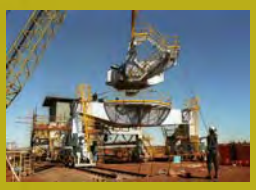
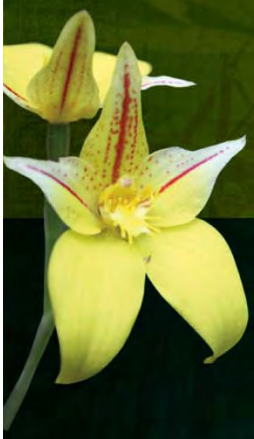
25 November 2008


Aviva Corporation Ltd

Central West Coal Project and Coolimba Power Station Project Vertebrate Fauna Survey



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Aviva Corporation Limited

Central West Coal Project and Coolimba Power Station Project

Vertebrate Fauna Survey

25 November 2008

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Executive Summary

URS Australia Pty Ltd (URS) commissioned *ecologia* Environment (*ecologia*), on behalf of Aviva Corporation Limited (Aviva), to undertake a single phase Level 2 vertebrate fauna assessment of the Central West Coal project and the Coolimba Power project, situated approximately eight kilometres south of Eneabba in the Lesueur Sandplain subregion of Western Australia (Figure 1.1). After the power line easement and power station footprints were finalised, *ecologia* conducted a Level 1 survey of these areas of impact to complement the Level 2 assessment. The information from both surveys is included in this report.

The Central West Coal project consists of an approximate 1400 ha footprint and the Coolimba Power Project an approximate 300 ha footprint, including 200 ha that has been allocated to the power line easement. Both projects are located on a mixture of cleared agricultural land, rehabilitated vegetation originally disturbed as part of Iluka Resources Limited (Iluka) mineral sands mining, re-growth from chain clearing over 50 years ago (which was extensively burnt at the end of the 2005) and patchy remnant vegetation on farmland which had been extensively grazed in the past. In this report 'project areas' refers to the combined footprints of the coal and power projects.

The aim of this study was to provide Aviva with an assessment of the vertebrate fauna assemblage and fauna habitats in the project areas.

Approximately half of the project areas consisted of native vegetation while agricultural land of little value as fauna habitat occupies the remaining half. The native vegetation within the project area is mainly comprised of kwongan heath with small associations of mixed low open banksia / eucalypt woodland with heathy understorey. While the vegetation was relatively uniform, the soil substrate varied between lateritic uplands and sandplain and the fossorial (burrowing) fauna inhabiting these varying habitats was expected to vary accordingly.

Based on species distributions 20 native and six introduced mammal, 131 bird, 90 reptile and 12 amphibian species potentially occur in the project area. This survey recorded 11 native and four introduced mammal species, 31 bird species, 22 reptile species and three amphibian species. This included three bird species and one reptile species of conservation significance as defined by the Environment Protection and Biodiversity Conservation Act (EPBC) and the Department of Environment and Conservation (DEC) Declared Threatened Fauna List: Carnaby's Black-Cockatoo (EPBC – Endangered), Rufous Fieldwren (DEC – Priority 4), Rainbow Bee-eater (EPBC – Migratory and Marine Listed) and Black-striped Snake (DEC – Priority 3).

Species accumulation curve modelling indicated that the survey recorded most fauna taxa present with the project areas, suggesting that the survey was adequate.

1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

URS Australia Pty Ltd (URS) commissioned *ecologia* Environment (*ecologia*), on behalf of Aviva Corporation Limited (Aviva), to undertake a single phase Level 2 vertebrate fauna assessment of the Central West Coal project and the Coolimba Power project, situated approximately eight kilometres south of Eneabba in the Lesueur Sandplain subregion of Western Australia (Figure 1.1). After the power line easement and power station footprints were finalised, *ecologia* conducted a Level 1 survey of these areas of impact to complement the Level 2 assessment. The information from both surveys is included in this report.

The Central West Coal project consists of an approximate 1400 ha footprint and the Coolimba Power Project consists of an approximate 300 ha footprint, including 200 ha that has been allocated to the power line easement. Both projects are located on a mixture of cleared agricultural land, rehabilitated vegetation originally disturbed as part of Iluka Resources Limited (Iluka) mineral sands mining, re-growth from chain clearing over 50 years ago (in addition, this area was extensively burnt at the end of the 2005) and patchy remnant vegetation on farmland which had been extensively grazed in the past. In this report the combination of both projects areas will be referred to as the project areas.

The aim of this study was to provide Aviva with an assessment of the vertebrate fauna assemblage and fauna habitats in the project areas.

1.2 LEGISLATIVE FRAMEWORK

The *Environmental Protection Act 1986* is "an Act to provide for an Environmental Protection Authority (EPA), for the prevention, control and abatement of environmental pollution, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing." Section 4a of this Act outlines five principles that are required to be addressed to ensure that the objectives of the Act are addressed. Three of these principles are relevant to native fauna and flora:

- *The Precautionary Principle*

  Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

- *The Principles of Intergenerational Equity*

  The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

- *The Principle of the Conservation of Biological Diversity and Ecological Integrity*

  Conservation of biological diversity and ecological integrity should be a fundamental consideration.

Projects undertaken as part of the Environmental Impact Assessment (EIA) process are required to address guidelines produced by the EPA, in this case Guidance Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact in Western Australia* (EPA, 2004),

and principles outlined in the EPA's Position Statement No. 3 *Terrestrial Biological Surveys as an element of Biodiversity Protection* (EPA, 2002).

Native fauna in Western Australia are protected at a Federal level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and at a State level under the *Western Australian Wildlife Conservation Act 1950: Wildlife Conservation (Specially Protected Fauna) Notice 2008* (WAWC Act).

The EPBC Act was developed to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance, to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources and to promote the conservation of biodiversity. The EPBC Act includes provisions to protect native species (and in particular prevent the extinction and promote the recovery of threatened species) and ensures the conservation of migratory species. In addition to the principles outlined in Section 4a of the EPBC Act, Section 3a of the EPBC Act includes a principle of ecologically sustainable development dictating that decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.

The WAWC Act was developed to provide for the conservation and protection of wildlife in Western Australia. Under Section 14 of this Act, all fauna and flora within Western Australia is protected; however, the Minister may, via a notice published in the *Government Gazette*, declare a list of fauna taxa identified as likely to become extinct, or is rare, or otherwise in need of special protection. The current listing was gazetted in January 2008.

1.3 SURVEY OBJECTIVES

ecologia's objectives are aligned with those specified in the EPA's Guidance Statement No. 56, as below:

- maintain the abundance, species diversity and geographical distribution of terrestrial fauna; and
- protect Specially Protected (Threatened) fauna, consistent with the provisions of the WAWC Act.

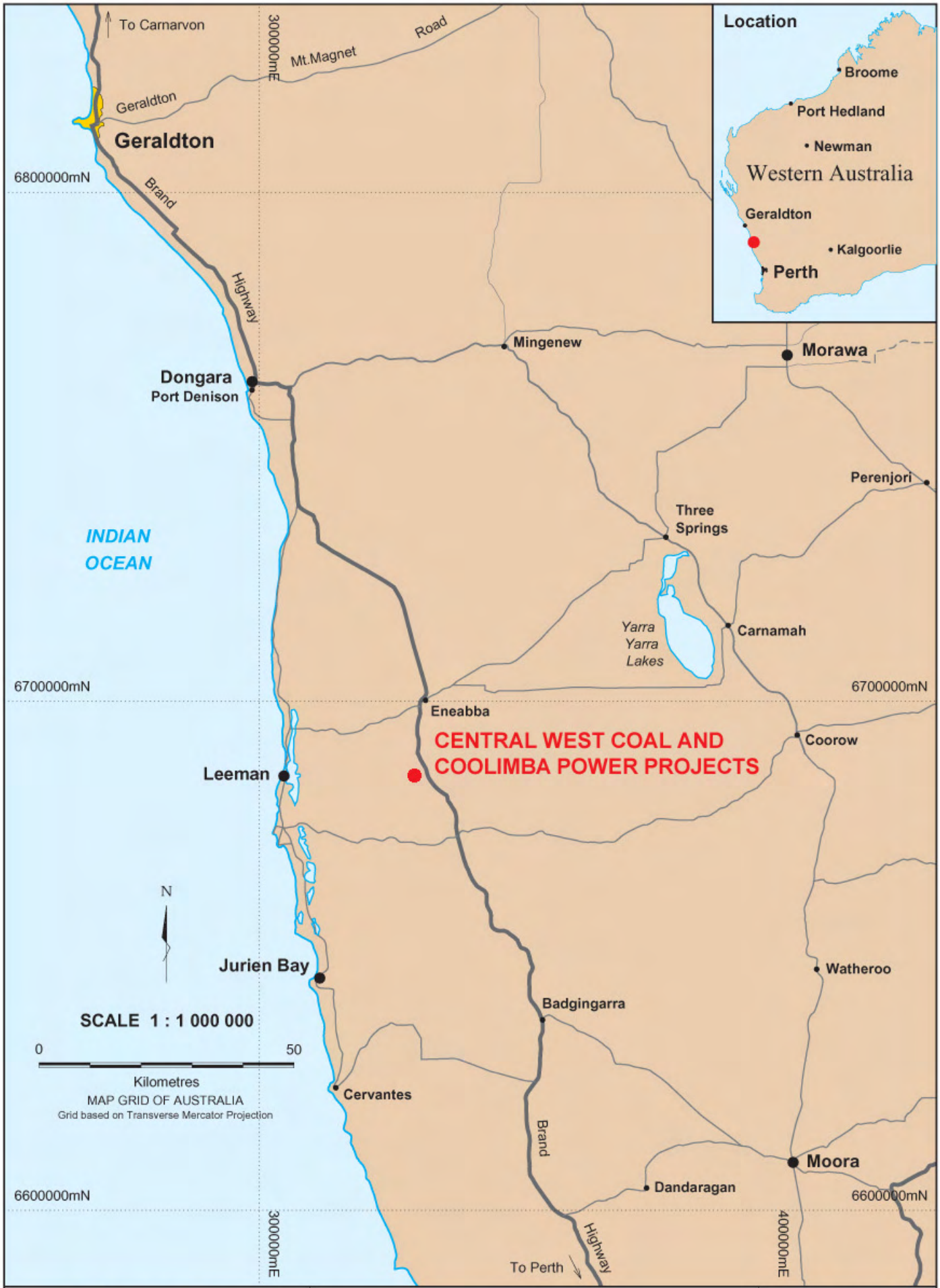
The objective of this study was to provide sufficient information to the EPA to assess the impact of the projects on the vertebrate fauna of the area, thereby ensuring that the above objectives will be upheld.

ecologia undertook a survey that satisfies the requirements documented in the EPA Guidance Statement No. 56 and Position Statement No. 3, providing:

- A review of background information (including literature and database searches);
- An inventory of vertebrate fauna species occurring in the project areas, incorporating recent published and unpublished records;
- An inventory of species of biological and conservation significance recorded or likely to occur within the project areas and surrounds;

- A description of fauna habitats occurring in the project areas;
- A description of the characteristics of the faunal assemblage;
- An appraisal of the current knowledge base for the area, including a review of previous surveys conducted in the area which are relevant to the current study, and
- A review of regional and biogeographical significance, including the conservation status of species recorded in the project areas.

An impact assessment of the proposed project on the vertebrate fauna in the area has also been carried out and, along with the associated management recommendations, is described in *ecologia* (2008).



ecologia ENVIRONMENT

Client: AVIVA CORPORATION LTD

Project: CENTRAL WEST COAL AND COOLIMBA POWER PROJECTS

Regional location of the project areas

(900.00) A4

Date: 5 February 2008

Scale: 1:1 Million

Author: S.F. / S.C.

Figure No. 1.1

Plan No. AV - 001

2.0 BIOPHYSICAL ENVIRONMENT

2.1 CLIMATE

The closest weather station to the project areas is located at Eneabba. Climatic conditions of the project areas are characterised by hot dry summers and mild wet winters, as typified by a Mediterranean climate. The area receives an average annual rainfall of 500 mm, the majority of which occurs between May and August (Figure 2.1). January and February are the hottest months of the year, June is the wettest and July is the coldest (Bureau of Meteorology, 2008). Daily weather conditions experienced during the Level 2 survey are presented in Appendix A.

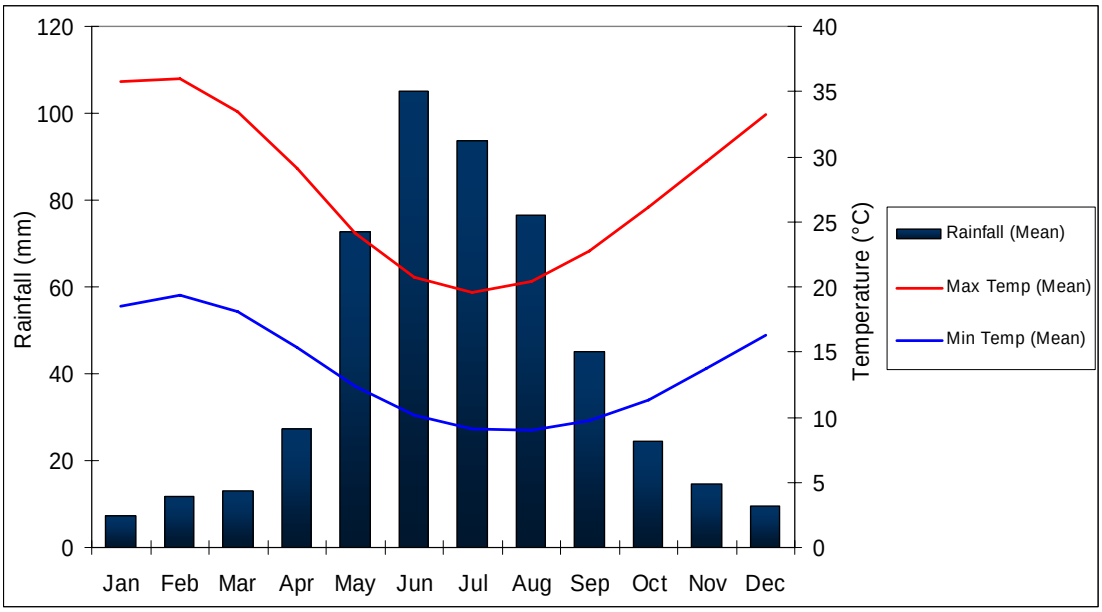


Figure 2.1 Summary of climatic data from Eneabba weather station.

2.2 BIOGEOGRAPHY

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Australia into 85 biogeographic regions on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell, 1995) (Figure 2.2). The project areas are situated in the Lesueur Sandplain subregion, described by Thackway and Cresswell (1995) as:

"A region composed mainly of proteaceous scrub-heaths, rich in endemics, on the sandy earths of an extensive, undulating, lateritic sandplain mantling Permian to Cretaceous strata. Extensive York Gum and Jam woodlands occur on outwash plains associated drainage. The Lesueur Sandplain (GS3) comprises coastal Aeolian and limestones, Jurassic siltstones and sandstones (often heavily lateritised) of central Perth Basin. Alluvials are associated with drainage systems. There are extensive yellow sandplains in south-eastern parts, especially where the subregions overlap the western edge of the Pilbara Craton. Shrub-heaths rich in endemics occur on a mosaic of lateritic mesas, sandplains, coastal sands and limestones. Heath on lateritised sandplains along the subregion's north-eastern margins."

Figure 2.2 Location of the Lesueur Sandplain subregion.

3.0 SURVEY METHODS

The survey methods adopted by *ecologia* are aligned with the EPA's Guidance Statement No. 56 (EPA, 2004) and Position Statement No. 3 (EPA, 2002).

Based on the location and the scale of the proposed developments, Guidance Statement No. 56 recommends that a Level 2 survey be undertaken (Detailed Field Survey). The purpose of the survey is to enhance the level of knowledge at a local scale, and requires:

"One or more visits in each season appropriate to the bioregion and the faunal group being surveyed. Generally, maximum survey will be the season that follows the season of maximum rainfall, but there will be need to time surveys according to seasonal activity patterns of some faunal groups (e.g. molluscs or amphibians)."

A follow up Level 1 Reconnaissance Survey of the finalised power station footprint and powerline easement corridor was also conducted. Both areas include very little native vegetation and a Level 2 survey was not necessary. During the survey, the potential for species of conservation significance, or habitat likely to support such species, was determined for these additional areas.

3.1 DETERMINATION OF SURVEY SAMPLING DESIGN AND INTENSITY

As recommended by the EPA in Guidance Statement No. 56, prior to the development of survey methods, a review is required to be undertaken of factors likely to influence survey design (EPA, 2004):

"The duration and spatial scale of fauna sampling are pivotal in environmental impact assessment and the methodology design and intensity of the survey needs careful consideration and will vary regionally and take into account local conditions"

A review of factors likely to influence survey design was conducted prior to the survey, and the results are presented below in Table 3.1.

