N02-0	DE																										
N03-0	DE	x	x											x			x										
N04-0	DE													x													
W02-0	DE																x		x								
W03-0	DE																										
W04-0	DE	x																									
W05-0	DE																										
W06-0	DE	x																									
W07-0	DE	x															x										
W08-0	DE	x																									
W09-0	DE	x									x						x										
N01-1	RSA	x																				x					
N01-2	RSA	x	x																								
N01-3	RSA	x						x												x	x						
N02-1	RSA		x																								
N02-2	RSA	x																							x		
N02-3	DE	x																				x					
N03-1	DE													x													
N03-2	DE																					x					
N03-3	RSA																										
N04-1	DE	x	x											x				x									
N04-2	RSA		x	x							x																
N04-3	RSA	x													x												
W01-1	RSA										x																
W02-1	RSA	x																							x		

Appendix 10. (cont.)

Camera	Location	Species																								
		Chuditch	Mitchell's Hopping Mouse	Mouse sp.	Western Grey Kangaroo	Western Brush Wallaby	Echidna	Malleefowl	Emu	Spotted Nightjar	Grey Currawong	Common Bronzewing	Brush Bronzewing	Southern Scrub-robin	Crested Bellbird	Chestnut Quail-thrush	Australian Raven	Crested Dragon	Western Bluetongue	Bobtail	Gould's Goanna	Southern Heath Monitor	Rabbit	Dog/Dingo	Cat	Fox
W02-2	DE	x		x																						
W02-3	DE	x																			x					
W03-1	RSA				x									x												
W03-2	RSA																									
W03-3	RSA																									
W04-1	RSA																				x					
W04-2	RSA																									
W04-3	RSA			x																						
W05-1	DE	x																								
W05-2	RSA																									
W05-3	RSA			x																						x
W06-1	DE			x										x												
W06-2	RSA																									
W06-3	RSA												x													
W07-1	DE	x			x																x					
W07-2	RSA										x															
W07-3	RSA			x										x												x
W08-1	RSA	x																								
W08-2	RSA																				x					x
W08-3	RSA																									
W09-1	RSA	x	x																		x					
W09-2	DE	x																								
W09-3	DE	x																								
W10-1	RSA																				x					
W11-1	RSA	x												x				x				x				
W12-1	DE																									
W13-1	DE	x																			x					
W14-1	RSA													x												
W15-1	RSA													x		x						x				
W16-1	RSA	x							x												x					
W17-1	DE																									
W01-4	RSA	x				x																				
W01-5	RSA	x			x			x																		
W02-4	RSA	x	x	x																						x
W02-5	RSA	x																						x		
W03-4	RSA			x																						

Appendix 10. (cont.)

Camera	Location	Species																								
		Chuditch	Mitchell's Hopping Mouse	Mouse sp.	Western Grey Kangaroo	Western Brush Wallaby	Echidna	Malleefowl	Emu	Spotted Nightjar	Grey Currawong	Common Bronzewing	Brush Bronzewing	Southern Scrub-robin	Crested Bellbird	Chestnut Quail-thrush	Australian Raven	Crested Dragon	Western Bluetongue	Bobtail	Gould's Goanna	Southern Heath Monitor	Rabbit	Dog/Dingo	Cat	Fox
W03-5	RSA		x																							
W04-4	RSA		x																							
W04-5	RSA	x																								
W05-4	RSA		x											x									x			
W05-5	RSA	x																							x	
W06-4	RSA			x																						
W06-5	RSA	x																								
W07-4	RSA	x																								
W07-5	RSA																						x		x	
W08-4	RSA									x															x	
W08-5	RSA	x																								
W09-4	RSA																									
W09-5	RSA	x																					x			
W10-4	RSA					x																				
W10-5	RSA																									
W11-4	RSA																									
W11-5	RSA																									
W12-4	DE																								x	
W12-5	RSA																									
W13-4	RSA	x																								
W13-5	RSA																									
W14-4	RSA	x		x			x																			
W14-5	RSA	x																								
W15-4	RSA																									
W15-5	RSA																								x	
W16-4	RSA	x																								
W16-5	RSA			x																						
W17-4	RSA		x																							
W17-5	RSA	x																								
W18-4	RSA																									
W18-5	RSA																									x
W19-4	RSA	x																								
W19-5	RSA																							x		
W20-4	RSA		x											x												
W20-5	RSA		x																				x			
W21-4	RSA																									

Appendix 10. (cont.)

