

*A VERTEBRATE FAUNA SURVEY
OF THE
WILUNA WEST PROJECT AREA
WESTERN AUSTRALIA
#2*



Prepared for Keith Lindbeck & Associates

By Ninox Wildlife Consulting

November 2006

SUMMARY

This report has been prepared for Keith Lindbeck & Associates on behalf of Golden West Resources Limited and presents the results of a second vertebrate fauna survey of the habitats within the Wiluna West Project Area, south-west of Wiluna, Western Australia. This current survey was undertaken within a section of mining tenement M53/1016, hereafter nominated as the Survey Area #2.

The study objectives were fulfilled by means of a spring field investigation (15-24 September 2006). A review of information relevant to the vertebrate fauna of Survey Area #2 was also undertaken and consisted of three parts:

1. a search of State and Commonwealth vertebrate fauna databases;
2. a review of published literature on the vertebrate fauna of the general area;
3. a review of unpublished records from the general area held by Ninox Wildlife Consulting.

The previous 2005 survey was undertaken following three years of low rainfall. During the summer of 2005-06, cyclonic events had provided substantial rainfall to the general area which resulted in a high level of germination of annual chenopods, herbs and grasses. Therefore, in order to realistically compare the 2005 and 2006 results, one 2005 site (WW3) was re-established and sampled again during this current survey.

A total of 52 species of bird, nine extant native mammal species, no frogs and 17 reptile species was recorded during the survey. The abandoned burrow system of an extinct native mammal was also noted. Only one introduced mammal was captured, the House Mouse (*Mus musculus*), two others were noted and identified from tracks or scats.

Two birds of particular conservation significance were recorded during the survey: the Malleefowl and Peregrine Falcon. Five additional birds, two mammals and one reptile may also occur although no signs of their presence have yet been recorded.

Based on the results of this October 2006 survey, none of the habitats surveyed currently appear to have any major conservation significance.

The results of this second field survey, which followed substantial summer rainfall, clearly demonstrate the inadequacy of single season surveys, particularly in the arid zone. A comparison of results from 2005 and 2006 showed that there was a significant increase in species recorded in all faunal groups: from 39 to 60 bird species; from six to 11 species of native mammal and from 10 to 21 reptile species. The accumulation of species to the area inventory will continue to increase, especially if cyclonic activity results in significant rainfall in the area during this 2006-07 summer. The diversity of species now known to occur in the Wiluna West Project Area is similar to other areas such as Wanjarri Nature Reserve.

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LIST OF PARTICIPANTS

Ninox Wildlife Consulting

Field Work	Jan Henry Maureen Francesconi Kevin Fairbairn	Senior Zoologist Assisting Zoologist/Ornithologist Assisting Zoologist/Ornithologist
Reporting	Jan Henry	

1 INTRODUCTION

This report has been prepared for Keith Lindbeck & Associates on behalf of Golden West Resources Limited and presents the results of a second vertebrate fauna survey of the habitats within the Wiluna West Project Area, south-west of Wiluna, Western Australia. This current survey was undertaken within a section of mining tenement M53/1016, hereafter nominated as the Survey Area #2. This survey area was to the west of the area reported in Ninox Wildlife Consulting (2005).

Included in this current report are:

- the methods used to assess the potential of the habitats within Survey Area #2 to support a range of vertebrate fauna species;
- a list of vertebrate fauna recorded during the October 2006 fauna survey;
- a comparison of the current results with those from November 2005;
- a review of species considered to be rare, threatened or endangered that are known, or could potentially occur, within Survey Area #2;
- a list of species not recorded during the survey but that are likely to occur within Survey Area #2;
- a review of locations within Survey Area #2 that are considered by Ninox Wildlife Consulting (Ninox) to be of conservation significance to vertebrate fauna and a series of recommendations for management of those habitats;
- general recommendations for management of fauna and their habitats during construction and operation of the mine and associated infrastructure.

2 DEFINITION OF TERMS

Prior to any discussion of the significance of vertebrate fauna or their habitats a definition of terms is required. This section of the document describes the various Commonwealth and State Acts that cover rare, threatened and vulnerable vertebrate fauna species and was correct at the time of the preparation of this document. However, as changes are made to both State and Commonwealth legislation and new treaties are entered into, all current documentation regarding rare, threatened and vulnerable fauna should be periodically reviewed for any changes to the status of these animals in a given area.