Table 3.1 Factors likely to influence survey design

FACTOR	RELEVANCE	COMMENT
Bioregion – level of existing survey / knowledge of the region and associated ability to predict accurately.	The project is located within the Lesueur Sandplain subregion (GS3) of the Geraldton Sandplain biogeographic region (IBRA). This region is located in the transitional zone between the South West and the Eremaean botanical provinces and has a high species diversity.	*ecologia* was commissioned by Aviva to undertake a single phase Level 2 survey of the project areas. Knowledge of the vertebrate fauna of the bioregion is extensive with 12 biological surveys conducted in the region between 1980 and 2001. *ecologia* placed four study sites within the areas to be impacted by the projects and two in the adjacent South Eneabba Reserve in order to compare the fauna assemblages between the project areas and important surrounding conservation areas. Once the power easement location was finalised, a Level 1 reconnaissance survey of the power station footprint and easement corridor was conducted.
Landform special characteristics/ specific fauna/ specific context of the landform characteristics and their distribution and rarity in the region.	Within the vegetated parts of the project area landform features are limited to sandplains and lateritic uplands supporting kwongan heaths, much of which are regenerating after a fire in 2005.	Survey sites were located to be representative of changes in landform and habitat within the project areas and to correspond with areas of disturbance. The project areas are dominated by kwongan heathland which is, structurally, relatively uniform across the project areas; fauna sites were chosen that represented subtle differences in heath density or substrate (e.g. lateritic ridges vs. sandplain) to maximise the range of potential fauna sampled.

FACTOR	RELEVANCE	COMMENT
Lifeforms, life cycles, types of assemblages and seasonality (e.g. migration) of species likely to be present.	The Geraldton Sandplain region experiences a Mediterranean climate, characterised by hot, dry summers and mild, wet winters. Most rainfall occurs between May and August. McNee *et al.* (1995) found that maximum abundances were recorded in May – September for frogs, November – March for reptiles, July for birds and November – January and July for Mammals.	A survey was undertaken in November 2007 following the season of maximum rainfall. Conditions were very favourable for reptiles. The warm, dry conditions resulted in low / moderate bird activity but did not prevent three species of amphibian from being observed.
Level of existing knowledge and results of previous regional sampling (e.g. species accumulation curves, species/ area curves).	The level of existing knowledge is high with 12 biological surveys previously completed in the surrounding region.	A Level 2 survey was required to obtain the level of detail required to adequately assess the habitats of the project areas. Because several fauna studies had been completed within 10km of the project areas, a single phase of trapping was conducted
Number of different habitats or degree of similarity between habitats within a survey area.	Two fauna habitats were identified within the vegetation in the project area. The native vegetation within the project area is mainly comprised of kwongan heath with small associations of mixed low open banksia / eucalypt woodland with heathy understorey. Kwongan heath was the dominant habitat and was underlain by substrates varying from sandplain to lateritic ridges.	Survey site locations were chosen to be representative of landform and habitat differences that occurred in the project area and to include areas of disturbance or clearing.

FACTOR	RELEVANCE	COMMENT
Climatic constraints (e.g. temperature or rainfall that preclude certain sampling methods).	Temperatures, humidity and wind varied over the duration of the survey (Appendix A).	Weather during the survey was hot (average temperature approximately 30ºC) and dry. Reptile activity was high during sampling but bird and amphibian activity was moderate to low. Climate constraints did not preclude the use of any sampling methods.
Sensitivity of the environment to the proposed activities.	The sandplain areas have suffered extensive land clearance for agriculture similar to that seen in the wheatbelt. A large number of distinct, species rich and geographically restricted vegetation communities occur in the Mt Lesueur and Coomalloo reserves and other reserves surrounding the project areas.	Approximately half of the project areas consist of open farmland. Areas most sensitive to impacts are the remnant kwongan heath vegetation. These areas were the focus of the fauna survey.
Size, shape and location of the proposed activities.	The project areas comprises areas of disturbed pasture and farmland (approximately 825 ha), as well as areas of intact native vegetation of varying quality (totalling approximately 875 ha). The predicted disturbance footprint for both projects is 1700 ha.	Remaining vegetation within the project areas was surveyed using four fauna sites, and a further two were included in the adjacent South Eneabba Reserve, which contains similar habitat, as a comparison.
Scale and impact of the proposal.	The location and scale of the project warrants a Level 2 survey (detailed field survey), in accordance with EPA guidelines.	A Level 2 survey was undertaken as per guidelines contained in the EPA's Guidance Statement No. 56.

3.2 LITERATURE REVIEW AND DATABASE SEARCHES

Several databases were consulted in the development of a list of the potential fauna (and conservation significant fauna). These include:

- Western Australian Museum (WAM) FaunaBase;
- Birds Australia Birdata;
- Department of Environment, Water, Heritage and the Arts Protected Matters Database;
- DEC Declared Threatened and Priority Fauna Database.

Search co-ordinates for the DEC Declared Threatened and Priority Fauna Database were: -29.79, 115.10; 30.07, 115.34 (Appendix B). EPBC Protected Matters Database search co-ordinates were: -29.98, 115.26; -29.97,115.2; -29.91,115.21; -29.91,115.23; -29.9,115.26, plus 10 km buffer. Biological surveys relevant to the project areas are listed below (Table 3.2) and their locations shown in Figure 3.1. These surveys were:

Table 3.2 Biological surveys relevant to the Project Areas.

No. on Figure 3.1	Authors	Locations	Distance From Project Areas (km)
1	Chapman *et al.* (1977)	Cockleshell Gully Nature Reserve	20
2	Dell *et al.* (1979)	Marchagee Nature Reserve	80
3	Murray (1980)	Badgingarra Nature Reserve	60
4	Halse *et al.* (1985)	Marchagee Track	80
5	Burbidge *et al*. (1990)	The Lesueur Area	16
6	Foulds and McMillan (1982)	The Leeman Area	18
7	Dunlop (1981)	Reserve 31030 (South Eneabba Nature Reserve)	5
8	Environmental Management and Research Consultants - EMRC (1996)	Combined Studies in RGC Mineral Sands rehabilitation up till 1995	5
9	McMillan *et al.* (1992)	Rehabilitation and control sites at the RGC Mineral Sands mine site	5
10	McNee *et al.* (1995)	Rehabilitation and control sites in the Eneabba region	5
11	Halpern Glick Maunsell (1998)	Sites located between Eneabba and the Iluka Mine site	5
12	Halpern Glick Maunsell (2001)	Sites located between Eneabba and the Iluka Mine site	5

Fauna species potentially occurring within the project area are listed in Appendix C.

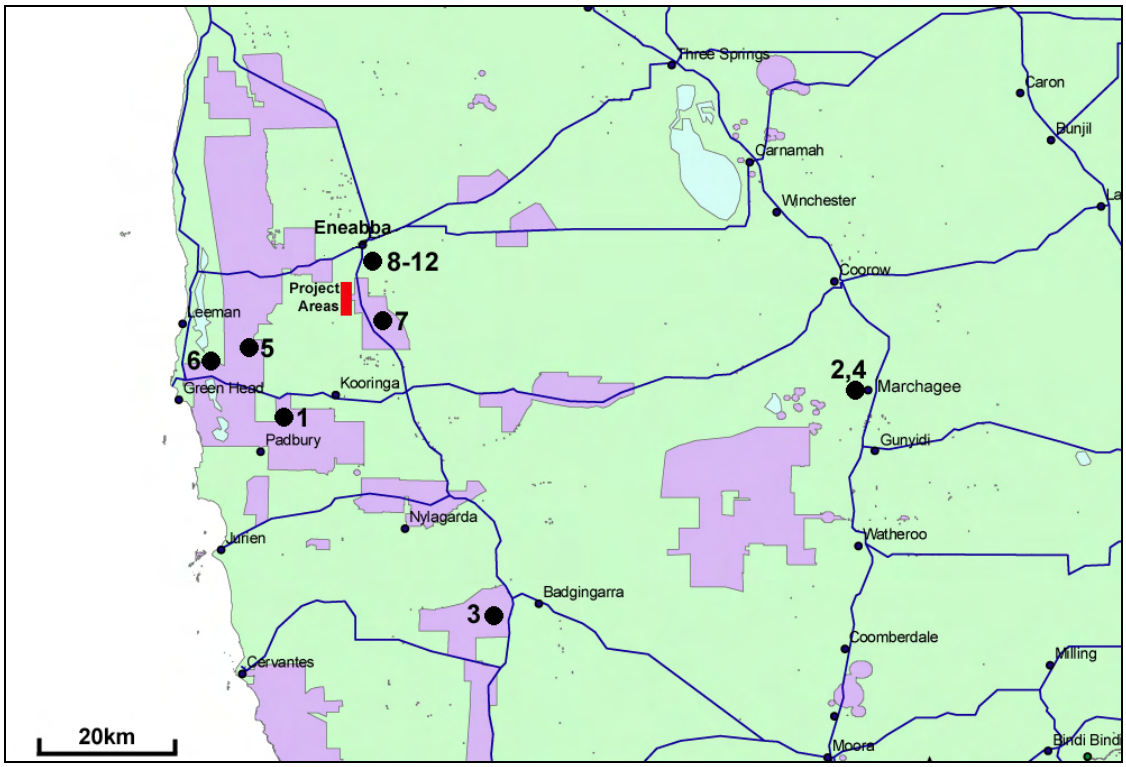


Figure 3.1 Location of previous biological surveys from the surrounding region.

3.3 SURVEY TIMING

The Level 2 survey was conducted in spring between the 19th and 28th of November 2007. The Level 1 survey was conducted in autumn on the 17th April 2008.

3.4 SITE SELECTION

Survey sites for the Level 2 survey were established in the project areas within remnant blocks of native vegetation based on observed variations in faunal habitat types. Six survey sites were sampled: four within the project area and two in the South Eneabba Nature Reserve (Figure 3.2a and 3.2b). The purpose of this survey design was to maximise the number of fauna habitats sampled within the project area and to compare the faunal assemblages of the project areas with those of the adjacent reserve.

Two opportunistic survey sites were also sampled. These lay outside of the project areas but included areas of markedly different habitats to the systematic survey sites mentioned above.

Survey sites for the Level 1 survey were located in areas of remnant vegetation located within the easement corridor. Eight survey sites were studied, based on the location of remnant vegetation within the power line easement corridor (Figure 3.2a and 3.2b).

Site locations are summarised in Table 3.3 and Table 3.4, with more detailed site descriptions and photographs given in Table 3.5.

Table 3.3 Location of Level 2 survey sites.

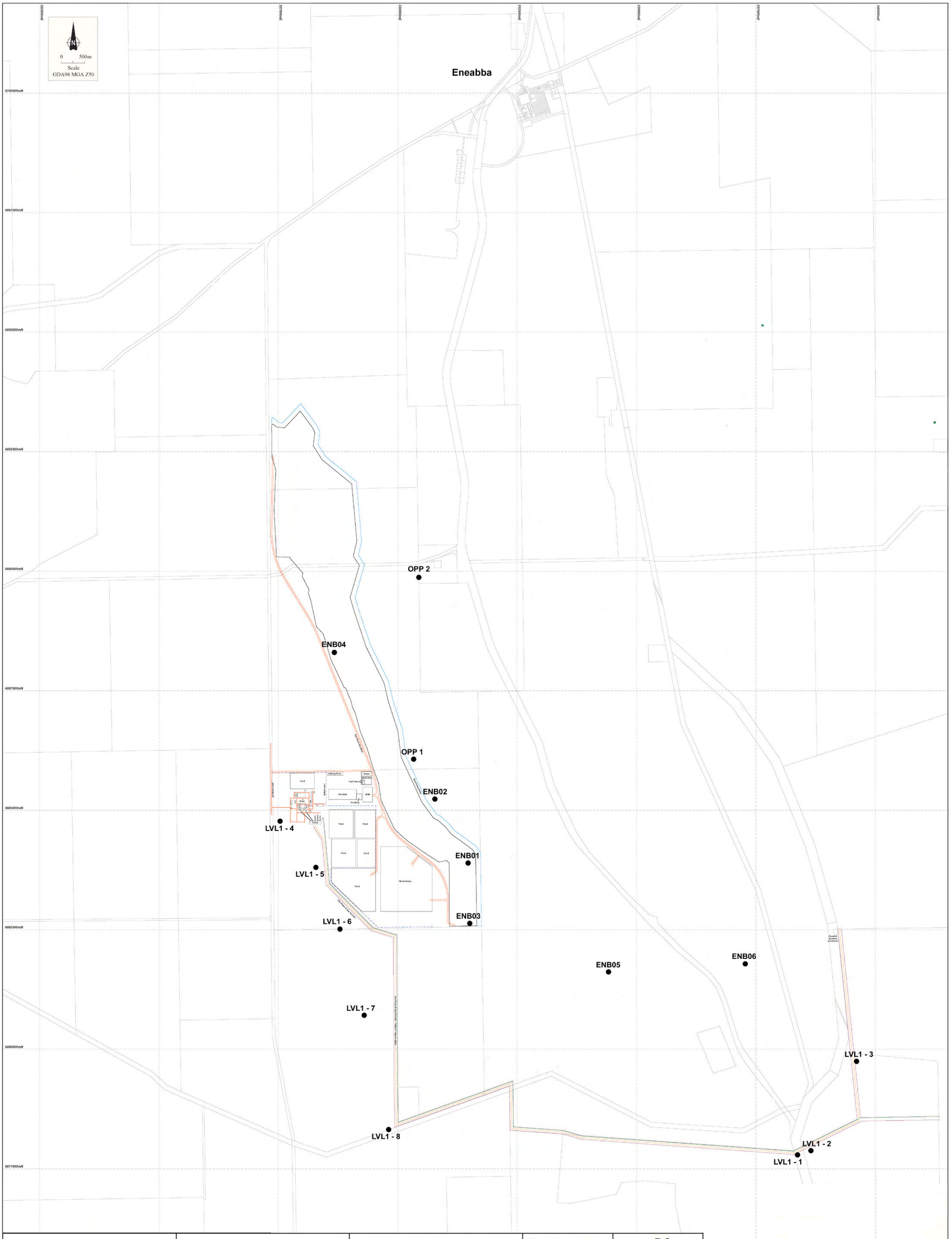
SITE	LANDFORM	VEGETATION	GPS CO-ORDINATES	
			E	N
ENB01	Sandplain	Kwongan Heath (burnt 2005)	331475	6683904
ENB02	Sandplain	Kwongan Heath (burnt 2005)	330788	6685240
ENB03	Lateritic upland	Kwongan Heath (burnt 2005)	331488	6682559
ENB04	Sandplain	Mixed banksia/eucalypt woodland	328691	6688752
ENB05	Sandplain (Reserve)	Kwongan Heath (burnt 2005)	334252	6681465
ENB06	Sandplain (Reserve)	Kwongan Heath (burnt 2005)	337307	6681728
OPP 1	Sandplain	Low eucalypt woodland	330353	6686086
OPP 2	Sandplain	Mixed banksia/eucalypt woodland over dense heath	330437	6689857

GPS datum: WGS84; Zone: 50J

Table 3.4 Location of Level 1 survey sites.

SITE	LANDFORM	VEGETATION	GPS CO-ORDINATES	
			E	N
LVL1 – 1	Sandplain	Low kwongan heath	338376	6677802
LVL1 – 2	Sandplain	Low kwongan heath	338641	6677896
LVL1 – 3	Sandplain	Low kwongan heath	339605	6679755
LVL1 – 4	Drainage line	Eucalypt / Melaleuca woodland	327522	6684769
LVL1 – 5	Drainage line	Eucalypt / Melaleuca woodland	328282	6683783
LVL1 – 6	Drainage line	Eucalypt / Melaleuca woodland	328813	6682506
LVL1 – 7	Lateritic upland	Disturbed kwongan heath	329221	6680712
LVL1 – 8	Sandplain	Low kwongan heath	329809	6678308

GPS datum: WGS84; Zone: 50J



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Location of fauna sites within the project area

Figure: 3.2a

Drawn: DC
Date: 25/11/08

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Scale: 1:25,000

A3

Eneabba

OPP2

ENB04

OPP1

ENB02

LVL1 - 4

LVL1 - 5

ENB01

LVL1 - 6

ENB03

ENB06

ENB05

LVL1 - 7

LVL1 - 3

LVL1 - 8

LVL1 - 1

LVL1 - 2

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Location of fauna sites within the project area

Figure: **3.2b**

Drawn: DC
Date: 25/11/08

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

A3

Table 3.5 Vegetation descriptions and photographs of Level 2 survey sites.