Camera	Location	Species																									
		Chuditch	Mitchell's Hopping Mouse	Mouse sp.	Western Grey Kangaroo	Western Brush Wallaby	Echidna	Malleefowl	Emu	Spotted Nightjar	Grey Currawong	Common Bronzewing	Brush Bronzewing	Southern Scrub-robin	Crested Bellbird	Chestnut Quail-thrush	Australian Raven	Crested Dragon	Western Bluetongue	Bobtail	Gould's Goanna	Southern Heath Monitor	Rabbit	Dog/Dingo	Cat	Fox
W21-5	RSA					x																				
W22-4	RSA	x																					x		x	
W22-5	RSA	x	x	x				x																		
W01-6	RSA			x	x																					
W02-6	RSA																									
W03-6	RSA					x																			x	
W04-6	RSA		x			x																				
W05-6	RSA																									
W06-6	RSA			x																						
W07-6	RSA											x														
W08-6	RSA																									
W09-6	RSA		x																							
W10-6	RSA																									
W12-6	RSA																									
W14-6	RSA																									
W15-6	RSA				x																					
W16-6	RSA																									
W17-6	RSA																									
W18-6	RSA			x	x																					
W19-6	RSA		x																							
W20-6	RSA	x	x																						x	
W21-6	RSA				x																					
W22-6	RSA		x	x																					x	
W02-7	DE							x																		
W03-7	DE			x																						
W04-7	DE																x									
W05-7	DE										x															
W06-7	DE																x									
W07-7	DE																									
W08-7	DE	x																x								
W10-7	DE	x														x						x				
W12-7	DE	x																								
W14-7	DE	x												x												
W15-7	DE																	x								
W16-7	DE																				x					
W17-7	DE		x		x																					

Appendix 10. (cont.)

Camera	Location	Species																								
		Chuditch	Mitchell's Hopping Mouse	Mouse sp.	Western Grey Kangaroo	Western Brush Wallaby	Echidna	Malleefowl	Emu	Spotted Nightjar	Grey Currawong	Common Bronzewing	Brush Bronzewing	Southern Scrub-robin	Crested Bellbird	Chestnut Quail-thrush	Australian Raven	Crested Dragon	Western Bluetongue	Bobtail	Gould's Goanna	Southern Heath Monitor	Rabbit	Dog/Dingo	Cat	Fox
W18-7	DE	x	x														x									
W19-7	DE	x		x		x								x												
W20-7	DE	x									x															
W21-7	DE	x																								
W22-7	DE		x																							
# of records (out of all 139 cameras):		53	22	18	8	6	1	4	1	1	6	1	1	14	1	2	8	4	1	1	10	6	5	2	11	5
# of records in DE (out of 45):		24	5	4	2	1	0	1	0	0	3	0	0	7	0	1	8	3	1	0	4	3	0	0	1	0
# of records in RSA (out of 94):		29	17	14	6	5	1	3	1	1	3	1	1	7	1	1	0	1	0	1	6	3	5	2	10	5

Appendix 11. Bat Call Identification Reports

Specialised Zoological

Bat call identification

from Mt Holland, Western Australia

Type:	Acoustic analysis
Prepared for:	Western Wildlife
Date:	7 February 2017
Job No.:	SZ422
Prepared by:	Kyle Armstrong and Yuki Konishi Specialised Zoological ABN 92 265 437 422 Tel 0404 423 264 kyle.n.armstrong@gmail.com http://szool.com.au

SZ422: *Bat call identification from Mt Holland, Western Australia*

SUMMARY

Bat identifications from acoustic recordings are provided from Mt Holland, near Southern Cross, Western Australia. At least nine species of bat were identified as being present (**Tables 1** and **2**). Representative echolocation calls for each identification are illustrated (**Figures 1** and **2**), as recommended by the Australasian Bat Society (ABS 2006). Further data are available should verification be required.

COMMENTS ON IDENTIFICATIONS

The identification of bat species from full spectrum WAV format recordings of their echolocation calls was based on measurements of characteristic frequency, observation of pulse shape, and the pattern of harmonics. Some identifications are ambiguous, and are accompanied by the following comments.