Additionally, in any discussion of rare, threatened or vulnerable species, several aspects require clarification before the significance of these species can be considered in context of the development and operation of any mining or development project.

- ◆ Resident, habitat-specific rare fauna are much more susceptible to the influences of disturbance than nomadic or migratory species.
- ◆ Not all rare species are equally susceptible to disturbance. Some rare species such as the Peregrine Falcon can accommodate the high levels of disturbance present in urban and rural environments.

- ♦ The concept of species rarity is a dynamic process considerably influenced by the level of survey work carried out in a particular location and the climatic conditions prevailing at the time.

2.1 Protected Species - Commonwealth

In 1974, Australia signed the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). As a result, an official list of endangered, vulnerable or presumed extinct species was constructed (Schedule 1) and is regularly updated (*Endangered Species Protection Act 1992*).

In July 2000 this Act was replaced by *The Environment Protection and Biodiversity Conservation Act 1999 (EPBC 1999)*, which retained the schedule of threatened species of the Act it replaced.

The vertebrate fauna listed on the current schedule differs from the two State lists, although there are several species that appear on both, for example, the Malleefowl (*Leipoa ocellata*), and the Giant Desert Skink (*Egernia kintorei*). There are six parts to the EPBC Act covering species that are:

1. extinct;
2. extinct in the wild;
3. critically endangered;
4. endangered;
5. vulnerable;
6. conservation dependent.

Table 1 lists the criteria for referral of a project under the *EPBC Act (1999)* for endangered and vulnerable fauna species.

Table 1 Criteria for referral of a project under the EPBC Act (1999) for endangered and vulnerable fauna species. (Extracted from www.deh.gov.au.)

ENDANGERED
An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:
* lead to a long-term decrease in the size of a population;
* reduce the area of occupancy of the species;
* fragment an existing population into two or more populations;
* adversely affect habitat critical to the survival of a species;
* disrupt the breeding cycle of a population;
* modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
* result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
* interfere with the recovery of the species.

VULNERABLE
An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:
* lead to a long-term decrease in the size of an important population of a species;
* reduce the area of occupancy of an important population;
* fragment an existing important population into two or more populations;
* adversely affect habitat critical to the survival of a species;
* disrupt the breeding cycle of an important population;
* modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
* result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
* interferes substantially with the recovery of the species.

2.2 Protected Species - Western Australia

Currently in Western Australia, rare or endangered species are protected by the *Wildlife Conservation Act 1950 (WC Act 1950)*. The various schedules defined under this act are:

- ◆ Declared Threatened Fauna - fauna that is ranked as presumed extinct, critically endangered, endangered or vulnerable;
- ◆ Conservation Dependent Fauna; and
- ◆ Other Specially Protected Fauna.

This Act is periodically reviewed and the current list of protected fauna can be viewed on CALM's Faunabase website. Burbidge (2004) acknowledges however, that the *Wildlife Conservation Act 1950* is now outdated and a Biodiversity Conservation Bill is currently being prepared for introduction to Western Australia's Parliament.

2.3 Priority Species - Western Australia

The Department of Conservation and Land Management (CALM) Priority Fauna List classifies species as:

- Priority 1 - 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 2 - 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 3 - 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 4 - taxa in need of monitoring.

Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.

- Priority 5 - taxa in need of monitoring.

Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

The Priority Fauna List does not confer any additional legal protection to the species listed, apart from the normal protection afforded to most native animals. It does, however, indicate the need for vigilance during the construction and commissioning of development projects to manage native vegetation and rehabilitation so that Priority species, should they occur, do not meet the criteria for listing on the Threatened Species List as a result of that development.

2.4 International Agreements

A range of birds are listed under the Japan-Australia (JAMBA) and China-Australia (CAMBA) Migratory Bird Agreements. Most of the species listed on the JAMBA and/or CAMBA agreements are shorebirds associated with coastal zones or inland saline wetlands and most are not relevant to the current Wiluna West Survey Area #2. However, there is a small range of birds listed on these international treaties that could occur within Survey Area #2 and these are discussed in this report.

2.5 Significant Fauna Habitats

Australia-wide, a small number of Threatened Ecological Communities (TEC) has been defined under Commonwealth legislation. However, while not defined under any legislation, some fauna habitats within a project area may be defined as locally significant because they:

- ◆ support rare or vulnerable species;
- ◆ support specialised or habitat specific fauna;
- ◆ are regionally or locally uncommon; or
- ◆ are restricted in area.