SITE ENB01: Open regenerating kwongan heath (2 years post-fire) on white sandy soils with scattered low shrubs.	
SITE ENB02: Open regenerating kwongan heath (2 years post-fire) on white sandy soils with scattered low shrubs and low trees.	

Table 3.5 Vegetation descriptions and photographs of Level 2 survey sites (continued).

SITE ENB03: Open regenerating kwongan heath (2 years post fire) on lateritic ridge with *Xanthorrhoea* sp. and low shrubs.	
SITE ENB04: Open mixed banksia / eucalypt woodland over open kwongan heath on white sandy soils.	

Table 3.5 Vegetation descriptions and photographs of Level 2 survey sites (continued).

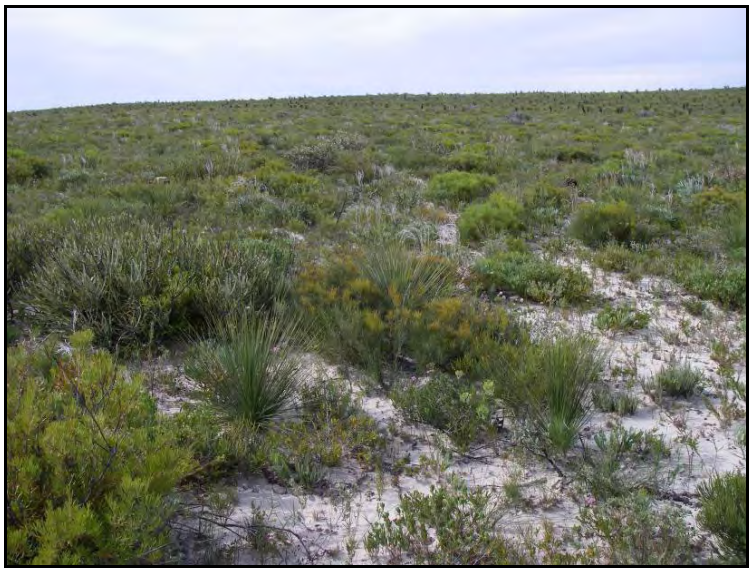
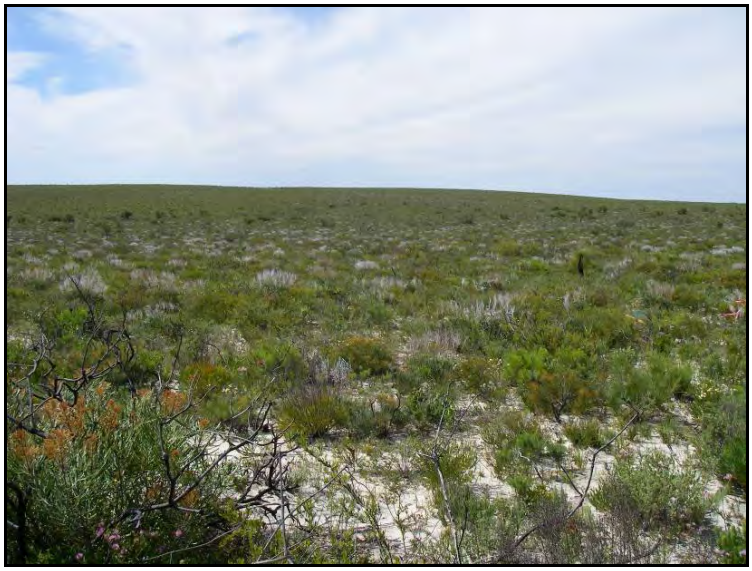
SITE ENB05: Open regenerating kwongan heath (2 years post fire) on white sandy soils between lateritic uplands. Located in South Eneabba Reserve.	
SITE ENB06: Open regenerating kwongan heath (2 years post fire) on white sandy soils between lateritic uplands. Located in South Eneabba Reserve.	

Table 3.5 Vegetation descriptions and photographs of Level 2 survey sites (continued).

OPP 1: Low eucalypt woodland over open melaleuca scrub. Little to no ground cover (except leaf litter).	
OPP 2: Mixed eucalypt / banksia woodland over dense unburnt heath on yellow sands with emergent lateritic ridges.	

Table 3.6 Vegetation descriptions and photographs of Level 1 survey sites.

LVL1 - 1 Low proteaceous heath on white sands with lateritic gravel present. No emergent eucalypt species present	
LVL1 - 2 Low proteaceous heath with some emergent eucalypt species on white sandy soils	

Table 3.6 Vegetation descriptions and photographs of Level 1 survey sites (continued).

LVL1 - 3 Low proteaceous heath on whites sands with lateritic gravel present. No emergent eucalypt species present.	
LVL1 - 4 Mixed remnant Melaleuca and Eucalyptus woodland over heavily grazed grassy understorey on sandy soils. Woodland vegetation is restricted to the drainage system.	

Table 3.6 Vegetation descriptions and photographs of Level 1 survey sites (continued).

LVL1 - 5 Mixed remnant Melaleuca and Eucalyptus woodland over heavily grazed grassy understorey on sandy soils. Woodland vegetation is restricted to the drainage system.	
LVL1 - 6 Mixed remnant Melaleuca and Eucalyptus woodland over heavily grazed grassy understorey on sandy soils. Woodland vegetation is not restricted to the drainage system with some vegetation patches occurring on the sandy flats nearby.	

Table 3.6 Vegetation descriptions and photographs of Level 1 survey sites (continued).

LVL1 - 7 Heavily disturbed remnant proteaceous heath with some emergent eucalypt mallee on gravelly sands. Area merges with surrounding cleared agricultural land.	
LVL1 - 8 Low proteaceous heath with some emergent shrub species on soft white sands.	

3.5 SAMPLING METHODS

The survey was undertaken using a variety of sampling techniques, including systematic and opportunistic sampling. Systematic sampling refers to data collected over a fixed time period in a discrete habitat type, using an equal or standardised sampling effort. The resulting information can be analysed statistically, facilitating comparisons between habitats and seasons. Opportunistic sampling includes data collected non-systematically or on an *ad hoc* basis. Total survey effort is presented in Table 3.7.

Table 3.7 Survey effort.

	TRAP NIGHTS				TIME (MINUTES)			
SITE	PIT	FUNNEL	ELLIOTT	CAGE	BIRD CENSUS	DIURNAL SEARCH	ANABAT	NIGHT SEARCH
ENB01	100	200	200	20	960	120	96	120
ENB02	100	200	200	20	960	120	96	120
ENB03	100	200	200	20	960	120	96	180
ENB04	100	200	200	20	960	180	96	180
ENB05	100	200	200	20	960	120	96	120
ENB06	100	200	200	20	960	120	96	120
OPP 1						120		
OPP 2						120		
Total	**600**	**1200**	**1200**	**120**	**5760**	**1020**	**576**	**840**

3.5.1 Systematic Sampling

3.5.1.1 Terrestrial Mammals and Herpetofauna

Trapping for terrestrial mammals and herpetofauna was undertaken using a standardised trapping format comprising a combination of pit-fall traps, Elliott box traps, funnel traps and cage traps.

Each fauna survey site consisted of the following:

- Pitfall trap and drift fence: five PVC pipes (16 cm diameter, minimum 50 cm deep) and five 20 L plastic buckets (30 cm diameter, 40 cm deep) were established at each site. A six metre flywire drift fence (30 cm high) bisected the pits, directing fauna into them. Pitfall traps were spaced 25 m apart.
- Elliott box traps: twenty medium sized Elliott box traps (9 × 9 × 32 cm) were located at each site, and baited with universal bait (a mixture of peanut butter, rolled oats and sardines). A trap was placed in association with each pitfall trap and another was placed between pits.
- Funnel traps: a funnel trap (Ecosystematica Type III) was placed at the end of each drift fence.

- Cage traps: Two cage traps were used per site with one trap placed at each end of the trap line.

3.5.1.2 Avifauna

Repeated twenty minute surveys were used to document the avifauna present at each of the fauna sites. During each survey an ornithologist recorded the number of individuals of each species seen or heard while actively searching a two hectare area. This technique is used as the basis for the ongoing avifaunal survey of Australia: the Birds Australia Atlas project.

Survey effort was concentrated between the post-dawn (06:00-09:00) and pre-dusk (15:00-18:00) time periods, as these are deemed to be the optimal time to record most bird species. Censuses between these times were also conducted, as these surveys may yield species less frequently observed in the early morning or late evening, such as diurnal raptors.

3.5.1.3 Bats

Bat echolocation calls were detected using an ANABAT II system (Titley Electronics, Ballina, NSW). The ANABAT Bat Detector is able to transform ultrasonic bat echolocation calls for analysis with computer software. The transformed calls were stored on minidiscs for later analysis. Mr Bob Bullen identified acoustic calls.

3.5.2 Opportunistic Data

3.5.2.1 Spotlighting

The project areas were searched at night using a combination of road transects and opportunistic ground searches, using head torches and hand-held spotlights, for nocturnal species such as geckos, snakes and nocturnal birds.

3.5.2.2 Hand Searching

Opportunistic sites were searched for cryptic species, which involved searching beneath the bark of trees, breaking open old logs, searching through leaf litter, investigating burrows, recording tracks, diggings and scats, and overturning logs and stones. Sites were selected on the basis of their representative nature of the project area, and also upon whether they were well represented by the systematic trapping effort.

3.5.2.3 Secondary Evidence

Records of species' tracks, diggings, scats, burrows and nests were also used when the identification of the species responsible was possible.

3.5.2.4 Opportunistic Sightings

The presence of fauna species was recorded while searching, travelling and during trap establishment within the project area during the day and night.

3.6 ANIMAL ETHICS

Surveying was conducted as per the *ecologia* Animal Ethics Code of Practice, which conforms to Section 5 of the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes (National Health and Medical Research Council, 2004).

In most cases, fauna were identified in the field and released at the point of capture. Where the taxonomy of specimens was not clearly discernable, or when species were collected that are known to exhibit significant morphological variation or are not yet fully described, vouchers specimens were lodged with the WAM. Voucher specimens were maintained according to WAM guidelines (Brad Maryan, *pers. comm.*) to ensure minimum stress to captured animals.

3.7 TAXONOMY AND NOMENCLATURE

Field identification of vertebrate species was based on the following texts:

Taxonomic Group	Field Guide
Mammals	Menkhorst and Knight (2004)
Bats	Churchill (1998), Menkhorst and Knight (2004)
Birds	Simpson and Day (2004)
Dragons	Cogger (2000), Storr *et al.* (1983)
Reptiles	Cogger (2000), Wilson and Swan (2008)
Geckos	Storr *et al.* (1990), Cogger (2000)
Skinks	Storr *et al.* (1999)
Legless Lizards	Storr *et al.* (1990), Cogger (2000)
Varanids	Cogger (2000), Storr *et al.* (1983)
Snakes	Storr *et al.* (2002)
Amphibians	Tyler *et al.* (2000), Cogger (2000)

Nomenclature for mammals, reptiles and amphibians within this report is written as per the WAM FaunaBase. Nomenclature for birds follows Christidis and Boles (2008).

3.8 DATA ANALYSIS

3.8.1 Species Richness

The number of species present (species richness) is the most intuitive representation of species diversity (Colwell, 2005; Magurran, 2004) and is the basic indicator of diversity used for this survey.

3.8.2 Randomised Species Accumulation Curves

Species accumulation curves were plotted as the number of species against the number of individuals (Thompson and Withers, 2003). The curves were randomised 10^4 times using EstimateS (Version 8, Colwell, 2005) software. Based on the data accumulated, an estimate of the total species richness was obtained using the Chao 1 and ACE estimators (Colwell, 2005; Magurran, 2004).

3.9 SURVEY TEAM

The survey described in this document was planned, coordinated and executed by:

ecologia ENVIRONMENT

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Project Staff

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S. Pynt	BSc	Zoologist
T. Rasmussen		Herpetologist

ecologia wishes to acknowledge the assistance Mr Bob Bullen for bat call identification and Brad Maryan and Giles Hardy who provided useful information on various technical aspects.

4.0 RESULTS

4.1 FAUNA ASSEMBLAGES

Based on species distributions 20 native and six introduced mammal species, 131 bird species, 90 reptile species and 12 amphibian species potentially occur in the project areas (Appendix C). The following sections describe the species recorded within the project areas during the *ecologia* survey. Tables presenting the fauna species recorded in the project areas are presented in Appendix D.

4.1.1 Native Mammals

Eleven species of native mammal were recorded during the survey (Appendix D-1). This included three Dasyurids (*Sminthopsis crassicaudata*, *S. dolichura* and *S. granulipes*), two macropods (*Macropus robustus* and *M. fuliginosus*), three bats (*Chalinolobus gouldii*, *Nyctophilus geoffroyi* and *Vespadelus regulus*), one rodent (*Pseudomys albocinereus*), the Honey Possum (*Tarsipes rostratus*) and the Echidna (*Tachyglossus aculeatus*).

4.1.2 Birds

Thirty-one bird species were recorded within or adjacent to the project areas (Appendix D-2). This included Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), listed as both Endangered under the EPBC Act and as a Schedule 1 species under the WAWC Act, Rainbow Bee-eater, listed as Migratory under the EPBC Act and Rufous Fieldwren (western wheatbelt population), which is listed as a Priority 4 species on DEC's Declared Threatened and Priority Fauna list (see Section 5.1).

4.1.3 Reptiles

Twenty-two reptile species were recorded during the survey (Appendix D-3). This comprised five elapids, three agamids, six skinks, two legless lizards, four geckoes, and two varanids.

The Black-striped Snake, *Neelaps calonotos*, was recorded at ENB02. This species is listed as Priority 3 on the DEC Declared Threatened and Priority Fauna and is thought to occur throughout the Swan Coastal Plain, yet records only exist from between Mandurah and Lancelin, with a single specimen recorded from Port Denison. This record bridges a 200 km gap between recorded localities.

4.1.4 Amphibians

Three frog species were recorded within the project areas (Appendix D-4): the Western Spotted Frog (*Heleioporus albopunctatus*), the Moaning Frog (*Heleioporus eyrei*) and the Turtle Frog (*Myobatrachus gouldii*). These species are all common on the sandplains within the Lesueur sandplain subregion.

4.1.5 Introduced Species

Four species of introduced mammal were recorded in the project areas. Tracks and scats of the Fox (*Vulpes vulpes*) were widespread and were recorded at Sites ENB01 through ENB05. Opportunistic sightings of foxes were made at Sites ENB03 and ENB04 during night spotting searches. Cat tracks (*Felis catus*) were recorded at Site ENB04 and an opportunistic sighting of an individual was recorded within the project areas.

Rabbits (*Oryctolagus cuniculus*) were recorded at sites ENB02 and ENB04 and the House Mouse (*Mus musculus*) at sites ENB02, ENB03, ENB05, and ENB06. The high number of cats and foxes present within the project areas is likely to have impacted the abundance of small to medium sized terrestrial fauna.

4.2 FAUNA HABITATS

Approximately half of the projects areas consists of native vegetation, and agricultural pasture land that is of little value for fauna habitat occupies the remaining half. Both projects are located on a mixture of cleared agricultural land, rehabilitated vegetation originally disturbed as part of Iluka mineral sands mining, re-growth from chain clearing over 50 years ago (which was extensively burnt at the end of the 2005) and patchy remnant vegetation on farmland which had been extensively grazed in the past. The native vegetation within the project area is mainly comprised of kwongan heath with small associations of mixed low open banksia / eucalypt woodland with heathy understorey. While the vegetation was relatively uniform from the perspective of vertebrate fauna, the soil substrate varied between lateritic uplands and sandplain and the fossorial (burrowing) fauna within these different habitats was expected to vary accordingly.

Morgan (2000) identified several bird species as indicators of ecosystem health in the Geraldton sandplains. Five of these species were recorded during the survey: Rufous Fieldwren (ENB01, ENB03 and ENB06), Emu (ENB05), Carnaby's Black-Cockatoo (ENB06), Tawny-crowned Honeyeater (recorded at all survey sites), and Hooded Robin (opportunistic sighting). Other species are Australian Shelduck, Australian Bustard, Banded Lapwing, Yellow-plumed Honeyeater, Grey-crowned Babbler, Varied Sittella and Crested Bellbird. The presence of five of these species during this survey indicates moderate ecosystem health. Past surveys in the region within the last 20 years have only recorded one additional indicator species (Australian Shelduck) suggesting that ecosystem health for the region is sub-optimal.

One of the most widespread mammal species recorded during the survey was the White-tailed Dunnart (*Sminthopsis granulipes*), which was recorded six times across sites ENB01, ENB02, ENB03 and ENB04 within the project area. Its absence from South Eneabba Nature Reserve seems anomalous given that Sites ENB05 and ENB06 are very similar to Sites ENB01 and ENB02. However, it is possible that this species does occur within the reserve and its absence from sites ENB05 and ENB06 is the result of chance rather than a significant difference in fauna habitat.