There were many calls with a characteristic frequency or minimum frequency between 40 and 50 kHz that had more than one possible attribution. The calls of long-eared bats *Nyctophilus* spp. are typically difficult to identify reliably to species, and there are calls present on the recordings that may be attributable to the Lesser Long-eared Bat *Nyctophilus geoffroyi* or the Western Long-eared Bat *N. major major*. Furthermore, calls within this frequency band were derived from the Inland Forest Bat *Vespadelus baverstocki*, the Southern Forest Bat *Vespadelus regulus* and the Chocolate Wattled Bat *Chalinolobus morio*—but calls of these species were not always clearly distinguishable from each other or the calls of *Nyctophilus* spp., particularly some shorter duration calls that were made close to vegetation. If greater certainty around the identity of all five of these bat species is required, a trapping survey would be recommended.

In addition, the calls of the Western Free-tailed Bat *Ozimops kitcheneri* and the Inland Free-tailed Bat *Ozimops petersi* are similar and overlap with the call variation of Gould's Wattled Bat *Chalinolobus gouldii*. In some cases, the two genera could be distinguished, and calls with a characteristic frequency below 26 kHz were generally attributed to *O. kitcheneri*. The putative calls of *Ozimops petersi* could not be confirmed unambiguously.

METHODS

Data recorded in full spectrum lossless WAC0 format with Wildlife Acoustics SM2BAT bat detectors (sampling rate 384 kHz, trigger 6 dB above background; 48 dB gain; set to turn on automatically at sunset and off at sunrise) was converted to high quality bitstream WAV format using Kaleidoscope 3.0.0 software.

the identifications with additional materials or resources. The capture of bats would provide greater confidence in the identifications made in the present report. While Specialised Zoological has made identifications to the best of our ability given the available materials, and reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.

6. It should be noted that while the identification of bat echolocation call recordings is a very efficient and convenient way to produce an inventory of bat species in a study area, the reliability of identification of each species varies, for several reasons. There are also a variety of factors that affect the 'detectability' of each species, given the frequency, power and shape characteristics of their calls. Further general comment can be provided, if required.

7. The scope of this report was limited to providing information on the identification of bats. Further comment on species of conservation significance and the possible impacts of a project on bat species were not part of the scope.

8. Further information on the analysis and the various factors that impinge on the reliability of identifications can be provided upon request.

References

ABS (2006). Recommendations of the Australasian Bat Society Inc for reporting standards for insectivorous bat surveys using bat detectors. *The Australasian Bat Society Newsletter* 27: 6–9. [ISSN 1448-5877]

Armstrong, K.N. and Aplin, K.P. (2014). Identifying bats in an unknown acoustic realm using a semi-automated approach to the analysis of large full spectrum datasets. Oral presentation at the 16th Australasian Bat Society Conference 22–25 April 2014, Townsville, Queensland. *The Australasian Bat Society Newsletter* 42: 35–36.

Armstrong, K.N., Aplin, K.P. and Crotty, S. (2016). A pipeline and app for massive filtering, and assisted inspection of enormous acoustic datasets. Poster presentation at the 17th Australasian Bat Society Conference, 29 March-1 April 2016, Hobart, Tasmania, Australia. *The Australasian Bat Society Newsletter* 46: 51.

Churchill, S.K. (2008). *Australian bats*. 2nd ed. Allen and Unwin, Crows Nest, NSW.

Fullard, J.H., Koehler, C., Surlykke, A. and McKenzie, N.L. (1991). Echolocation ecology and flight morphology of insectivorous bats (Chiroptera) in south-western Australia. *Australian Journal of Zoology* 39: 427–438.

Jackson, S.M. and Groves, C.P. (2015). *Taxonomy of Australian mammals*. CSIRO Publishing, Victoria.

Parnaby, H.E. (2009). A taxonomic review of Australian Greater Long-eared Bats previously known as *Nyctophilus timoriensis* (Chiroptera: Vespertilionidae) and some associated taxa. *Australian Zoologist* 35: 39–81.

References continued over...