Although not protected under any State or Commonwealth legislation, in the interests of good project management, where possible, conservation of such locations within a project area will provide the basis for the fauna component of an environmental management plan to be put in place for the duration of a project.

3 METHODS

The main study objectives of this assessment of Survey Area #2 were to:

- assess the potential of the habitats to support a range of vertebrate fauna species;
- produce an inventory of the vertebrate fauna recorded;
- review vertebrate fauna considered to be rare, threatened, vulnerable or geographically restricted that could potentially occur;
- assess the relationships between vertebrate fauna and the vegetation communities in order to clearly identify any habitats of significance;
- assess the regional and local conservation status of the vertebrate fauna and their habitats;
- based on all the above, assess the potential impact of mining and associated infrastructure on vertebrate fauna; and,
- produce a comprehensive analysis suitable for integration with the reports on landform, soils, flora and vegetation.

The study objectives were fulfilled by means of a spring field investigation (15-24 September 2006) which has added to the vertebrate fauna inventory of the Wiluna West Project Area. The results of the two surveys will provide information to satisfy a Level 2 Detailed Survey as defined in the Environmental Protection Authority's Guidance Statement No. 56.

A thorough data and literature review was conducted for the 2005 report and this facilitated the prediction of a range of species not recorded but likely to occur within that section of the Project Area. To build upon this information, a more recent review of information relevant to the vertebrate fauna of Survey Area #2 was undertaken and consisted of three parts:

1. a search of State and Commonwealth vertebrate fauna databases;
2. a review of published literature on the vertebrate fauna of the general area;
3. a review of unpublished records from the general area held by Ninox Wildlife Consulting.

A report on the fauna of the Sandstone – Sir Samuel site (now Wanjarri Nature Reserve) by McKenzie *et al.* (1994) remains the most relevant information for the general area. This data was gathered as part of the biological survey of the eastern goldfields conducted between 1979 and 1981.

3.1 Sampling Sites and Methods

Six vertebrate fauna sampling sites were established in the various habitats within Wiluna West Survey Area #2. The previous 2005 survey was undertaken following three years of low rainfall. During the summer of 2005-06, cyclonic events had provided substantial rainfall to the general area which had resulted in a high level of germination of annual chenopods, herbs and grasses. Therefore, in order to realistically compare the 2005 and 2006 results, one 2005 site (WW3) was re-established and sampled again during this current survey and was given the site code WW13-3. Plates 1 to 10 show the individual sampling sites and Table 2 summarises the plant community in each. An AMG grid reference is also shown in Table 2. Site code numbers continue from the initial six sites surveyed during November 2005.

One trapline consisted of surface traps only as there was no soil for the establishment of pitfall traps (WW07). This trapline was also split over two locations on the ironstone ridge to ensure adequate coverage of this habitat. A second trapline (WW10) was also split between two locations because of the relatively small size of the habitat in each location.

Table 2 *Site descriptions and AMG coordinates of the locations sampled for vertebrate fauna during the October 2006 survey of the Wiluna West Survey Area #2. (See Plates 1 to 10 for site photographs.)*

SITE CODE	EASTING	NORTHING	DESCRIPTION
WW07 A & B	793 875 794 224	7 033 726 7 036 062	Top of banded iron formation ridge: Mulga (<i>Acacia aneura</i>) woodland with emergent Gidgee (<i>Acacia pruinocarpa</i>) over mixed shrubs; extremely rocky with very little or no soil.
WW08	793 990	7 034 665	Top of banded iron formation ridge: Mulga woodland over mixed shrubs over spinifex (<i>Triodia melvillei</i>) with occasional <i>Eucalyptus kingsmillii</i> . Rocky clay soils.
WW09	793 965	7 036 458	Creekline (degraded) with eucalypts over shrubs, grasses, chenopods and weeds on very sandy, clay soils.
WW10 A & B	793 729 794 237	7 036 475 7 039 679	Mixed <i>Acacia</i> shrubland, including <i>Acacia quadrimarginea</i> and <i>Acacia grasbyi</i> , on very rocky, clay soils.
WW11	793 773	7 037 267	Tall, very dense Mulga (<i>Acacia aneura</i>) woodland over an extremely dense, mixed shrubland on deep sandy, clay soils.
WW12	793 820	7 038 217	Tall, dense Mulga (<i>Acacia aneura</i> – broad leaf) woodland over <i>Eremophila</i> species on sandy, clay soils.
WW13-3	794 275	7 042 475	Mulga (<i>Acacia aneura</i>) woodland with emergent Gidgee (<i>Acacia pruinocarpa</i>) over mixed <i>Acacia</i> species over mixed shrubs over chenopods and sparse grasses on red clay with ironstone detritus.