The Honey Possum (*Tarsipes rostratus*) was only recorded at the banksia / eucalypt woodland of Site ENB04. Since the preferred habitat of the Honey Possum is known to be banksia woodlands associated with heaths (Bradshaw and Bradshaw, 2002), the other, more open habitats, could support this species as part of the species normal range.

Fossorial species recorded during this study included *Diplodactylus alboguttatus*, *Diplodactylus ornatus*, *Lerista elegans*, *L. praepedita*, *Delma fraseri*, *Varanus gouldii*, *Neelaps bimaculatus*, *N. calonotos* and *Simoselaps bertholdi*. None of these species were recorded at Site ENB03, characterised by a hard lateritic ridge, suggesting that these landforms may represent a significant barrier to fossorial species.

The Western Bearded Dragon (*Pogona minor*), Western Heath Dragon (*Rankinia adelaidensis*) and *Ctenotus fallens* were recorded at least once at every site, indicating that their distribution is contiguous with the general heathland habitat within the subregion and is not restricted by fine scale variations in soil substrate and overstorey complex.

Further sampling would be required to make inferences regarding the associations between fauna and fauna habitats. While there appeared to be little distinction between the quality of the habitat within the project footprint and the South Eneabba Nature Reserve, five species were recorded there but not within the projects footprints (Little Long-tailed Dunnart, Emu, Stubble Quail, Carnaby's Black-Cockatoo and Blue-breasted Fairy-wren). This is likely to be a result of chance rather than differences between the native vegetation of the project areas and South Eneabba Nature Reserve, as the fauna assemblages overall are similar.

4.3 SURVEY ADEQUACY

The number of potential fauna species is the maximum number of species likely to utilise the project area. Tables presented in Appendix C are based on the WAM FaunaBase, Birdata (2008), species distribution maps published in field guides, and from previous biological surveys from similar regional areas. Potential species lists may include numerous non-residential and / or transient species and do not take into consideration population fluctuations. The total number of potential species when compared with those observed and those predicted (from the species accumulation curves) are presented in Table 4.1; introduced fauna are excluded from the analysis.

Table 4.1 Observed, expected and potential species richness.

Taxa	Observed (O)	Estimated (E)	O/E %	Potential (P)	O/P %
Mammals	11	7.62 ± 2.49 (*ACE*)	144%	18	61%
Birds	31	30.3 ± 4.29 (*ACE*)	102%	131	24%
Reptiles	22	22.05 ± 3.99 (*ACE*)	99%	90	24%
Amphibians	3	N/A	N/A	9	33%

*Introduced species

Sampling adequacy can be assessed using randomised species accumulation curves (SACs), which show the trend in total number of species recorded (species richness) as the number of individuals sampled increases. The total number of species recorded approaches a plateau (the asymptote) when most species in an area have been recorded.

SACs were not generated for amphibian species caught as only eight records of three species were recorded, and this may have skewed the data. Additionally, SACs are limited in that they only utilise data that are collected systematically; opportunistic data is excluded because it was not collected in a comparable manner.

Species accumulation curves generated for mammals (Figure 4.1), birds (Figure 4.2) and reptiles (Figure 4.3) do not appear to be approaching an asymptote. This suggests that not all species within the project area were recorded. Sophisticated estimators of species richness such as *Chao 1* and *ACE* have recently been developed (Magurran, 2004) that enable ecologists to predict, based on the species richness and abundance of a given set of data, the total species richness of the assemblage being tested. These were calculated for each faunal group (Table 4.1).

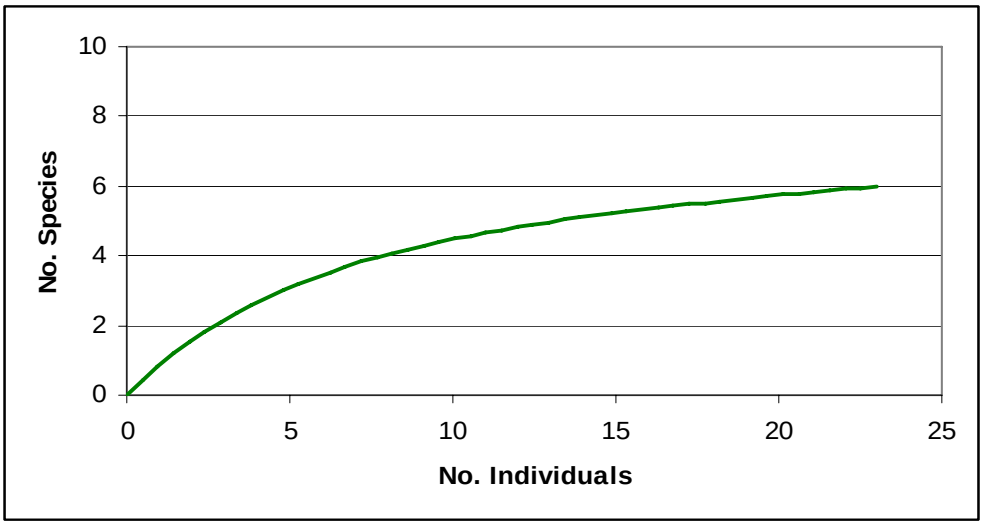

Figure 4.1 Species accumulation curve for mammals observed in the project area.

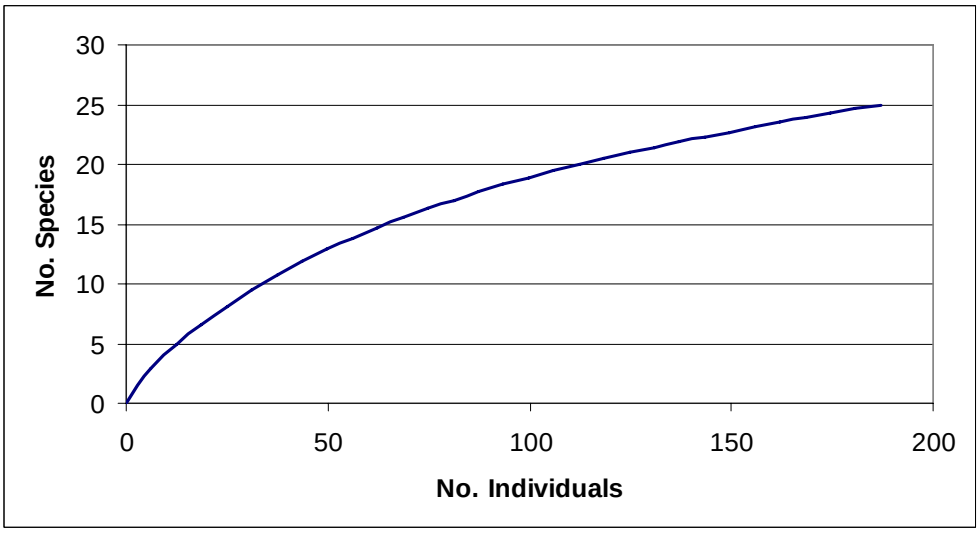

Figure 4.2 Species accumulation curve for birds observed in the project area.

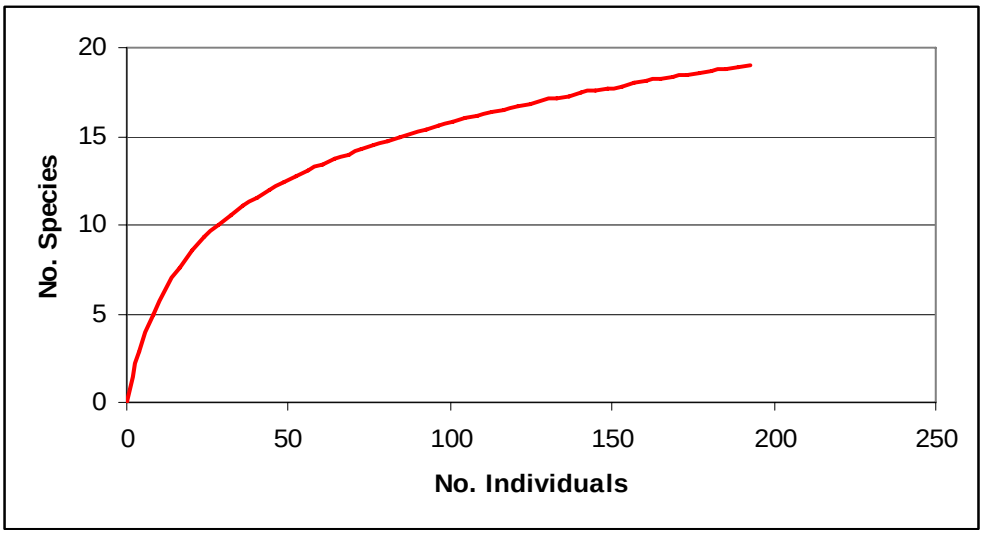

Figure 4.3 Species accumulation curve for reptiles observed in the project area.

In Table 4.1, the observed number is the actual number of species observed during the survey. Comparing this with the estimated number, which is based on species accumulation curves, shows that 144% of the estimated mammal species, 102% of the estimated bird species and 99% of the estimated reptile species were recorded during sampling. The estimate of the total number of mammals and birds was lower than the number observed because 60% of the observed mammal species and 16% of the observed bird species were recorded opportunistically. Mammal species included three bats, two macropods, echidna, fox, cat and rabbit. Bird species included Little Eagle, Horsfield's Bronze-Cuckoo, White-fronted Chat, Hooded Robin and Magpie-Lark.

When the number of taxa observed is compared with the potential number occurring based on WAM FaunaBase, Birdata (2008) and field guides, the percentages are overall much lower, suggesting that the survey is incomplete. Potential species lists based on database and field guide searches tend to overestimate the number of fauna potentially occurring in an area, as they include fauna that may not normally inhabit the habitats within it and species only present sporadically during certain seasons or conditions. Additionally, it is difficult to predict the effect that habitat quality, successional stage or completeness may have on the fauna of a given area. For these reasons, the species estimators based on actual collected data are more likely to be accurate, although the potential for greater species richness should not be ruled out.

4.4 SURVEY LIMITATIONS

A recommendation of Guidance Statement No. 56 (EPA, 2004) is to indicate any limitations of the methods used to conduct a fauna survey. Potential constraints are listed in Guidance Statement No. 56 and these are discussed below in relation to the limitations of the current survey (Table 4.2).

Table 4.2 Summary of survey limitations.

CONSTRAINT	CONSTRAINT RELEVANT?	COMMENT
Competency/ experience of the consultant carrying out the survey.	No	All members of the survey team have appropriate training, experience and mentoring in fauna identification and fauna surveys.
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	Yes	Mammal, bird and reptile faunal groups were sampled during the survey. Amphibians may have been under-represented in the field data due to a lack of rainfall. There were no constraints on sampling methods; methods used at each site were the same.
Proportion of fauna identified, recorded and/ or collected.	No	61% of potential native mammal species, 24% of potential bird species, 24% of potential reptile species and 33% of potential amphibian species were recorded (Table 4.1). However, species accumulation curves indicate that the majority of species present were recorded (Section 4.3) All fauna sampled were identified to species level.
Sources of information (previously available information as distinct from new data).	No	The results from 12 surveys conducted around the project areas were available.
The proportion of the task achieved and further work which might be needed.	No	Species accumulation curves suggest that the majority of the fauna was sampled and that the survey was adequate. The survey is considered complete.
Timing/weather/season/cycle.	Part	The survey was conducted during November 2007, during which time maximum temperatures averaged 35°C. Reptile activity was high and mammal captures were good. Humid conditions at night resulted in limited amphibian captures. Windy conditions on some days reduced bird and bat activity.
Disturbances which affected results of the survey (e.g. fire, flood, accidental human intervention).	No	No such disturbances were encountered.
Intensity (in retrospect was the intensity adequate).	No	All fauna habitats were represented and comparison sites were used in adjacent reserved natural vegetation.

CONSTRAINT	CONSTRAINT RELEVANT?	COMMENT
Completeness (e.g. was relevant area fully surveyed).	Part	Approximately 40% of the project area is located on Iluka tenements which was not accessible during the survey. However, four biological surveys, McMillan *et al.* (1992), McNee *et al.* (1995), HGM (1998) and HGM (2001) have been completed since 1992 within the bounds of the Iluka tenements allowing an adequate assessment of the vertebrate fauna from the Iluka tenements.
Resources (e.g. degree of expertise available in animal identification to taxon level).	No	All recorded individuals were identified to species level by qualified team members.
Remoteness and/ or access problems.	No	Areas to be disturbed by the development were largely accessible by access roads and tracks.
Availability of contextual (e.g. biogeographic) information on the region.	No	Contextual information is available for the Lesueur sandplain region through IBRA (Thackway and Cresswell, 1995).
Efficacy of sampling methods (i.e. any groups not sampled by survey methods).	No	The sampling methods employed were effective for the sampling of all vertebrate fauna groups.

5.0 CONSERVATION SIGNIFICANT FAUNA

Table 5.1, overleaf, provides an overview of the conservation significant fauna that were recorded during the survey or that have the potential to occur within the project areas. Potential to occur is based on the habitats present in the project areas, known distribution, database searches and the results of previous biological surveys in the surrounding region. Also included in Table 5.1 is a summary of the species' conservation status, preferred habitat and likelihood of occurrence based on habitat requirements and previous records. Each species is considered more fully in Sections 5.2 and 5.3.

5.1 STATUTORY FRAMEWORK

Fauna species that have been formally recognised as rare, threatened with extinction, or as having high conservation value are protected by law under Commonwealth and State legislation. At the national level, fauna are protected under the EPBC Act. Within WA, rare fauna are listed under the WAWC Act. International Agreements include the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA).

Schedule 1 of the Commonwealth EPBC Act contains a list of species that are considered Critically Endangered, Endangered, Vulnerable, Extinct, Extinct in the Wild and Conservation Dependent. Definitions of categories relevant to fauna occurring or potentially occurring in the project area are provided in Appendix E-1.

Classification of rare and endangered fauna under the WAWC Act recognises four distinct schedules, as listed in Appendix E-2. In addition, DEC maintains a Declared Threatened and Priority Fauna list which includes those removed from the Wildlife Conservation Act and other species known from only a few populations or in need of monitoring. Five priority codes are recognised, as detailed in Appendix E-3.

Table 5.1 Conservation significant fauna potentially occurring in project areas.