A multi-step acoustic analysis procedure developed to process large full spectrum echolocation recording datasets from insectivorous bats (Armstrong and Aplin 2014; Armstrong et al. 2016) was then applied to the recordings made on the survey. Firstly, the WAV files were scanned for bat echolocation calls using several parameter sets in the software SCAN'R version 1.7.7 (Binary Acoustic Technology), which also provides measurements (in "SonoBat™ compatible output") from each putative bat pulse. The output was then used to determine if putative bat pulses measured in SCAN'R could be identified to species. This was done using a custom [R] language script that performed three tasks: 1. undertook a Discriminant Function Analysis on training data from representative calls from Western Australia; 2. from the measurements of each putative bat pulse from SCAN'R, calculated values for the first two Discriminant Functions that could separate the echolocation call types derived from the analysis of training data, and plotted these resulting coordinates over confidence regions for the defined call types; and 3. facilitated an inspection in a spectrogram of multiple examples of each call type for each recording night by opening the original WAV files containing pulses of interest in Adobe Audition CS6 version 5.0.2.

Species were identified based on information in Fullard et al. (1991) and Churchill (2008), and nomenclature follows Parnaby (2009), Jackson and Groves (2015) and Reardon et al. (2014, 2015).

LIMITATIONS

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

1. The identifications made herein were based on the acoustic data recorded and provided by a 'third party' (the client named on the front of this report).
2. Other than the general locality of the study area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a site visit to observe the habitats available for bats, nor have we visited the site on a previous occasion. Descriptions and photographs of recording sites were not provided with the acoustic recordings analysed here.
3. In the case of the present report, the recording equipment was supplied and set-up by Specialised Zoological, but the equipment was operated by the third party during the survey.
4. Specialised Zoological has had no input into the overall design of this bat survey, other than the supply of recording equipment. Specialised Zoological has had no input into the survey timing, recording site placement, nor degree of recording site replication on this survey.
5. As far as Specialised Zoological is aware, the acoustic recordings analysed here have not been made in association with trapping effort, examination of field captures or voucher collection. Thus, Specialised Zoological has had no opportunity to validate

Reardon, T.B., McKenzie, N.L., Cooper S.J.B, Appleton, B., Carthew, S. and Adams, M. (2014). A molecular and morphological investigation of species boundaries and phylogenetic relationships in Australian free-tailed bats *Mormopterus* (Chiroptera: Molossidae). *Australian Journal of Zoology* 62: 109–136.

Reardon, T.B., Armstrong, K.N. and Jackson, S.M. (2015). A current taxonomic list of Australian Chiroptera. Australasian Bat Society. Version 2015-05-15. URL: http://ausbats.org.au/taxonomic-list/4589345107

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

VESPERTILIONIDAE	
Gould's Wattled Bat	*Chalinolobus gouldii*
Inland Broad-nosed Bat	*Scotorepens balstoni*
Southern Forest Bat	*Vespadelus regulus*
Inland Forest Bat	*Vespadelus baverstocki*
MOLOSSIDAE	
White-striped Free-tailed Bat	*Austronomus* (=*Tadarida*) *australis*
Western Free-tailed Bat	*Ozimops* (=*Mormopterus*) *kitcheneri*
Ambiguous identifications	
Lesser Long-eared Bat / ***and/or*** Western Long-eared Bat	*Nyctophilus geoffroyi* / *Nyctophilus major major*
Chocolate Wattled Bat	*Chalinolobus morio*
Inland Free-tailed Bat	*Ozimops* (=*Mormopterus*) *petersi*

TABLE 2. Species identifications, with the degree of confidence indicated by a code. Date and serial/unit number correlates with site; see **Table 1** for full species names.

	A. australis	*C. gouldii*	*C. morio*	*Nyctophilus sp.*	*O. kitcheneri*	*O. petersi*	*S. balstoni*	*V. baverstocki*	*V. regulus*
SM2BAT 8072									
23/11/2016	◆	—	—	NC	◆	NC	—	—	◆
24/11/2016	◆	◆	—	NC	◆	NC	—	◆	◆
25/11/2016	◆	◆	—	NC	◆	NC	◆	◆	◆
26/11/2016	◆	◆	NC	NC	◆	NC	◆	◆	◆
27/11/2016	◆	◆	NC	NC	◆	—	—	—	◆
28/11/2016	◆	◆	NC	NC	◆	—	—	—	—
29/11/2016	◆	◆	—	—	—	NC	—	—	◆
SM2BAT 10890									
23/11/2016	◆	◆	—	NC	◆	NC	—	◆	—
24/11/2016	◆	◆	—	NC	◆	NC	—	—	◆
25/11/2016	◆	◆	NC	NC	◆	NC	—	—	◆
26/11/2016	◆	◆	NC	NC	◆	NC	—	◆	◆
27/11/2016	◆	◆	—	NC	◆	NC	—	◆	—
28/11/2016	◆	NC	—	NC	◆	NC	—	◆	—

Definition of confidence level codes:

— Not detected.