A team of three personnel was used to efficiently carry out the survey. One person was responsible for clearing of traplines, identification, marking and safe release of animals. The second team member conducted systematic bird sampling which was carried out concurrently with trapline monitoring. The third team member assisted with trapline and/or bird sampling when required.

While the methods employed during both surveys were no different, they have been described in this current document for ease of reference.

3.1.1 Birds

As described in Ninox Wildlife Consulting (2005) the plant community surrounding each trapline was searched thoroughly in order to record all birds utilising the habitat. An experienced observer moved slowly through each habitat for approximately 45 minutes each day, identifying and counting all bird species seen and heard. Recording took place during the peak bird activity period between 6am and midday. Sampling times in the various locations were rotated to minimise variations in weather and the peak activity periods of birds. The resulting data has allowed for some comparisons to be made between the various habitats.

While systematically monitoring a site over a set number of days, it is inevitable that some birds will be recorded on several occasions. Examples are highly territorial birds such as Fairy-wrens, inquisitive species such as Grey Fantails which sometimes follow the observer, nesting birds or flocking species such as cockatoos and Tree Martins which may remain in a localised area for an extended period. This over-recording unavoidably results in an exaggerated figure of relative abundance for some species. To overcome this difficulty, the daily data from the seven sites were scanned to ascertain the specific day when the highest number of individuals for each species in every site was recorded. The total for this day was selected as being a reliable index of the relative abundance of birds on a site-by-site basis.



Plate 1
Sampling Site WW07A



Plate 2
Sampling Site WW07B



Plate 3
Sampling Site WW08



Plate 4
Sampling Site WW09



Plate 5
Sampling Site WW10A



Plate 6
Sampling Site WW10B



Plate 7
Sampling Site WW1



Plate 8
Sampling Site WW12



Plate 9
Sampling Site WW13-3



Plate 10
Sampling Site WW13-3 in November 2005

3.1.2 *Mammals, Amphibians and Reptiles*

Experience throughout Western Australia has shown that without sampling in several seasons and over several years, compiling a complete inventory of small mammals, amphibians and reptiles is not possible. However, there are a range of procedures used to maximise capture rates in the shorter term and several current techniques were used as described below.

Within most sites a mammal, amphibian and reptile trapline was established which consisted of ten pitfall traps (15 litre plastic drums) bisected across the top by 10 metres of flywire drift fence 300mm high. A sloping, plastic funnel was placed at the top of the trap leaving a central 150mm gap through which animals could fall (Plate 11). These funnels helped to retain animals within the trap. The traps were arranged in a single line of 10 traps or as two lines of five traps each depending on the landscape. Surface traps in each site consisted of ten medium Elliott box traps and four cage traps which were placed in association with the pitfall traps. Four additional 10 metre fence lines in each sampling location included two flywire funnel traps each. In the extremely rocky areas (WW07A and B), it was not possible to use pitfall traps, therefore only Elliott, cage and funnel traps were used. These traps were placed in crevices in the rock or under shrubs. Traplines were monitored over six consecutive nights and were checked each morning. An AMG grid reference was recorded at each sampling location using a GPS unit to enable trapline positions to be accurately mapped. At the end of the sampling period all traps were removed.