SPECIES	COMMON NAME	CONSERVATION SIGNIFICANCE*			HABITAT	PREVIOUS RECORDS	LIKELIHOOD OF OCCURRENCE IN PROJECT AREA
		EPBC	WAWC	DEC			
BIRDS							
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	EN	S1		Proteaceous scrubs and heaths, eucalypt and pine forests	Birdata, Watheroo 2001 and Hill River 2004 (DEC)	**HIGH –** Species observed in project area, suitable heathland on site for foraging
Merops ornatus	Rainbow Bee-eater	M			Habitat preference varying. Breeds in burrows constructed in sandy soils	Birdata, and recorded from multiple surveys in the Eneabba region	**HIGH –** Species observed in project area. Suitable habitat for foraging and nesting
Calamanthus campestris montanellus	Rufous Fieldwren (Western Wheatbelt)			P4	Low, sparse heath, saltmarsh or samphire, with or without emergent trees	Birdata, Eneabba 2001 (DEC)	**HIGH –** Species observed in project area. Habitat suitable for foraging and nesting
Ardeotis australis	Australian Bustard			P4	Open grassland, low heathlands	Birdata, Eneabba 1973,1978 & 2001 (DEC)	**MEDIUM –** Nomadic and has been recorded in region. Suitable foraging and nesting habitat present
Pomatostomus superciliosus ashbyi	White-browed Babbler (Western Wheatbelt)			P4	Thickets of mulga, wattle and acacia as well as uncleared road verges	Cockleshell Gully Reserve (Chapman *et al.*, 1977), Marchagee Nature Reserve (Dell *et al.*, 1979) and the Lesueur area (Burbidge *et al.*, 1990)	**MEDIUM –** No suitable habitat present in the project areas but suitable foraging and nesting habitat nearby (OPP 2)

SPECIES	COMMON NAME	CONSERVATION SIGNIFICANCE*			HABITAT	PREVIOUS RECORDS	LIKELIHOOD OF OCCURRENCE IN PROJECT AREA
		EPBC	WAWC	DEC			
Oreoica gutturalis	Crested Bellbird (Southern)			P4	Variety of habitats, most types of scrub and thicket including open banksia scrub and heathland	Birdata. White Gums Nature Reserve 1982 (DEC)	**MEDIUM –** Previously recorded in region. Suitable habitat present for foraging and nesting
Phaps elegans	Brush Bronzewing			P4	Dense shrublands near water, especially acacia and melaleuca thickets	Birdata and recorded from the Iluka mine site (HGM, 1998)	**MEDIUM** – Previous records from adjacent Iluka mine site. Little observed suitable feeding or nesting habitat present in project areas
Charadrius rubricollis	Hooded Plover			P4	Margins and shallows of saltlakes, dams	Recorded Eneabba 2006 (DEC)	**LOW –** Recorded in the region, CWC Dewatering storage may provide suitable habitat in the project areas
Apus pacificus	Fork-tailed Swift	M			Almost entirely aerial	The Lesueur area (Burbidge *et al.*, 1990)	**LOW** – Aerial visitor. Only occurrence will be of individuals flying above the project areas
Haliaeetus leucogaster	White-bellied Sea Eagle	M			Restricted to coastal areas and lower to middle reaches of large rivers.	No previous records	**LOW –** No suitable breeding, feeding or roosting sites present in the project areas.
Falco peregrinus	Peregrine Falcon		S4		Clifts ranges and wooded watercourses	Birdata and recorded in the Lesueur area (Burbidge *et al.*, 1990) and the Leeman area (Foulds and McMillan, 1982)	**LOW** – Recorded in the region. Potential hunting habitat present, but no suitable nesting or roosting habitat observed

SPECIES	COMMON NAME	CONSERVATION SIGNIFICANCE*			HABITAT	PREVIOUS RECORDS	LIKELIHOOD OF OCCURRENCE IN PROJECT AREA
		EPBC	WAWC	DEC			
Ardea alba	Great Egret/White Egret	M			Shallow fresh/salty wetlands	The Leeman area (Foulds and McMillan, 1982) and the Lesueur area (Burbidge *et al.*,1990)	**LOW -** No records from region. CWC Dewatering storage may provide suitable habitat in the project areas
Ardea ibis	Cattle Egret	M			Dry grass plains. Occasionally near shallow wetlands	No previous records	**LOW** – Suitable feeding habitat exists in the project areas but not recorded in the region
REPTILES							
Neelaps calonotos	Black-striped Snake			P3	Eucalypt / banksia woodlands in coastal sandplain regions of WA	Recorded at Site ENB02. Nearest records Port Denison to the north and Lancelin to the south	**HIGH –** Species recorded in project area and suitable habit present
Cyclodomorphus branchialis	Gilled Slender Blue-tongue		S1	VU	In Lesueur region, dense heath on sandy soils (Burbidge and Boscacci, 1989)	Recorded at Mt Lesueur (Burbidge *et al.*, 1990) and southern Beekeepers reserve (Burbidge and Boscacci, 1989)	**Medium** – Recorded in region and suitable habitat found in project areas.
Aspidites ramsayi	Woma		S4	P1	Woodlands, heaths and shrublands on sandy soils, in subhumid to arid areas	Marchagee Nature reserve 1986 and Watheroo 1989 (Maryan, 2002)	**MEDIUM -** Recorded in region and suitable habitat found in project areas.

Note: *Description of conservation significance codes provided in Appendix E-1 – E-3
EPBC = *Environment Protection and Biodiversity Conservation Act 1999*
WCA = *Wildlife Conservation Act 1950*
DEC = Department of Environment and Conservation Priority Fauna list

5.2 CONSERVATION SIGNIFICANT FAUNA RECORDED

5.2.1 Mammals

There were no mammals of conservation significance recorded during this survey.

5.2.2 Birds

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) – EPBC Act Endangered; WAWC Act Schedule 1

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), also known as Short-billed Black-Cockatoo, is one of the largest cockatoos in the world, reaching lengths of up to 58 cm and weights of 790 g. Notable features of this species include their white tail panels, white cheek patches and a distinctly short bill (Johnstone and Storr, 1998).

They mainly feed in shrubland or kwongan heath foraging on seeding proteaceous species, such as *Banksia*, *Dryandra*, *Hakea*, *Eucalyptus*, *Grevillea*, *Pinus* and *Allocasuarina* spp., flowering *Dryandra sessilis*, *D. quercifolia*, *Lambertia inermis*, *Banksia grandis*, *Eucalyptus* spp., *Grevillea* spp., and *Calistemon* spp. (Johnstone and Storr, 1998).

The estimated total population of Carnaby's Black-Cockatoos left in the wild is thought to be 40,000 (Johnstone *et al.*, 2007) and it is estimated that the total population has declined by over 50% in the past 45 years (DEH, 2004).

Factors contributing to their decline include:

- Habitat fragmentation, particularly in the northern and eastern areas of the Wheatbelt. Most habitats suitable for breeding and feeding in the Wheatbelt have been cleared.
- Clearing of heathland surrounding breeding sites has reduced the survival rate of fledglings by decreasing the available food sources for the young (Saunders, 1986).
- Poaching of eggs and young by collectors and animal dealers
- The introduction and spread of invasive species such as the Galah and the Western Long-billed Corella. These species compete with and exclude Carnaby's Black-Cockatoos from traditional nest hollows (Saunders, 1979).

Carnaby's Black-cockatoo was recorded opportunistically flying within 100 m of Site ENB06 within the South Eneabba Reserve during the Level 2 Survey and 26 individuals were seen feeding on *Banksia* sp. in the South Eneabba Nature Reserve during the Level 1 survey, which, given the similarity between the vegetation in the nature reserve and the adjacent natural vegetation of the project areas, suggest that Carnaby's Black-Cockatoos are likely to utilise both areas for feeding. Therefore Carnaby's Black-Cockatoos are likely to be seasonal but regular visitors to the project areas, feeding in remnant patches of native vegetation after moving between inland breeding areas in the north east (Three Springs, Carnamah) and non-breeding, feeding areas closer to the coast. Approximately 720ha of remnant heath vegetation will be removed during the development of this project which is approximately 10% of the remnant vegetation that occurs within 10km of the project area.

Rainbow Bee-eater (*Merops ornatus*) – EPBC Act Migratory

The Rainbow Bee-eater lives almost anywhere suitable for hawking insects. It migrates within Australia and up to Indonesia and New Guinea, breeding in both New Guinea and Australia (Johnstone and Storr, 1998). In Western Australia, this species can occur as a resident, breeding visitor, postnuptial nomad, passage migrant or winter visitor. Breeding occurs from October through till December and nests are built in burrows dug usually at a slight angle on flat ground, sandy banks or cuttings, and often at the margins of roads or tracks (Simpson and Day, 2004).

This species was recorded at Site ENB04 and was also opportunistically sighted within the project areas, near Site ENB02. Given the timing of the survey and the sandy soil types of the region that are suitable for nest burrows, the individuals recorded are expected to be breeding visitors. Rainbow Bee-eaters are generally common in the region.

Rufous Fieldwren (*Calamanthus campestris montanellus*) – DEC Priority 4

The western Wheatbelt subspecies of the Rufous Fieldwren inhabits heath and low shrubland on sandplains as well as lateritic ridges (Johnstone and Storr, 2004). Once widespread across most of the south west of Western Australia, habitat destruction due to overgrazing and clearing for agriculture has resulted in this species being restricted to patches of remnant vegetation. Breeding occurs from July to October in globular dome shaped nests that are constructed very close to the ground.

The Rufous Fieldwren was recorded in kwongan heath on sandplain and on lateritic upland at Sites ENB01, ENB03 and ENB06. The individuals recorded are expected to be post breeding residents occupying territories in the remnant vegetation of the project areas and the adjacent nature reserves.

5.2.3 Reptiles

Black-striped Snake (*Neelaps calonotos*) – DEC Priority 3

This fossorial elapid is rarely seen, and is restricted to the coastal sand plain region from just south of Perth through to Lancelin. It inhabits dunes and sandplains vegetated with heaths and eucalypt/banksia woodlands (Wilson and Swan, 2008). One specimen has previously been recorded from Port Denison (70 km south of Geraldton) and the sighting at Eneabba provides a link between this northernmost record and those 200km further south.

The Black-striped snake was recorded once in kwongan heath on sandplain at Site ENB02. This species is locally abundant on the Swan Coastal Plain in Banksia woodland (Storr *et al.*, 2002) and it is expected to occur through out the heathy sandplains surrounding the project areas. The Black-striped snake is still threatened due to the continued clearance of its primary habitat (banksia woodlands) to the south near Perth.

Figure 5.1 shows the individual that was recorded during this survey.

Figure 5.1 *Neelaps calonotos* recorded during the current survey

5.3 POTENTIALLY OCCURRING CONSERVATION SIGNIFICANT FAUNA

5.3.1 Mammals

There were no mammal species of conservation significance potentially occurring within the project areas. Since European settlement and the subsequent spread of cats, foxes and rabbits and the clearance of large areas for agriculture, ten species of mammal have experienced range contractions that have resulted in these species no longer occurring in the project areas. These are Chuditch (*Dasyurus geoffroii*), Dibbler (*Parantechinus apicalis*), Western Barred Bandicoot (*Perameles bougainville*), Bilby (*Macrotis lagotis*), Burrowing Bettong (*Bettongia lesueur*), Tammar Wallaby (*Macropus eugenii*), Shark Bay Mouse (*Pseudomys fieldi*), Western Mouse (*Pseudomys occidentalis*), Heath Mouse (*Pseudomys shortridgei*) and Pale Field-rat (*Rattus tunneyi*). A further three species of mammal have become extinct as a result of the same factors: Broad-faced Potoroo *(Potorous platyops*), Big-eared Hopping-mouse (*Notomys macrotis*) and Gould's Mouse (*Pseudomys gouldii*) (Johnson, 2006).

5.3.2 Birds

Australian Bustard (*Ardeotis australis*) – DEC Priority 4

Australian Bustards are large nomadic birds that utilise a number of open habitats, including heathlands in the south of Western Australia. There are no recent records of the Australian Bustard from Eneabba according to Birds Australia (Birdata, 2008); however, DEC records list the species as being present at Eneabba in 1973 and 1978, and biological surveys have recorded Australian Bustards at Cockleshell Gully Nature Reserve (Chapman *et al*., 1977), Marchagee Track (Halse *et al*., 1985), The Lesueur area (Burbidge *et al*., 1990) and near Leeman (Foulds and McMillan, 1982)

Australian Bustards prefer habitat consisting of tussock grassland, grassy woodland, low shrublands, and structurally similar artificial habitats, such as croplands and golf-courses (Johnstone and Storr, 2004). They will also use denser vegetation when this has been temporarily opened up by recent burning (Marchant and Higgins, 1993). According to Johnstone and Storr (1998), their abundance varies locally and seasonally from scarce to common, according to variation in the number of their prey species, principally grasshoppers. Given the open nature of the vegetation, particularly the cleared agricultural land and regenerating heath, it is possible that the species could use areas within the project areas and the adjacent South Eneabba Nature Reserve.

White-browed Babbler (*Pomatostomus superciliosus ashbyi*) – DEC Priority 4

The western wheatbelt subspecies of the White-browed Babbler is listed as a Priority 4 species (DEC). More than 50% of its former habitat has been cleared for agriculture and the subsequent pressure this places on the continuity of the species is the cause behind its current listing. Although this species has suffered a large reduction in the amount of available habitat, it has managed to persist in the remaining fragmented habitat much better than other taxa (Garnett and Crowley, 2000). This species is most often found in thickets of mulga, wattle and acacia as well as uncleared road verges in farmlands (Johnstone and Storr, 2004).

The White-browed Babbler has been previously recorded in Cockleshell Gully Reserve (Chapman *et al.*, 1977), Marchagee Nature Reserve (Dell *et al.*, 1979) and the Lesueur area (Burbidge *et al.*, 1990) with several recorded on Birdata (2008). No suitable habitat was found in the project areas, although vegetation with sufficient structural complexity was observed nearby (OPP 2).

Crested Bellbird (*Oreoica gutturalis*) (southern) – DEC Priority 4

The Crested Bellbird is listed as a conservation significant species due to the contraction of its current range to less than 50% of its past distribution. The main cause of this reduction is the clearing of habitat for agricultural purposes. In the Eneabba area, Crested Bellbirds occur on open banksia scrubs and heathland (Johnstone and Storr, 2004).

Crested Bellbirds have frequently been recorded in the region (Birdata, 2008) with records from the Marchagee area (Halse *et al.*, 1985; Dell *et al.*, 1979) and the Lesueur area (Burbidge *et al.*, 1990). Crested Bellbirds are likely to occur in the few parts of the project areas that have adequate trees and shrubs, such as at site ENB04. They are expected to be less likely to occur in very open, largely treeless areas such as those found at Sites ENB01 and ENB03 and in South Eneabba Nature Reserve.

Brush Bronzewing (*Phaps elegans*) – DEC Priority 4

Formerly widespread across the south west of Western Australia, the Brush Bronzewing is now locally extinct across much of this range (Johnstone and Storr, 1998). The Brush Bronzewing prefers habitat consisting of dense shrublands with significant vertical vegetation structure and access to water, especially thickets of acacias and melaleucas near the coast (Johnstone and Storr, 1998). This habitat type is not found within the project areas but records exist of Brush Bronzewings in the Iluka mine site (HGM, 1998) and to the south west in Southern Beekeepers Reserve (Burbidge and Boscacci, 1989).

Hooded Plover (*Charadrius rubricollis*) – DEC Priority 4

Hooded plovers are small wading birds restricted to the south west of Western Australia. The total population is estimated to be 3,000 individuals, and with no indication of a decline in population size this species is listed as Priority 4 (Garnett and Crowley, 2000). Hooded Plovers are restricted to coastal areas, estuaries and salt lakes (Johnstone and Storr, 1998) and were recorded at Eneabba in 2006 (DEC records). Construction of the dewatering storage pond will create an area of open water with sandy shorelines providing suitable habitat for this species in project areas. This will increase the potential for this species to occur in the project areas.

Fork-tailed Swift (*Apus pacificus*) – EPBC Act Migratory

Fork-tailed Swifts are a migratory species that winters in Australia after breeding in Mongolia and China. Fork-tailed Swifts have previously been recorded from the Lesueur area (Burbidge *et al.*, 1990) arriving in early to mid-summer. Fork-tailed Swifts are attracted to thunderstorms and they are usually seen before and after these climatic events (Johnstone and Storr, 1998). Due to the Fork-tailed Swift's aerial lifestyle and migratory nature, it is expected to be an infrequent visitor to the project areas and will not directly utilise the fauna habitats present.

White-bellied Sea-Eagle (*Haliaeetus leucogaster*) – EPBC Act Migratory

The White-bellied Sea-Eagle is a large bird of prey that is found near coastal areas around Australia and in the lower and middle reaches of large rivers in the Kimberley region. They area also occasionally recorded in near coastal wetlands. Breeding is almost entirely restricted to islands and occurs from July to August (Johnstone and Storr, 1998).

White-bellied Sea-Eagles have not been recorded near the project areas and it is very unlikely that they will move inland from the coast. Breeding birds have been recorded on Boulanger Island near Jurien Bay. No potential breeding, feeding or roosting sites exist in the project areas and the nearest suitable habitat is over 20 km to the west.

Peregrine Falcon (*Falco peregrinus*) – WAWC Act Schedule 4

The Peregrine Falcon has a cosmopolitan distribution, breeding on all continents except Antarctica with Australia considered as one of the strongholds of the species, since it has declined in many other parts of the world. The Australian subspecies *Falco peregrinus macropus* is widespread throughout Western Australia, with the exception of most deserts and the Nullarbor Plain (Johnstone and Storr, 1998) but is never common.

Peregrine Falcons most commonly occur near cliffs along the coast, rivers and ranges, as well as around wooded watercourses and lakes. It nests primarily on ledges on cliffs, granite outcrops and in quarries (Johnstone and Storr, 1998).

Peregrine Falcons have been recorded in both the Leeman area (Foulds and McMillan, 1982) and the Lesueur area (Burbidge *et al.*, 1990) including Cockleshell Gully Nature Reserve (Chapman *et al.*, 1977) and several sightings have been recorded on Birdata (2008). No potential breeding sites are present in or near the project areas but the species may utilise the project areas for foraging.

Eastern Great Egret (*Ardea alba*) – EPBC Migratory

The Eastern Great Egret is one of the larger members of the family Ardeidae. It can be distinguished from other white egrets by its distinctly longer neck with a pronounced kink

as well as subtle differences in gape length and bill proportion. They are most commonly found in both fresh and saline shallow waters (Johnstone and Storr, 1998) both of which are not present in the study area. This species has been recorded in the Leeman (Foulds and McMillan, 1982) and Lesueur areas (Burbidge *et al.*, 1990) and construction of the dewatering storage pond will create an area of open water with sandy shorelines providing suitable habitat for this species in project areas. These factors will increase the potential for this species to occur in the project areas.