◆ Unambiguous identification of the species at the site based on measured call characteristics and comparison with available reference material. Greater confidence in this ID would come only after capture and supported by morphological measurements or a DNA sequence.

NC Needs Confirmation. Either call quality was poor, or the species cannot be distinguished reliably from another that makes similar calls. Alternative identifications are indicated in the *Comments on identifications* section of this report. If this is a species of conservation significance, further survey work might be required to confirm the record.

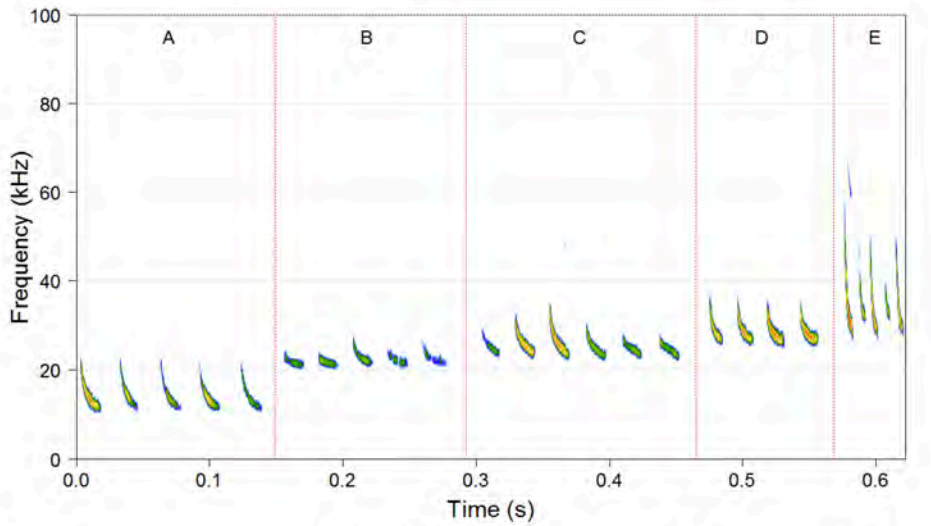

FIGURE 1. Representative call sequence portions of the species identified (**A**: *Austronomus australis*; **B**, **C**: *Ozimops kitcheneri*; **D**: *Ozimops petersi*?; **E**: *Chalinolobus gouldii*; time between pulses has been compressed).

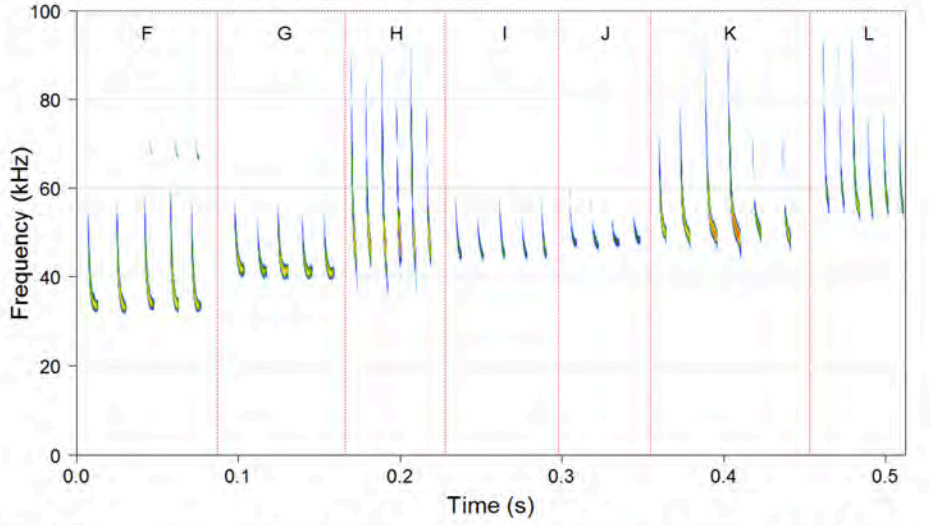

FIGURE 2. Representative call sequence portions of the species identified (**F**: *Scotorepens balstoni*; **G**: *Vespadelus regulus*; **H**: *Nyctophilus sp.*; **I**, **J**: *Vespadelus baverstocki*; **K**: *Chalinolobus morio*; **L**: *Chalinolobus morio / Nyctophilus sp.*; time between pulses has been compressed).