Plate 11
Pitfall trap including funnel

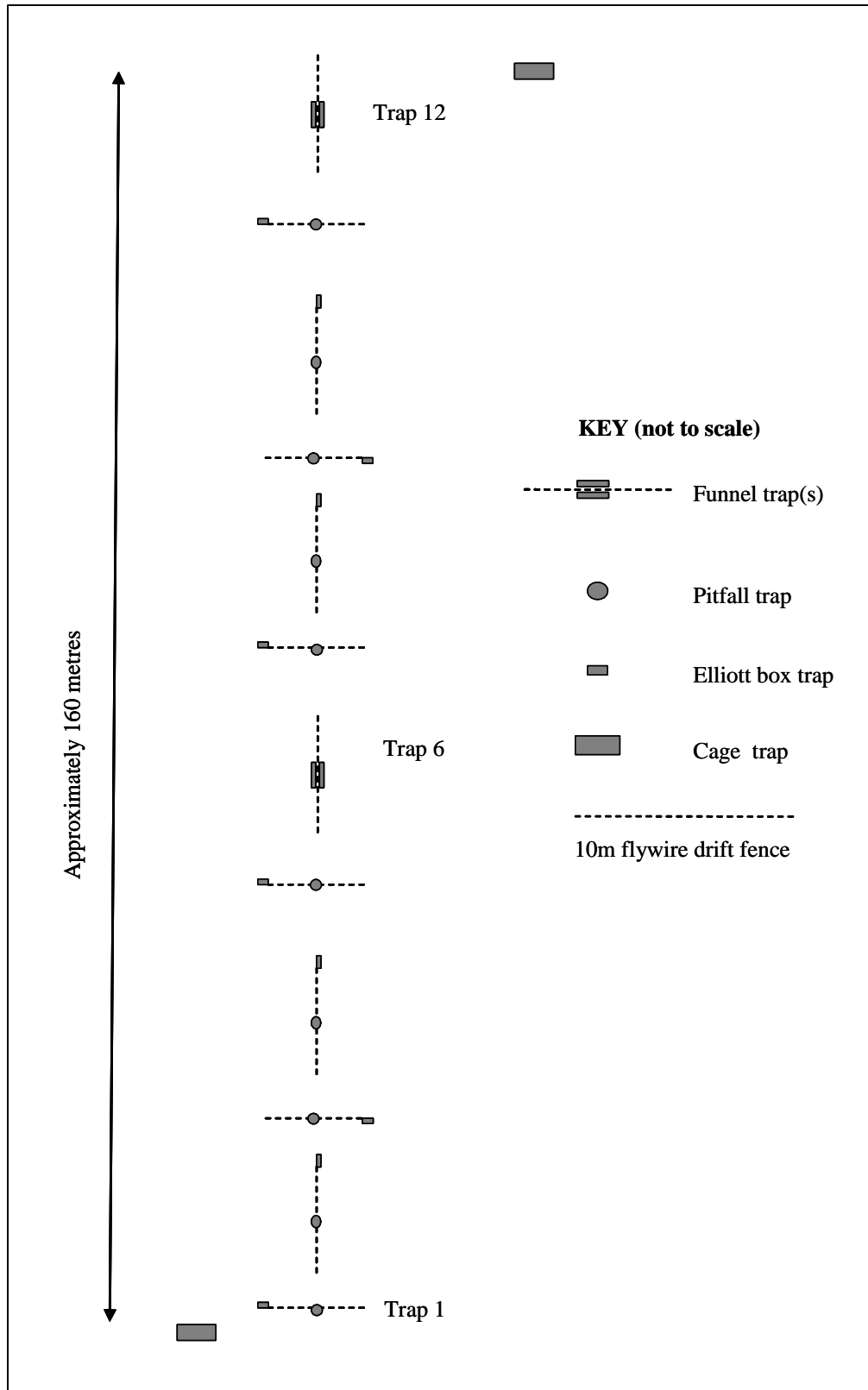


Figure 1 Diagrammatic layout of traplines used in the vertebrate fauna survey of the Wiluna West Survey Area #2 in October 2006.

Bats were sampled using an automatic bat-trap placed where a concentrating effect occurred within a narrow creekline.

Captured animals were identified and details were recorded on field data sheets. The animals were then released near their point of capture. All small mammals captured were marked by a fur-clip on the rump prior to release to indicate a recaptured animal when subsequently trapped.

3.2 Study Team

Jan Henry - a principal of Ninox Wildlife Consulting since 1981, provides expertise in fauna surveys to mining and development companies, government departments and broad-based natural resource consultants and engineers. Prior to forming Ninox she spent 17 years in the Western Australian Museum (WAM) mammal department, specialising in identification, taxonomy, cataloguing, data entry, analysis of research data and public liaison. Field work included fauna surveys in the WA Wheatbelt, Eastern Goldfields, Pilbara and Kimberley. Since forming Ninox she has undertaken extensive fauna survey work, particularly in the Pilbara, Goldfields and south-west forests. Other long-term studies have involved monitoring of fauna colonisation of rehabilitation areas, assessing rare fauna within mining and other development sites and completing management plans for vertebrate fauna in various bushland remnants.