Cattle Egret (*Ardea ibis*) – EPBC Act Migratory Species

The Cattle Egret is a relatively small member of the Ardeidae family. This species has white plumes, occasionally with a wash of yellow on its head (Johnstone and Storr, 1998). The beak and neck of this species are shorter and thicker than other egrets. Cattle Egrets are often found in dry grassy habitats, where they feed largely on insects; unlike most herons, which are associated with shallow water. The Cattle Egret is native to parts of Asia, Africa and Europe, though has dispersed and colonised other continents including Australia; without the aid of humans.

The Cattle Egret is an irregular visitor (mainly in Autumn) to wetlands and pastures in Western Australia (Johnstone and Storr, 1998). There are few records for this species in south western Australia. The two closest records come from Pindadanoo on the Murchison River, and near Nanson (Birdata 2008), north of Geraldton.

Suitable feeding habitat exists for this species in the cleared agricultural land located in the project areas. No breeding events have been recorded in Western Australia.

5.3.3 Reptiles

Woma (*Aspidites ramsayi*) (south-west population) – WAWC Act Schedule 4; DEC Priority 1

The Woma python is a moderately large snake that prefers woodlands, heaths and shrublands on sandplains (Maryan, 2002). With several populations identified across Australia, the south-west population, the range of which includes the project areas, has not been recorded since 1989. The two most recent sightings have occurred within 100 km of the project areas at the localities of Marchagee and Watheroo (Maryan, 2002). Clearing of much of its natural habitat for agricultural purposes and predation by foxes and cats has resulted in a major decline of this species' population. Suitable habitat in the form of heath on sand plains is present within the project areas, but due to its scarcity and the prevalence of introduced predators in the project areas it is unlikely to be present.

Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*) – DEC Vulnerable; WAWC Act Schedule 1

The Gilled Slender Blue-tongue is a large skink found in semi arid shrublands in an area between the Murchison and Irwin Rivers. This species has also previously been recorded in the Mt Lesueur area, in a salt lake complex (Burbidge *et al.*, 1990) and in dense heath (Burbidge and Boscacci, 1989), and it has also been identified in DEC records as occurring in the Lesueur region. Due to the close proximity of these records and the occurrence of heath in the project areas, it is likely that the Gilled Slender Blue-tongue could potentially occur, although the large-scale burn in 2005 may have caused a large decline in the local population if present.

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APPENDIX A DAILY WEATHER DATA DURING SURVEYS

Appendix A Daily weather observations from Eneabba weather station, Western Australia for November 2007 (station 008225) (Source: Bureau of Meteorology, 2008: http://www.bom.gov.au)

Date	Min (°C)	Max (°C)	Rain (mm)	9am Temp (°C)	9am RH (%)	9am cloud (oktas)	9am wind direction	9am wind speed (km/h)	3pm Temp (°C)	3pm RH (%)	3pm cloud (oktas)	3pm wind direction	3pm wind speed (km/h)
19/11/07	10.4	26.6	0	19.1	54	6	SW	4	24	39	2	WSW	28
20/11/07	9.3	29	0	18.7	41	0	SE	11	28	15	0	S	6
21/11/07	13.1	34.7	0	22.8	20	0	ESE	19	34	9	n/a	ESE	19
22/11/07	19.4	38	0	28.6	16	6	NE	19	37	n/a	6	n/a	Calm
23/11/07	19.2	n/a	0	27.8	n/a	6	NE	4	38.1	9	0	WNW	7
24/11/07	n/a	n/a	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
25/11/07	n/a	39.1	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
26/11/07	12	36	0	22.7	63	1	n/a	Calm	33	32	2	WSW	37
27/11/07	17.5	37.4	0	25.1	28	0	SE	19	37	15	1	SW	7
28/11/07	14	38	0	28.1	16	0	NE	7	33	13	1	W	19

APPENDIX B RESULTS OF DATABASE SEARCHES

9334 0579
2007/000430 9334 0278
Kellie Mantle kellie.mantle@dec.wa.gov.au

Simon Pynt
Ecologia
1025 Wellington Street
WEST PERTH WA 6005

Dear Simon

REQUEST FOR THREATENED FAUNA INFORMATION

I refer to your request of 6th November for information on threatened fauna occurring in the vicinity of study site 8km south of Eneabba (plus ~20km buffer).

A search was undertaken for this area of the Department's Threatened Fauna database, which includes species which are declared as '*Rare or likely to become extinct* (Schedule 1)', '*Birds protected under an international agreement* (Schedule 3)', and '*Other specially protected fauna* (Schedule 4)'.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the sixth point that refers to the requirement to undertake field investigations for the accurate determination of threatened fauna occurrence at a site. The information supplied should be regarded as an indication only of the threatened fauna that may be present.

An invoice for $150.00 (plus GST), being the set charge for the supply of this information, will be forwarded.

It would be appreciated if any populations of threatened fauna encountered by you in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss threatened fauna management, please contact my Principal Zoologist, Dr Peter Mawson on 08 93340421.

Yours sincerely

……
for Keiran McNamara
DIRECTOR GENERAL
Department of Environment and Conservation

12th November, 2007

Attachment

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

THREATENED FAUNA INFORMATION

Conditions In Respect Of Supply Of Information

* All requests for data to be made in writing to the Executive Director, Department of Environment and Conservation, Attention: Principal Zoologist, Species and Communities Branch.

* The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided without the prior consent of the Executive Director, Department of Environment and Conservation

* Specific locality information for Threatened Fauna is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for Threatened Fauna may not be used in reports without the written permission of the Executive Director, Department of Environment and Conservation. Reports may only show generalised locations or, where necessary, show specific locations without identifying species. The Principal Zoologist is to be contacted for guidance on the presentation of Threatened Fauna information.

* Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data, they may be present. The Department of Environment and Conservation accepts no responsibility for this.

* Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.

* It should be noted that the supplied data do not necessarily represent a comprehensive listing of the Threatened Fauna of the area in question. Its comprehensiveness is dependent of the amount of survey carried out within a specified area. The receiving organisation should employ a biologist/zoologist, if required, to undertake a survey of the area under consideration.

* Acknowledgment of the Department of Environment and Conservation as the source of data is to be made in any published material. Copies of all such publications are to be forwarded to the Department of Environment and Conservation, Attention; Principal Zoologist, Species and Communities Branch.

29.791 °S 115.102 °E / 30.068 °S 115.344 °E Study site 8km S of Eneabba (plus~10km buffer)

*	Date	Certainty	Seen	Location Name	Method

Schedule 1 - Fauna that is rare or is likely to become extinct

Idiosoma nigrum **Shield-backed Trapdoor Spider** *1 records*

This species is in decline in its patchy distribution through the northern and central wheatbelt and coastal plain. It is a long-lived species that is very sensitive to disturbance.

1987	1	2	Eneabba	Caught or trapped

Priority One: Taxa with few, poorly known populations on threatened lands

Austromerope poultoni **Austromerope poultoni** *1 records*

This species of scorpion fly is associated with forest litter and appears to be active after rainy periods. Little else is known of its biology and habitat requirements.

1998	1	1	Eneabba	Caught or trapped

Priority Four: Taxa in need of monitoring

Ardeotis australis **Australian Bustard** *2 records*

This species is uncommon and may occur in open or lightly wooded grasslands.

1973	1	1	Eneabba	Day sighting
1978	1	3	Eneabba	Day sighting

Charadrius rubricollis **Hooded Plover** *1 records*

This species frequents the margins and shallows of salt lakes, also along coastal beaches, where it forages for invertebrates along the water's edge.

2006	1	42	Eneabba	Day sighting

Calamanthus campestris montanellus **Rufous Fieldwren (western wheatbelt)** *3 records*

This species lives in low, sparse heath, saltmarsh or samphire, with or without emergent trees.

2001	1	2	Eneabba
2001	1	1	Eneabba
2001	1	1	Eneabba

***** Information relating to any records provided for listed species:-
Date: date of recorded observation
Certainty (of correct species identification): 1=Very certain; 2=Moderately certain; and 3=Not sure.
Seen: Number of individuals observed.
Location Name: Name of reserve or nearest locality where observation was made
Method: Method or type of observation

Department of **Conservation** and **Land Management**

Conserving the nature of WA

Your Ref:
Our Ref: 2001F001096V13
Enquires: Christine Freegard

Phone: 9334 0579
Fax: 9334 0278
Email: christinef@calm.wa.gov.au

Gillian Lane
URS Australia Pty Ltd
Level 3, Hyatt Centre
20 Terrace Road
EAST PERTH WA 6004

Dear Ms Lane

REQUEST FOR THREATENED FAUNA INFORMATION

I refer to your request of 19 October for information on threatened fauna occurring in the vicinity of Eneabba.

A search was undertaken for this area of the Department's Threatened Fauna database, which includes species which are declared as '*Rare or likely to become extinct* (Schedule 1)', '*Birds protected under an international agreement* (Schedule 3)', and '*Other specially protected fauna* (Schedule 4)'. Attached are print outs from these databases where records were found.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the sixth point that refers to the requirement to undertake field investigations for the accurate determination of threatened fauna occurrence at a site. The information supplied should be regarded as an indication only of the threatened fauna that may be present.

An invoice for $150.00 (plus GST), being the set charge for the supply of this information, will be forwarded.

It would be appreciated if any populations of threatened fauna encountered by you in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss threatened fauna management, please contact my Senior Zoologist, Dr Peter Mawson on 08 93340421.

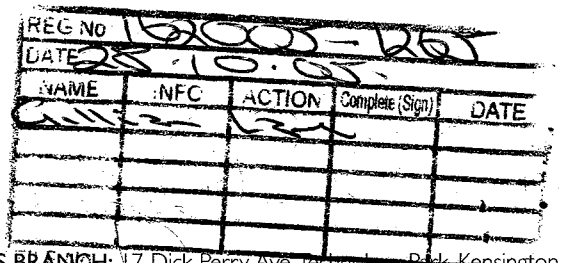
Yours sincerely

Freegard

.....

for Keiran McNamara
EXECUTIVE DIRECTOR

27 October, 2005



SPECIES AND COMMUNITIES BRANCH: 17 Dick Perry Ave, Technology Park, Kensington
Postal address: Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia 6983
Phone: (08) 9334 0455 Fax: (08) 9334 0278 Website: www.naturebase.net

Attachment

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

THREATENED FAUNA INFORMATION

Conditions In Respect Of Supply Of Information

* All requests for data to be made in writing to the Executive Director, Department of Conservation and Land Management, Attention: Senior Zoologist, Wildlife Branch.

* The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided without the prior consent of the Executive Director, Department of Conservation and Land Management.

* Specific locality information for Threatened Fauna is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for Threatened Fauna may not be used in reports without the written permission of the Executive Director, Department of Conservation and Land Management. Reports may only show generalised locations or, where necessary, show specific locations without identifying species. The Senior Zoologist is to be contacted for guidance on the presentation of Threatened Fauna information.

* Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data, they may be present. The Department of Conservation and land Management accepts no responsibility for this.

* Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.

* It should be noted that the supplied data do not necessarily represent a comprehensive listing of the Threatened Fauna of the area in question. Its comprehensiveness is dependent of the amount of survey carried out within a specified area. The receiving organisation should employ a biologist/zoologist, if required, to undertake a survey of the area under consideration.

* Acknowledgment of the Department of Conservation and Land Management as the source of data is to be made in any published material. Copies of all such publications are to be forwarded to the Department of Conservation and Land Management, Attention; Senior Zoologist, Wildlife Branch.

29.675 °S 114.0817 °E / 30.23333 °S 115.55 °E Eneabba area

*	Date	Certainty	Seen	Location Name	Method

Schedule 1 - Fauna that is rare or is likely to become extinct

Calyptorhynchus latirostris — Carnaby's Black-Cockatoo — *10 records*

This species moves around seasonally in flocks to feeding areas in proteaceous scrubs and heaths and eucalypt woodlands as well as pine plantations. Breeding occurs in winter/spring, mainly in the eastern forests and wheatbelt where they can find mature hollow-bearing trees to nest in.

2001	1	3	Watheroo	Day sighting
2001	1	7	Watheroo	Day sighting
2001	1	0	Watheroo	Definite signs
2001	1	0	Watheroo	Definite signs
2001	1	1	Watheroo	Day sighting
2001	1	0	Watheroo	Definite signs
2001	1	1	Watheroo	Day sighting
2001	1	12	Watheroo	Day sighting
2001	1	30	Watheroo	Day sighting
2004	1	6	Hill River	Day sighting

Calyptorhynchus sp — White-tailed Black Cockatoo — *1 records*

These records pertain to either Baudin's Black-Cockatoo or Carnaby's Black-Cockatoo.

1982	1	32	White Gums Nature Reserve	Day sighting

Cyclodomorphus branchialis — Cyclodomorphus branchialis — *1 records*

A ground-dwelling and largely nocturnal skink which shelters in spinifex, leaf litter and under fallen timber.

1999	1		Lesueur NP	Caught or trapped

Idiosoma nigrum — Shield-backed Trapdoor Spider — *1 records*

This species is in decline in its patchy distribution through the northern and central wheatbelt and coastal plain. It is a long-lived species that is very sensitive to disturbance.

1987	1	2	Eneabba	Caught or trapped

Priority One: Taxa with few, poorly known populations on threatened lands

Austromerope poultoni — Austromerope poultoni — *1 records*

This species of scorpion fly is associated with forest litter and appears to be active after rainy periods. Little else is known of its biology and habitat requirements.

	1		Eneabba

Priority Two: Taxa with few, poorly known populations on conservation lands

Phasmodes jeeba — Phasmodes jeeba — *1 records*

This species of stick-insect is only known from an area near Eneabba.

1984	1	2	Cockleshell Gully

Priority Three: Taxa with several, poorly known populations, some on conservation lands

Hemisaga vepreculae — Hemisaga vepreculae — *3 records*

This species of cricket has been recorded from Jurien Bay and northwest of Eneabba.

1974	1	1	Jurien Bay
1975	1	5	Green Head

29.675 °S 114.0817 °E / 30.23333 °S 115.55 °E Eneabba area

*	Date	Certainty	Seen	Location Name	Method
	1980	1	1	Eneabba	

Hylaeus globuliferus **Hylaeus globuliferus** *1 records*

This species of native bee is known to feed on the flowers of Adenanthos cygnorum in particular but has also been collected from the flowers of Grevillea cagiana, Banksia grossa and Banksia attenuata.

1996	1		Tathra National Park	

Priority Four: Taxa in need of monitoring

Macroderma gigas **Ghost Bat** *1 records*

This species is Australia's only carnivorous bat and has a patchy distribution across northern Australia. It shelters in caves, mine shafts and deep rock fissures and is sensitive to disturbance.

1990	2	1	Drovers Cave National Park	Bones

Ardeotis australis **Australian Bustard** *1 records*

This species is uncommon and may occur in open or lightly wooded grasslands.

1999	1	1	Eneabba	Dead

Calamanthus campestris montanellus **Rufous Fieldwren (western wheatbelt)** *3 records*

This species lives in low, sparse heath, saltmarsh or samphire, with or without emergent trees.

2001	1	2	Eneabba	
2001	1	1	Eneabba	
2001	1	1	Eneabba	

Oreoica gutteralis gutteralis **Crested Bellbird (southern)** *1 records*

This sedentary and solitary species inhabits the drier mallee woodlands and heaths of the southern parts of the State.