Specialised Zoological

Bat call identification from Mt Holland, Western Australia

Type:	Acoustic analysis
Prepared for:	Western Wildlife
Date:	17 November 2017
Job No.:	SZ437
Prepared by:	Kyle Armstrong and Yuki Konishi Specialised Zoological ABN 92 265 437 422 Tel 0404 423 264 kyle.n.armstrong@gmail.com http://szool.com.au

This report should be included amongst the technical appendices of the main report, and cited as:

Specialised Zoological (2017). Bat call identification from Mt Holland, Western Australia. Acoustic analysis. Unpublished report by Specialised Zoological for Western Wildlife, 17 November 2017, Job number SZ437.

SZ437: *Bat call identification from Mt Holland, Western Australia*

SUMMARY

Bat identifications from acoustic recordings are provided from Mt Holland, near Southern Cross, Western Australia. At least five species of bat were identified as being present (**Tables 1** and **2**). Representative echolocation calls for each identification are illustrated (**Figure 1**), as recommended by the Australasian Bat Society (ABS 2006). Further data are available should verification be required.

COMMENTS ON IDENTIFICATIONS

The identification of bat species from full spectrum WAV-format recordings of their echolocation calls was based on measurements of characteristic frequency, observation of pulse shape, and the pattern of harmonics. Some calls could not be attributed unambiguously to one species. Calls with a characteristic frequency just above 40 kHz were most likely from the Southern Forest Bat *Vespadelus regulus*, but higher frequency examples might have come from the Inland Forest Bat *Vespadelus baverstocki*.

In addition, the calls of the Western Free-tailed Bat *Ozimops kitcheneri* and the Inland Free-tailed Bat *Ozimops petersi* are similar and overlap with the call variation of Gould's Wattled Bat *Chalinolobus gouldii*. In some cases, the two genera could be distinguished, and calls with a characteristic frequency below 26 kHz were generally attributed to *O. kitcheneri*. Calls of *Ozimops petersi* could not be confirmed unambiguously.

METHODS

Data were recorded in full spectrum WAV format with Titley Scientific AnaBat Swift bat detectors (sampling rate 500 kHz, set to turn on automatically at sunset and off at sunrise).

A multi-step acoustic analysis procedure developed to process large full spectrum echolocation recording datasets from insectivorous bats (Armstrong and Aplin 2014; Armstrong et al. 2016) was then applied to the recordings made on the survey. Firstly, the WAV files were scanned for bat echolocation calls using several parameter sets in the software SCAN'R version 1.7.7 (Binary Acoustic Technology), which also provides measurements (in "SonoBat™ compatible output") from each putative bat pulse. The output was then used to determine if putative bat pulses measured in SCAN'R could be identified to species. This was done using a custom [R] language script that performed three tasks: 1. undertook a Discriminant Function Analysis on training data from representative calls from Western Australia; 2. from the measurements of each putative bat pulse from SCAN'R, calculated values for the first two Discriminant Functions that could separate the echolocation call types derived from the analysis of training data, and plotted these resulting coordinates

over confidence regions for the defined call types; and 3. facilitated an inspection in a spectrogram of multiple examples of each call type for each recording night by opening the original WAV files containing pulses of interest in Adobe Audition CS6 version 5.0.2. Species were identified based on information in Fullard et al. (1991) and Churchill (2008), and nomenclature follows Jackson and Groves (2015) and Reardon et al. (2015).

LIMITATIONS

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

1. The identifications made herein were based on the ultrasonic acoustic data recorded and provided by a 'third party' (the client named on the front of this report).
2. The scope of this report extended to providing information on the identification of bat species in bulk ultrasonic recordings. Further comment on these species and the possible impacts of a planned project on bat species were not part of the scope.
3. In the case of the present report, the recording equipment was set up and supplied by Specialised Zoological. The equipment was operated by the third party during the survey.
4. Other than the general locality of the study area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a site visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.
5. Specialised Zoological has had no input into the overall design of this bat survey. Specialised Zoological has had no input into the survey timing, recording site placement, nor degree of recording site replication on this survey.
6. While Specialised Zoological has made identifications to the best of our ability given the available materials, and reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort or non-invasive methods such as video recordings. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.
7. There are a variety of factors that affect the 'detectability' of each bat species, given the frequency, power and shape characteristics of their calls. Further information on the analysis and the various factors that can impinge on the reliability of identifications can be provided upon request.