Maureen Francesconi - a specialist in ornithology, Maureen has sub-contracted to Ninox Wildlife Consulting since 1992. Maureen is also a principal of Aquila Wildlife Surveys, providing expertise to other fauna consultants when skilled and reliable bird surveys are required. These surveys have been undertaken throughout Western Australia, particularly in the Kimberley, Pilbara, Goldfields and South-west. Although specialising in bird surveys, over the last 14 years Maureen has developed a thorough expertise in reptile and mammal identification.

Kevin Fairbairn - a specialist in ornithology, Kevin has sub-contracted to Ninox Wildlife Consulting since 1994. Kevin is also a principal of Ariel Wildlife Services, providing expertise to other fauna consultants when skilled and reliable bird surveys are required. These surveys have been undertaken throughout Western Australia, particularly in the Kimberley, Goldfields and South-west. Although specialising in bird surveys, over the last 12 years Kevin has developed a thorough expertise in reptile and mammal identification.

3.3 Study Limitations

The assessment described above was based on an extensive literature and data search covering the general area and a single season (spring) field survey. Weather conditions at the time of the survey were warm to hot but with relatively cool nights.

Rainfall between 2003 and 2005 to mid-November (when the initial survey was conducted) was very low, negatively affecting vertebrate fauna population levels. However, the rainfall between January and September 2006 increased dramatically, mainly between January and March (337.5 mm). A summary of rainfall data for the Wiluna area has been graphed below (Figure 2). Data was extracted from Bureau of Meteorology records (www.bom.gov.au). Data for this current year is obviously incomplete but the graph shows the rainfall prior to the commencement of the second field survey in October 2006.

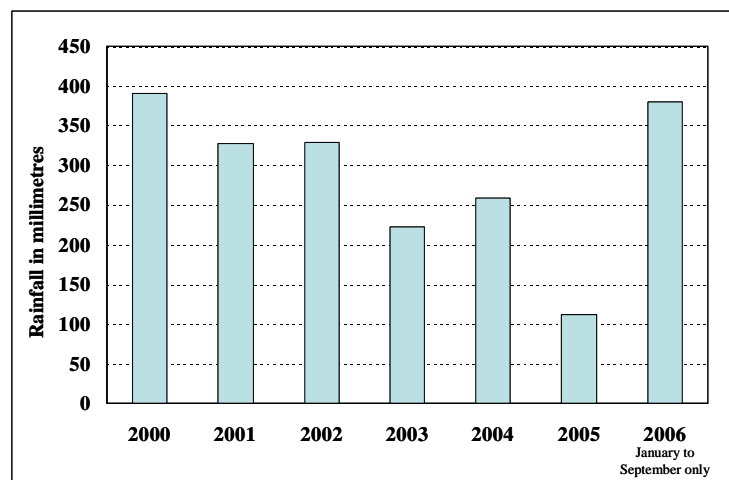


Figure 2 Summary of rainfall data for the Wiluna area between January 2000 and September 2006.

This graph shows that since 2000, rainfall in the Wiluna area has been steadily reducing with 2005 rainfall to mid-November being particularly low. However, the 2006 rainfall to date has been substantial and will have had a profound effect on the results of this current survey.

3.4 Nomenclature, Taxonomy and Distribution Patterns

The nomenclature used in this report follows the WAM checklist except where errors occur in the WAM list. The following literature sources have been used to discuss historical and current fauna distribution patterns and other relevant details used in this report:

- Birds:** Barrett *et al.* (2003); Johnstone and Storr (1998 and 2004).
Mammals: Strahan (1998). **Bats:** Churchill (1998)
Amphibians: Tyler *et al.* (2000).
Reptiles: Cogger (1992); Storr *et al.* (1983); Storr *et al.* (1990); Storr *et al.* (1999); Storr *et al.* (2002); Wilson and Swan (2003).

4 RESULTS AND DISCUSSION

A total of 52 species of bird, nine extant native mammal species and 17 reptile species were recorded during the survey. Signs of an additional species of extinct native mammal were also noted. The results for each faunal group are discussed in detail in the following Sections.