1982	2	1	White Gums Nature Reserve	Day sighting

* Information relating to any records provided for listed species:-
Date: date of recorded observation
Certainty (of correct species identification): 1=Very certain; 2=Moderately certain; and 3=Not sure.
Seen: Number of individuals observed.
Location Name: Name of reserve or nearest locality where observation was made
Method: Method or type of observation

APPENDIX C REGIONAL FAUNA DATA

Appendix C-1 Regional mammal data

FAMILY and species	Common Name	WAM / DEC	Van Dyck and Strahan (2008)	Menkhorst and Knight (2004)	Chapman *et al.* (1977)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
TACHYGLOSSIDAE															
Tachyglossus aculeatus	Short-beaked Echidna		✓	✓		✓	✓	✓		✓					✓
DASYURIDAE															
Sminthopsis crassicaudata	Fat-tailed Dunnart		✓	✓	✓	✓		✓							
Sminthopsis griseoventer	Grey-bellied Dunnart		✓					✓							
Sminthopsis dolichura	Little Long-tailed Dunnart	✓	✓	✓				✓							
Sminthopsis granulipes	White-tailed Dunnart	✓	✓	✓	✓			✓		✓				✓	✓
TARSIPEDIDAE															
Tarsipes rostratus	Honey Possum	✓	✓	✓	✓			✓	✓	✓	✓	✓		✓	✓
PHALANGERIDAE															
Trichosurus vulpecula	Common Brushtail Possum			✓											
MACROPODIDAE															
Macropus fuliginosus	Western Grey Kangaroo	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
Macropus irma	Western Brush Wallaby		✓	✓	✓	✓		✓							
Macropus robustus	Common Wallaroo		✓	✓			✓	✓	✓						
MOLLOSSIDAE															
Tadarida australis	White-striped Freetail-bat		✓	✓		✓	✓								✓
Mormopterus sp.	South-western Free-tailed bat		✓												
VESPERTILIONIDAE															
Nyctophilus geoffroyi	Lesser Long-eared Bat	✓	✓	✓	✓			✓		✓					
Chalinolobus gouldii	Gould's Wattled Bat	✓	✓	✓	✓		✓	✓		✓					
Chalinolobus morio	Chocolate Wattled Bat	✓	✓	✓	✓			✓							

FAMILY and species	Common Name	WAM / DEC	Van Dyck and Strahan (2008)	Menkhorst and Knight (2004)	Chapman *et al.* (1977)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
Scotorepens balstoni	Inland Broad-nosed Bat		✓	✓											
Vespadelus regulus	Southern Forest Bat	✓						✓							
MURIDAE															
Notomys alexis	Spinifex Hopping-mouse		✓	✓			✓								
Pseudomys albocinereus	Ash-grey Mouse	✓	✓		✓	✓		✓		✓	✓	✓		✓	✓
Pseudomys hermannsburgensis	Sandy Inland Mouse		✓				✓								
**Mus musculus*	House Mouse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Rattus fuscipes	Bush Rat	✓	✓		✓			✓							
**Rattus rattus*	Black Rat		✓	✓											
CANIDAE															
**Canis familiaris familiaris*	Dog							✓							✓
**Vulpes vulpes*	Fox		✓		✓	✓	✓	✓	✓	✓	✓				✓
FELIDAE															
**Felis catus*	Cat		✓		✓	✓	✓	✓	✓	✓	✓				✓
SUIDAE															
**Sus scrofa*	Pig			✓	✓										
LEPORIDAE															
**Oryctolagus cuniculus*	Rabbit		✓	✓	✓	✓	✓	✓	✓	✓	✓				✓

* Introduced species

Appendix C-2 Regional bird data

FAMILY and species	Common Name	WAM / DEC	Simpson and Day (2004)	Birdata	Chapman et al. (1977)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
CASUARIIDAE															
Dromaius novaehollandiae	Emu		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
PHASIANIDAE															
Coturnix pectoralis	Stubble Quail		✓	✓	✓	✓		✓	✓						
COLUMBIDAE															
Columba livia	Rock Dove		✓					✓	✓					✓	
Streptopelia senegalensis	Laughing Dove		✓	✓											
Phaps chalcoptera	Common Bronzewing		✓	✓	✓	✓	✓	✓	✓	✓				✓	✓
Phaps elegans	Brush Bronzewing	✓		✓										✓	
Ocyphaps lophotes	Crested Pigeon		✓	✓	✓	✓	✓	✓		✓	✓			✓	✓
Geopelia cuneata	Diamond Dove		✓	✓											
PODARGIDAE															
Podargus strigoides	Tawny Frogmouth		✓	✓	✓	✓	✓	✓							
EUROSTOPODIDAE															
Eurostopodus argus	Spotted Nightjar		✓		✓										
AEGOTHELIDAE															
Aegotheles cristatus	Australian Owlet-nightjar		✓	✓	✓	✓	✓	✓							
APODIDAE															
Apus pacificus	Fork-tailed Swift							✓							
PELECANIDAE															
Pelecanus conspicillatus	Australian Pelican		✓	✓											

FAMILY and species	Common Name	WAM / DEC	Simpson and Day (2004)	Birdata	Chapman et al. (1977)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
THRESKIORNITHIDAE															
Threskiornis molucca	Australian White Ibis		✓	✓											
Threskiornis spinicollis	Straw-necked Ibis		✓	✓											
ACCIPITRIDAE															
Elanus axillaris	Black-shouldered Kite		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	
Lophoictinia isura	Square-tailed Kite		✓												
Hamirostra melanosternon	Black-breasted Buzzard		✓												
Haliastur sphenurus	Whistling Kite		✓	✓	✓			✓							
Milvus migrans	Black Kite		✓												
Accipiter fasciatus	Brown Goshawk		✓	✓	✓		✓	✓		✓				✓	✓
Accipiter cirrocephalus	Collared Sparrowhawk		✓	✓	✓			✓						✓	
Circus assimilis	Spotted Harrier		✓	✓	✓		✓	✓							
Circus approximans	Swamp Harrier		✓	✓				✓	✓						
Aquila audax	Wedge-tailed Eagle		✓	✓	✓	✓	✓	✓		✓				✓	✓
Hieraaetus morphnoides	Little Eagle		✓	✓	✓	✓	✓	✓							✓
FALCONIDAE															
Falco cenchroides	Nankeen Kestrel		✓	✓	✓	✓	✓	✓	✓	✓				✓	✓
Falco berigora	Brown Falcon		✓	✓	✓	✓		✓	✓	✓				✓	✓
Falco longipennis	Australian Hobby		✓	✓			✓	✓	✓	✓					
Falco hypoleucos	Grey Falcon		✓							✓					
Falco peregrinus	Peregrine Falcon		✓	✓	✓			✓	✓						

FAMILY and species	Common Name	WAM / DEC	Simpson and Day (2004)	Birdata	Chapman et al. (1977)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
OTIDIDAE															
Ardeotis australis	Australian Bustard		✓	✓	✓	✓		✓	✓						
BURHINIDAE															
Burhinus grallarius	Bush Stone-curlew		✓			✓									
CHARADRIIDAE															
Vanellus tricolor	Banded Lapwing		✓	✓	✓	✓	✓	✓	✓						
TURNICIDAE															
Turnix varius	Painted Button-quail		✓					✓		✓				✓	
Turnix velox	Little Button-quail		✓	✓				✓						✓	✓
CACATUIDAE															
Calyptorhynchus banksii	Red-tailed Black-Cockatoo		✓	✓			✓	✓							
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	✓		✓		✓		✓						✓	
Calyptorhynchus baudinii	Baudin's Black-Cockatoo				✓				✓	✓	✓				
Lophochroa leadbeateri	Major Mitchell's Cockatoo		✓	✓											
Eolophus roseicapillus	Galah		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
Cacatua pastinator	Western Corella			✓	✓		✓	✓						✓	
Cacatua sanguinea	Little Corella		✓	✓											
Nymphicus hollandicus	Cockatiel		✓	✓	✓										✓
PSITTACIDAE															
Polytelis anthopeplus	Regent Parrot		✓	✓	✓	✓		✓	✓						
Barnardius zonarius	Australian Ringneck	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓
Melopsittacus undulatus	Budgerigar		✓	✓											
Neophema elegans	Elegant Parrot			✓											

FAMILY and species	Common Name	WAM / DEC	Simpson and Day (2004)	Birdata	Chapman et al. (1977)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
CUCULIDAE															
Chalcites basalis	Horsfield's Bronze-Cuckoo		✓	✓	✓	✓		✓		✓	✓				✓
Chalcites lucidus	Shining Bronze-Cuckoo		✓	✓				✓	✓						
Cacomantis pallidus	Pallid Cuckoo		✓	✓	✓	✓	✓	✓	✓						
Cacomantis flabelliformis	Fan-tailed Cuckoo		✓	✓		✓									
STRIGIDAE															
Ninox novaeseelandiae	Southern Boobook	✓	✓	✓	✓	✓	✓	✓	✓						
TYTONIDAE															
Tyto javanica	Eastern Barn Owl	✓	✓	✓	✓		✓	✓							
HALCYONIDAE															
Dacelo novaeguineae	Laughing Kookaburra	✓		✓	✓			✓							
Todiramphus pyrrhopygius	Red-backed Kingfisher		✓	✓			✓							✓	✓
Todiramphus sanctus	Sacred Kingfisher		✓	✓	✓		✓	✓		✓					
MEROPIDAE															
Merops ornatus	Rainbow Bee-eater	✓	✓	✓	✓	✓		✓		✓				✓	✓
MALURIDAE															
Malurus splendens	Splendid Fairy-wren		✓	✓	✓		✓	✓	✓	✓				✓	
Malurus leucopterus	White-winged Fairy-wren	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	
Malurus lamberti	Variegated Fairy-wren	✓	✓	✓	✓	✓	✓	✓		✓				✓	✓
Malurus pulcherrimus	Blue-breasted Fairy-wren		✓	✓	✓	✓		✓						✓	
Stipiturus malachurus	Southern Emu-wren			✓				✓						✓	✓
ACANTHIZIDAE															
Sericornis frontalis	White-browed Scrubwren	✓	✓	✓	✓		✓	✓	✓					✓	✓

FAMILY and species	Common Name	WAM / DEC	Simpson and Day (2004)	Birdata	Chapman et al. (1977)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
Hylacola cauta	Shy Heathwren							✓							
Calamanthus fuliginosus	Striated Fieldwren				✓	✓		✓		✓	✓				
Calamanthus campestris	Rufous Fieldwren		✓	✓										✓	✓
Pyrrholaemus brunneus	Redthroat		✓	✓		✓	✓								
Smicrornis brevirostris	Weebill		✓	✓	✓	✓	✓	✓		✓				✓	✓
Gerygone fusca	Western Gerygone		✓	✓	✓	✓	✓	✓		✓					✓
Acanthiza chrysorrhoa	Yellow-rumped Thornbill		✓	✓	✓	✓	✓	✓	✓						✓
Acanthiza uropygialis	Chestnut-rumped Thornbill		✓	✓		✓	✓								
Acanthiza inornata	Western Thornbill				✓	✓		✓	✓	✓					
Acanthiza apicalis	Inland Thornbill		✓	✓	✓	✓		✓							
Acanthiza pusilla	Brown Thornbill						✓			✓					
Aphelocephala leucopsis	Southern Whiteface		✓	✓											
PARDALOTIDAE															
Pardalotus punctatus	Spotted Pardalote			✓				✓							
Pardalotus striatus	Striated Pardalote	✓	✓	✓	✓	✓	✓	✓		✓				✓	✓
MELIPHAGIDAE															
Acanthorhynchus superciliosus	Western Spinebill			✓	✓			✓							
Certhionyx variegatus	Pied Honeyeater			✓				✓							
Lichenostomus virescens	Singing Honeyeater		✓	✓	✓	✓	✓	✓	✓		✓			✓	✓
Purnella albifrons	White-fronted Honeyeater		✓	✓										✓	
Manorina flavigula	Yellow-throated Miner		✓	✓	✓	✓	✓	✓						✓	
Acanthagenys rufogularis	Spiny-cheeked Honeyeater		✓	✓	✓		✓	✓		✓					
Anthochaera lunulata	Western Wattlebird			✓	✓			✓	✓						

FAMILY and species	Common Name	WAM / DEC	Simpson and Day (2004)	Birdata	Chapman et al. (1977)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
Anthochaera carunculata	Red Wattlebird			✓	✓			✓	✓	✓	✓				✓
Epthianura tricolor	Crimson Chat		✓	✓		✓				✓					
Epthianura albifrons	White-fronted Chat		✓	✓	✓	✓	✓	✓	✓					✓	
Glyciphila melanops	Tawny-crowned Honeyeater	✓	✓	✓	✓	✓		✓		✓	✓			✓	✓
Lichmera indistincta	Brown Honeyeater		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
Phylidonyris novaehollandiae	New Holland Honeyeater			✓						✓				✓	
Phylidonyris niger	White-cheeked Honeyeater		✓	✓	✓	✓		✓	✓	✓	✓			✓	✓
Melithreptus brevirostris	Brown-headed Honeyeater			✓	✓	✓	✓	✓		✓					
POMATOSTOMIDAE															
Pomatostomus superciliosus	White-browed Babbler		✓	✓	✓		✓	✓							
PSOPHODIDAE															
Psophodes occidentalis	Chiming Wedgebill		✓	✓											
NEOSITTIDAE															
Daphoenositta chrysoptera	Varied Sittella		✓					✓							
CAMPEPHAGIDAE															
Coracina novaehollandiae	Black-faced Cuckoo-shrike		✓	✓	✓	✓	✓	✓	✓	✓				✓	✓
Lalage sueurii	White-winged Triller		✓	✓		✓		✓	✓	✓					
PACHYCEPHALIDAE															
Pachycephala pectoralis	Golden Whistler		✓	✓	✓		✓	✓							
Pachycephala rufiventris	Rufous Whistler		✓	✓	✓	✓	✓	✓	✓	✓				✓	✓
Colluricincla harmonica	Grey Shrike-thrush		✓	✓	✓	✓	✓	✓						✓	✓
Oreoica gutturalis	Crested Bellbird		✓	✓		✓	✓	✓							
ARTAMIDAE															

FAMILY and species	Common Name	WAM / DEC	Simpson and Day (2004)	Birdata	Chapman et al. (1977)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
Artamus personatus	Masked Woodswallow		✓	✓											
Artamus cinereus	Black-faced Woodswallow		✓	✓	✓	✓	✓	✓		✓	✓			✓	✓
Artamus cyanopterus	Dusky Woodswallow			✓				✓							
Cracticus torquatus	Grey Butcherbird		✓	✓	✓	✓	✓	✓	✓						
Cracticus nigrogularis	Pied Butcherbird		✓	✓	✓	✓	✓	✓							✓
Cracticus tibicen	Australian Magpie		✓	✓	✓	✓	✓	✓							✓
Strepera versicolor	Grey Currawong		✓	✓	✓		✓	✓							
RHIPIDURIDAE															
Rhipidura albiscapa	Grey Fantail		✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
Rhipidura leucophrys	Willie Wagtail		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
CORVIDAE															
Corvus coronoides	Australian Raven	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
Corvus bennetti	Little Crow		✓	✓	✓	✓	✓	✓						✓	
MONARCHIDAE															
Grallina cyanoleuca	Magpie-lark		✓	✓	✓	✓	✓	✓	✓	✓				✓	✓
PETROCIDAE															
Microeca fascinans	Jacky Winter		✓	✓		✓		✓							
Petroica boodang	Scarlet Robin				✓			✓							
Petroica goodenovii	Red-capped Robin	✓		✓	✓	✓	✓	✓		✓				✓	
Melanodryas cucullata	Hooded Robin		✓	✓	✓	✓		✓		✓					
Eopsaltria griseogularis	Western Yellow Robin		✓	✓			✓								
Eopsaltria georgiana	White-breasted Robin	✓		✓	✓			✓						✓	
Drymodes brunneopygia	Southern Scrub-robin		✓	✓			✓								

FAMILY and species	Common Name	WAM / DEC	Simpson and Day (2004)	Birdata	Chapman et al. (1977)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
MEGALURIDAE															
Megalurus gramineus	Little Grassbird		✓		✓			✓	✓						
Cincloramphus cruralis	Brown Songlark		✓	✓	✓		✓	✓	✓	✓					✓
TIMALIIDAE															
Zosterops lateralis	Silvereye		✓	✓	✓	✓		✓	✓	✓				✓	✓
HIRUNDINIDAE															
Cheramoeca leucosterna	White-backed Swallow		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
Hirundo neoxena	Welcome Swallow		✓	✓	✓	✓	✓	✓		✓	✓			✓	✓
Petrochelidon ariel	Fairy Martin		✓	✓										✓	✓
Petrochelidon nigricans	Tree Martin		✓	✓	✓	✓	✓	✓	✓					✓	✓
NECTARINIIDAE															
Dicaeum hirundinaceum	Mistletoebird		✓	✓	✓		✓	✓	✓						
ESTRILDIDAE															
Taeniopygia guttata	Zebra Finch		✓	✓		✓	✓								
MOTACILLIDAE															
Anthus novaeseelandiae	Australasian Pipit		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓

Appendix C-3 Regional reptile data

FAMILY and species	Common Name	WAM / DEC	Wilson & Swan (2008)	Storr *et al.* (1999)	Storr *et al.* (2002)	Chapman *et al.* (1977)	Murray (1980)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
CHELUIDAE																	
Chelodina oblonga	Oblong Turtle					✓											
AGAMIDAE																	
Amphibolurus longirostris	Long-nosed Dragon		✓														
Ctenophorus maculatus maculatus	Spotted Military Dragon	✓	✓			✓		✓		✓		✓	✓		✓	✓	
Ctenophorus nuchalis	Central Netted Dragon		✓														
Ctenophorus reticulatus	Western Netted Dragon		✓														
Ctenophorus scutulatus	Lozenge-marked Dragon		✓						✓								
Moloch horridus	Thorny Devil		✓					✓				✓	✓				
Pogona minor minor	Dwarf Bearded Dragon	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Rankinia adelaidensis adelaidensis	Western Heath Dragon	✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
ELAPIDAE																	
Brachyurophis fasciolata	Narrow-banded Shovel-nosed Snake		✓		✓												
Brachyurophis semifasciata	Southern Shovel-nosed Snake		✓		✓												
Demansia psammophis	Yellow-faced Whipsnake		✓		✓	✓				✓							
Echiopsis curta	Bardick	✓	✓		✓	✓									✓		
Neelaps bimaculatus	Black-naped Snake		✓		✓	✓	✓			✓							
Parasuta gouldii	Gould's Hooded Snake	✓			✓									✓	✓		
Parasuta monachus	Monk Snake		✓		✓				✓								
Pseudechis australis	Mulga Snake	✓	✓		✓					✓							✓
Pseudonaja modesta	Ringed Brown Snake		✓		✓				✓								