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

VESPERTILIONIDAE	
Gould's Wattled Bat	*Chalinolobus gouldii*
Chocolate Wattled Bat	*Chalinolobus morio*
MOLOSSIDAE	
White-striped Free-tailed Bat	*Austronomus* (=*Tadarida*) *australis*
Western Free-tailed Bat	*Ozimops* (=*Mormopterus*) *kitcheneri*
Ambiguous identifications	
Southern Forest Bat / **and/or** Inland Forest Bat	*Vespadelus regulus* / **and/or** *Vespadelus baverstocki*

TABLE 2. Species identifications, with the degree of confidence indicated by a code. Date and serial/unit number correlates with site; see **Table 1** for full species names.

	A. australis	*C. gouldii*	*C. morio*	*O. kitcheneri*	*V. baverstocki* / *V. regulus*
Swift 449958					
5/10/2017	◆	◆	—	—	NC
6/10/2017	◆	◆	◆	—	NC
7/10/2017	◆	◆	—	—	NC
8/10/2017	—	◆	—	◆	NC
9/10/2017	◆	◆	—	◆	NC
10/10/2017	◆	◆	—	◆	NC
11/10/2017	—	◆	—	◆	NC
Swift 450053					
5/10/2017	◆	◆	◆	◆	NC
6/10/2017	—	◆	◆	◆	NC
7/10/2017	◆	◆	◆	◆	NC
8/10/2017	◆	◆	—	◆	NC
9/10/2017	◆	◆	◆	◆	NC
10/10/2017	◆	◆	◆	◆	NC

Definition of confidence level codes:

— Not detected.

◆ Unambiguous identification of the species at the site based on measured call characteristics and comparison with available reference material. Greater confidence in this ID would come only after capture and supported by morphological measurements or a DNA sequence.

NC Needs Confirmation. Either call quality was poor, or the species cannot be distinguished reliably from another that makes similar calls. Alternative identifications are indicated in the *Comments on identifications* section of this report. If this is a species of conservation significance, further survey work might be required to confirm the record.

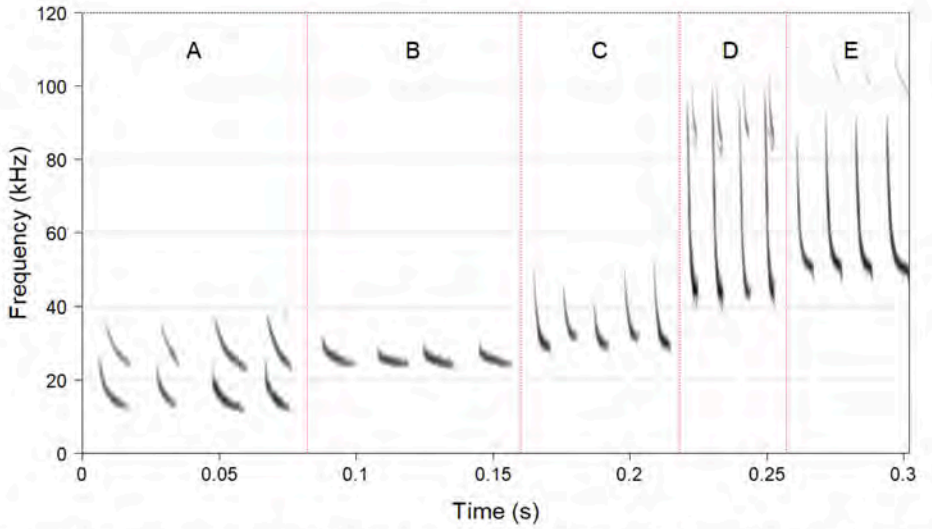

FIGURE 1. Representative call sequence portions of the species identified (**A**: *Austronomus australis*; **B**: *Ozimops kitcheneri*; **C**: *Chalinolobus gouldii*; **D**: *Vespadelus baverstocki / Vespadelus regulus*; **E**: *Chalinolobus morio*; time between pulses has been compressed).