4.1 Birds

A total of 52 species of bird were recorded during the survey (Table 3). Of these, 47 species were recorded during systematic sampling of the seven sites and the resulting data have been used in comparisons of species richness and abundance of individuals between habitats. The remaining four species were recorded opportunistically in locations away from these sites or when travelling between sites. Two birds of particular conservation significance were recorded during the survey: the Malleefowl and Peregrine Falcon. These birds are discussed in detail in Section 4.6 along with other significant species that could potentially occur in the general area.

Table 3 List of bird species recorded during the October 2006 survey of the Wiluna West Survey Area #2. (OP – opportunistic recordings only.)

BIRD SPECIES	SITE CODE	WW 07	WW 08	WW 09	WW 10	WW 11	WW 12	WW 13-3	O P
CASUARIIDAE									
<i>Dromaius novaehollandiae</i>	Emu					1			
MEGAPODIIDAE									
<i>Leipoa ocellata</i>	Malleefowl								X
ACCIPITRIDAE									
<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk					1			
<i>Aquila audax</i>	Wedge-tailed Eagle		1						
FALCONIDAE									
<i>Falco berigora</i>	Brown Falcon							1	X
<i>Falco cenchroides</i>	Australian Kestrel				1				
<i>Falco peregrinus</i>	Peregrine Falcon								X
TURNICIDAE									
<i>Turnix velox</i>	Little Button-quail				2		1	2	
COLUMBIDAE									
<i>Phaps chalcoptera</i>	Common Bronzewing		2				2	1	
<i>Ocyphaps lophotes</i>	Crested Pigeon			2	2	1			
<i>Geopelia cuneata</i>	Diamond Dove		3	2	2		1	2	
PSITTACIDAE									
<i>Cacatua roseicapilla</i>	Galah		2	3					
<i>Platycercus zonarius</i>	Australian Ringneck			2				3	
<i>Platycercus varius</i>	Mulga Parrot					1			
<i>Neophema bourkii</i>	Bourke's Parrot								X
<i>Melopsittacus undulatus</i>	Budgerigar	6	10		20	3	25	30	
CUCULIDAE									
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo	1		1					
AEGOTHELIDAE									
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar				1				
HALCYONIDAE									
<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher								X

BIRD SPECIES	SITE CODE	WW 07	WW 08	WW 09	WW 10	WW 11	WW 12	WW 13-3	O P
MALURIDAE									
<i>Malurus splendens</i>	Splendid Fairy-wren		4	2	6	4	8	4	
ACATHIZIDAE									
<i>Pyrrholaemus brunneus</i>	Redthroat		1	2	2	2	2	2	
<i>Smicrornis brevirostris</i>	Weebill			4					
<i>Acanthiza apicalis</i>	Broad-tailed Thornbill		7	1		2	2	3	
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill				5	1	4		
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	4	13	3	4	8	8	5	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill					2			
<i>Aphelocephala leucopis</i>	Southern Whiteface						2	2	
MELIPHAGIDAE									
<i>Lichenostomus virescens</i>	Singing Honeyeater		1	1	2	2	2	2	
<i>Manorina flavigula</i>	Yellow-throated Miner		5	2		1			
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater		2	2	2	1	2	4	
PETROICIDAE									
<i>Petroica goodenovii</i>	Red-capped Robin				1	1			
<i>Petroica cucullata</i>	Hooded Robin	1							
POMATOSTOMIDAE									
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler			4	2		3	5	
<i>Pomatostomus superciliosus</i>	White-browed Babbler	1			2	6	7		
CINCLOSOMATIDAE									
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush				1		1	2	
PACHYCEPHALIDAE									
<i>Oreoica gutturalis</i>	Crested Bellbird		2	2	2	2	2	2	
<i>Pachycephala rufiventris</i>	Rufous Whistler	2	1	1	2	2	1	2	
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	2	2	2	1	2	1	1	
DICRURIDAE									
<i>Rhipidura leucophrys</i>	Willie Wagtail	1	1	1	2	1	1	1	
CAMPEPHAGIDAE									
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			1	2			1	
<i>Coracina maxima</i>	Ground Cuckoo-shrike		2						
<i>Lalage tricolor</i>	White-winged Triller				2				
ARTAMIDAE									
<i>Artamus personatus</i>	Masked Woodswallow								X
<i>Artamus minor</i>	Little Woodswallow	1							X
CRACTICIDAE									
<i>Cracticus torquatus</i>	Grey Butcherbird		1	1	1	2	2		
<i>Cracticus nigrogularis</i>	Pied Butcherbird		1	1	1	1		1	
CORVIDAE									
<i>Corvus orru</i>	Torresian Crow						2		
<i>Corvus bennetti</i>	Little Crow			1					
PTILONORHYNCHIDAE									
<i>Ptilonorhynchus maculatus</i>	Western Bowerbird					2			
HIRUNDINIDAE									
<i>Cheramoeca leucosternum</i>	White-backed Swallow	1							
<i>Hirundo neoxena</i>	Welcome Swallow				2				
PASSERIDAE									
<i>Taeniopygia guttata</i>	Zebra Finch		2	4	8			6	
	Total Number of Species (52)	10	20	23	26	23	21	22	7
	Number of Individuals	20	63	45	78	49	79	82	