FAMILY and species	Common Name	WAM / DEC	Wilson & Swan (2008)	Storr *et al.* (1999)	Storr *et al.* (2002)	Chapman *et al.* (1977)	Murray (1980)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
Pseudonaja nuchalis	Western Brown Snake; Gwardar	✓	✓		✓	✓		✓		✓							✓
Simoselaps bertholdi	Jan's Banded Snake	✓	✓		✓				✓								
Simoselaps littoralis	West Coast Banded Snake	✓	✓		✓	✓				✓		✓			✓		
Suta fasciata	Rosen's Snake		✓		✓												
GEKKONIDAE																	
Crenadactylus ocellatus	Clawless Gecko		✓			✓				✓							
Lucasium alboguttatus	White-spotted Ground Gecko	✓	✓			✓			✓	✓							
Lucasium squarrosum									✓								
Diplodactylus granariensis granariensis	Western Stone Gecko	✓	✓						✓	✓						✓	
Diplodactylus ornatus		✓	✓				✓			✓							
Diplodactylus polyophthalmus	Speckled Stone Gecko	✓								✓		✓					
Gehyra variegata		✓	✓			✓		✓	✓	✓	✓			✓			
Heteronotia binoei	Byno's gecko		✓						✓								
Nephrurus levis	Smooth Knob-tailed Gecko		✓														
Oedura marmorata	Marbled Velvet Gecko					✓				✓	✓						
Strophurus michaelseni								✓									
Strophurus spinigerus spinigerus	Soft Spiny-tailed Gecko	✓	✓			✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Underwoodisaurus milii	Thick-tailed/Barking Gecko	✓	✓			✓				✓	✓						
PYGOPODIDAE																	
Aprasia fusca	Exmouth Worm-lizard		✓														
Aprasia repens	Sand-plain Worm-lizard	✓	✓									✓					
Delma australis			✓						✓								

FAMILY and species	Common Name	WAM / DEC	Wilson & Swan (2008)	Storr *et al.* (1999)	Storr *et al.* (2002)	Chapman *et al.* (1977)	Murray (1980)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
Delma butleri			✓														
Delma concinna						✓	✓			✓	✓	✓					
Delma fraseri fraseri		✓	✓			✓				✓	✓		✓	✓			
Delma grayii		✓	✓			✓				✓						✓	
Delma tincta			✓														
Lialis burtonis	Burton's Snake-lizard	✓	✓			✓	✓	✓		✓		✓			✓		
Pletholax gracilis gracilis	Keeled Legless Lizard	✓	✓							✓	✓						
Pygopus lepidopodus	Common Scaly-foot	✓	✓			✓	✓			✓	✓					✓	
BOIDAE																	
Antaresia stimsoni	Stimson's Python		✓		✓					✓							
Aspidites ramsayi	Woma		✓		✓												
Morelia spilota	Carpet/Diamond Python		✓		✓												
SCINCIDAE																	
Cryptoblepharus carnabyi			✓	✓					✓								
Cryptoblepharus plagiocephalus		✓	✓	✓		✓		✓	✓	✓		✓		✓			
Ctenotus australis		✓		✓									✓				
Ctenotus fallens		✓	✓	✓		✓	✓	✓		✓		✓			✓	✓	✓
Ctenotus impar	South-western Odd-striped Ctenotus	✓		✓		✓	✓			✓		✓	✓	✓			
Ctenotus labillardieri													✓				
Ctenotus lesueurii						✓	✓			✓							
Ctenotus mimetes			✓	✓													
Ctenotus pantherinus pantherinus	Leopard Ctenotus	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓

FAMILY and species	Common Name	WAM / DEC	Wilson & Swan (2008)	Storr *et al.* (1999)	Storr *et al.* (2002)	Chapman *et al.* (1977)	Murray (1980)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
Ctenotus schomburgkii		✓	✓	✓					✓			✓	✓		✓		
Ctenotus severus			✓														
Ctenotus uber uber									✓								
Cyclodomorphus branchialis	Gilled Slender Blue-tongue		✓			✓				✓							
Cyclodomorphus celatus	Western Slender Blue-tongue	✓	✓	✓													
Egernia depressa	Pygmy Spiny-tailed Skink								✓								
Egernia kingii	King's Skink			✓						✓	✓						
Egernia multiscutata bos	Bull Skink	✓		✓		✓				✓							
Egernia napoleonis						✓				✓							
Eremiascincus richardsonii	Broad-banded Sand-swimmer		✓	✓													
Lerista bipes													✓				
Lerista christinae		✓					✓			✓				✓		✓	
Lerista elegans		✓	✓	✓		✓		✓		✓	✓						
Lerista lineopunctulata		✓	✓	✓													
Lerista macropisthopus			✓														
Lerista muelleri			✓						✓								
Lerista planiventralis decora		✓	✓	✓		✓				✓							
Lerista praepedita		✓	✓	✓		✓				✓		✓	✓	✓	✓		✓
Menetia greyii		✓	✓	✓		✓	✓		✓	✓		✓				✓	✓
Menetia surda			✓														
Morethia butleri			✓	✓													
Morethia lineoocellata		✓	✓	✓		✓				✓	✓						

FAMILY and species	Common Name	WAM / DEC	Wilson & Swan (2008)	Storr *et al.* (1999)	Storr *et al.* (2002)	Chapman *et al.* (1977)	Murray (1980)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
Morethia obscura		✓	✓	✓		✓	✓			✓		✓					
Tiliqua occipitalis	Southern/Blotched Blue Tongue		✓	✓		✓	✓	✓	✓	✓	✓	✓				✓	
Tiliqua rugosa rugosa	Bobtail	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TYPHLOPIDAE																	
Ramphotyphlops australis	Southern Blind Snake		✓			✓	✓										
Ramphotyphlops hamatus			✓		✓												
Ramphotyphlops waitii		✓	✓		✓												
VARANIDAE																	
Varanus caudolineatus	Stripe-tailed Monitor								✓								
Varanus eremius	Pygmy Desert Monitor		✓														
Varanus gouldii	Sand/Gould's Goanna		✓					✓		✓		✓					
Varanus tristis	Black-headed/Freckled Monitor		✓							✓						✓	✓

Appendix C-4 Regional amphibian data

FAMILY and species	Common Name	WAM	Tyler *et al.* (2000)	Chapman *et al.* (1977)	Murray (1980)	Halse *et al.* (1985)	Dell *et al.* (1979)	Burbidge *et al.* (1990)	Foulds and McMillan (1982)	Dunlop (1981)	RGCMS Rehabilitation (EMRC 1996)	McMillan *et al.* (1992)	McNee *et al.* (1995)	HGM (1998)	HGM (2001)
MYOBATRACHIDAE															
Crinia pseudinsignifera	Bleating Froglet	✓	✓					✓						✓	
Heleioporus albopunctatus	Western Spotted Frog	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓		✓
Heleioporus eyrei	Moaning Frog	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
Heleioporus psammophilus	Sand Frog		✓					✓							✓
Limnodynastes dorsalis	Bullfrog or Banjo Frog		✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Myobatrachus gouldii	Turtle Frog		✓		✓			✓		✓		✓	✓		✓
Neobatrachus kunapalari	Kunapalari Frog	✓													
Neobatrachus pelobatoides	Humming Frog	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		
Neobatrachus sutor	Shoemaker Frog		✓	✓			✓								
Neobatrachus wilsmorei	Wilsmore's Frog		✓				✓							✓	
Pseudophryne guentheri	Günther's Toadlet	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓
HYLIDAE															
Litoria moorei	Motorbike Frog or Bell Frog		✓	✓				✓		✓	✓	✓			✓

APPENDIX D FAUNA SPECIES RECORDED DURING SURVEYING

Appendix D-1 Mammals recorded during survey; numbers indicate the total number of captures or observations.

FAMILY and Species	Common Name	Site ENB01	Site ENB02	Site ENB03	Site ENB04	Site ENB05	Site ENB06	OPP
TACHYGLOSSIDAE								
Tachyglossus aculeatus	Short-beaked Echidna	tracks scats						
DASYURIDAE								
Sminthopsis crassicaudata	Fat-tailed Dunnart	1					2	
Sminthopsis dolichura	Little Long-tailed Dunnart					1		
Sminthopsis granulipes	White-tailed Dunnart	1	2	2	1			
MACROPODIDAE								
Macropus fuliginosus	Western Grey Kangaroo	1	1		2	1	2	1
Macropus robustus	Euro						1	5
TARSIPEDIDAE								
Tarsipes rostratus	Honey Possum				1			
VESPERTILIONIDAE								
Chalinolobus gouldii	Gould's Wattled Bat		A					
Nyctophilus geoffroyi	Lesser Long-eared Bat	A				A		
Vespadelus regulus	Southern Forrest Bat				A	A		
MURIDAE								
**Mus musculus*	House Mouse		3	1		1	4	
Pseudomys albocinereus	Ash Grey Mouse	1		1			1	
LEPORIDAE								
**Oryctolagus cuniculus*	European Rabbit		1		2			
CANIDAE								
**Vulpes vulpes*	Red Fox	tracks	tracks	1	2	tracks		tracks
FELIDAE								
**Felis catus*	Cat				tracks			1

* Introduced species
A Acoustic recording from ANABAT

Appendix D-2 Birds recorded during survey; numbers indicate the total number of captures or observations.

FAMILY and Species	Common Name	Site ENB01	Site ENB02	Site ENB03	Site ENB04	Site ENB05	Site ENB06	OPP
CASUARIIDAE								
Dromaius novaehollandiae	Emu					3		
PHASIANIDAE								
Coturnix pectoralis	Stubble Quail					1		
ACCIPITRIDAE								
Aquila morphnoides	Little Eagle							1
Aquila audax	Wedge-tailed Eagle	1	1	1				
FALCONIDAE								
Falco berigora	Brown Falcon	1						1
Falco cenchroides	Nankeen Kestrel		1		6			1
ALCEDINIDAE								
Ocyphaps lophotes	Crested Pigeon				6		1	
PSITTACIDAE								
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo						5	
Cacatua roseicapilla	Galah	4			19		2	
CUCULIDAE								
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo							1
MEROPIDAE								
Merops ornatus	Rainbow Bee-eater				1			1
MALURIDAE								
Malurus lamberti	Variegated Fairy-wren				3			
Malurus pulcherrimus	Blue-breasted Fairy-wren						2	
Malurus leucopterus	White-winged Fairy-wren	7	1				11	

FAMILY and Species	Common Name	Site ENB01	Site ENB02	Site ENB03	Site ENB04	Site ENB05	Site ENB06	OPP
ACANTHIZIDAE								
Calamanthus campestris	Rufous Fieldwren	4		1			1	
MELIPHAGIDAE								
Lichmera indistincta	Brown Honeyeater	4	2		3		5	
Lichenostomus virescens	Singing Honeyeater				1			
Phylidonyris melanops	Tawny-crowned Honeyeater	21	14	4	1	7	16	
Anthochaera lunulata	Little Wattlebird				1			
Epthianura albifrons	White-fronted Chat							1
PETROICIDAE								
Petroica cucullata	Hooded Robin							1
DICRURIDAE								
Grallina cyanoleuca	Magpie-Lark							1
CAMPEPHAGIDAE								
Coracina novaehollandiae	Black-faced Cuckoo-shrike	1			3			
Lalage tricolor	White-winged Triller				4		9	
ARTAMIDAE								
Artamus cinereus	Black-faced Woodswallow	4			4		5	
CRACTICIDAE								
Cracticus tibicen	Australian Magpie						1	1
CORVIDAE								
Corvus coronoides	Australian Raven	3			3			1
ZOSTEROPIDAE								
Zosterops lateralis	Silvereye	4						
SYLVIIDAE								

FAMILY and Species	Common Name	Site ENB01	Site ENB02	Site ENB03	Site ENB04	Site ENB05	Site ENB06	OPP
Cincloramphus cruralis	Brown Songlark	1						
PASSERIDAE								
Taeniopygia guttata	Zebra Finch				3			
MOTACILLIDAE								
Anthus novaeseelandiae	Australasian Pipit	3					2	1

Appendix D-3 Reptiles recorded during survey; numbers indicate the total number of captures or observations.

FAMILY and Species	Common Name	Site ENB01	Site ENB02	Site ENB03	Site ENB04	Site ENB05	Site ENB06	Opp 1	Opp 2
AGAMIDAE									
Ctenophorus maculatus	Spotted Military Dragon	1	3		6				
Pogona minor	Western Bearded Dragon	4	6	1	3	8	6		1
Rankinia adelaidensis	Western Heath Dragon	4	9	4	4	24	7		
GEKKONIDAE									
Crenadactylus ocellatus	Clawless Gecko							4	
Diplodactylus alboguttatus	White-spotted Ground Gecko	5	6		1	4	1		
Diplodactylus ornatus		2	5						
Strophurus spinigerus	Soft Spiny-tailed Gecko	4		3	1	8	7		
PYGOPODIDAE									
Delma fraseri					2				
Lialis burtonis	Burton's Snake-lizard	3	2		2				
SCINICIDAE									
Cryptoblepharus plagiocephalus								2	
Ctenotus fallens		3	1	1	9	2	19		1
Lerista elegans		3	4	2					
Lerista praepedita		1	2	1	3				
Menetia greyii		1			1			1	
Tiliqua rugosa	Bobtail		1		3		1		

FAMILY and Species	Common Name	Site ENB01	Site ENB02	Site ENB03	Site ENB04	Site ENB05	Site ENB06	Opp 1	Opp 2
VARANIDAE									
Varanus gouldii	Sand Goanna	1	1						
Varanus tristis	Black-headed Monitor							1	
ELAPIDAE									
Neelaps bimaculatus	Black-naped Snake	3			2	1			
Neelaps calonotos	Black-striped Snake		1						
Pseudechis australis	Mulga Snake				1				
Pseudonaja nuchalis	Gwardar				2				
Simoselaps bertholdi	Jan's Banded Snake		1						

Appendix D-4 Amphibians recorded during survey numbers indicate the total number of captures or observations.

FAMILY and Species	Common Name	Site ENB01	Site ENB02	Site ENB03	Site ENB04	Site ENB05	Site ENB06	Opp 1	Opp 2
MYOBATRACHIDAE									
Heleioporus albopunctatus	Western Spotted Frog		1	1	2				
Heleioporus eyrei	Moaning Frog	1	1			1			
Myobatrachus gouldii	Turtle Frog		1						

APPENDIX E DEFINITIONS OF CONSERVATION VALUE CATEGORIES

Appendix E-1 Definitions of relevant categories under the *Environment Protection and Biodiversity Conservation* Act.

CATEGORY	DEFINITION
Endangered (EN)	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate, or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable (VU)	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Migratory (M)	Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: • the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a range state; • The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA); or • The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Appendix E-2 Definition of Schedules under the *Wildlife Conservation Act* 1950

SCHEDULE	DEFINITION
Schedule 1 (S1)	Fauna which are Rare or likely to become extinct, are declared to be fauna that is in need of special protection.
Schedule 2 (S2)	Fauna which are presumed extinct are declared to be fauna that is in need of special protection.
Schedule 3 (S3)	Birds which are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction are declared to be fauna that is in need of special protection.
Schedule 4 (S4)	Declared to be fauna that is in need of special protection, otherwise than for the reasons mentioned above.

Appendix E-3 Definition of Department of Environment and Conservation Priority Codes

PRIORITY	DEFINITION
Priority One (P1)	*Taxa with few*, *poorly known populations on threatened lands*. Taxa which are known from few specimens or sight records from one or a few localities, on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Two (P2)	*Taxa with few*, *poorly known populations on conservation lands.* Taxa which are known from few specimens or sight records from one or a few localities, on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Three (P3)	*Taxa with several*, *poorly known populations*, *some on conservation lands.* Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Four (P4)	*Taxa in need of monitoring.* Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.
Priority Five (P5)	*Taxa in need of monitoring* Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.