It can be seen from Table 3 that no site had greater than 51% of the total number of species observed during systematic sampling, with site WW10 having the highest species richness with 26 species. Five sites had between 20 and 23 species, while one site, the top of the rocky ridge (WW07), had only 10 species. These data have been graphed in Figure 3a.

Only four species were recorded in all sites although another four species were recorded in six of the seven sites, the exception being the relatively exposed top of the rocky ridge (WW07). These latter species were, however, recorded in site WW08 which was also situated on the top of the ridge but had more dense vegetation and was therefore more sheltered. Seventeen species of bird were recorded in single sites only, with many having only one individual sighted (Table 3).

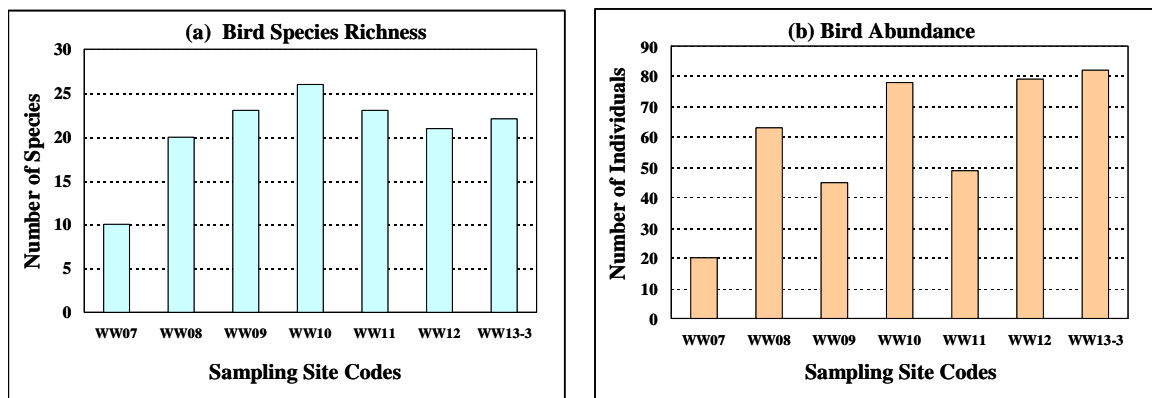


Figure 3 Graph showing the (a) bird species richness and (b) abundance of individual birds within the systematic sampling sites at the Wiluna West Survey Area #2 during October 2006.

Figures 3a and 3b shows that while the species richness was relatively high in all sites except WW07, the abundance of individuals was high in only three sites (WW10, WW12 and WW13-3). This latter site had changed since the November 2005 survey when a total of 15 species and 38 individuals were recorded; 22 species and 82 individuals were recorded during this current survey. The flowering, seed set and growth of annuals in this habitat following the cyclonic rainfall events of summer 2006 almost certainly increased the diversity and abundance of birds in the general area (see Plates 9 and 10).

The combined results from the two surveys in the Wiluna West Project Area now stands at 60 bird species with 21 species being added to the area inventory in this October 2006 survey. Based on the search of various databases and literature, a further 40 species of bird are known to occur in the general area and many of these could be expected to occur either as resident or seasonal visitors (Appendix 1a) when favourable environmental conditions occur. Additional vagrant species could be observed particularly when unusual weather patterns prevail. These latter species have not been listed in Appendix 1a.

Table 4 List of bird species recorded during the November 2005 and October 2006 surveys of the Wiluna West Project Area.

BIRD SPECIES		11/05	10/06
<i>Dromaius novaehollandiae</i>	Emu	X	X
<i>Leipoa ocellata</i>	Malleefowl		X
<i>Hamirostra melanosternum</i>	Black-breasted Buzzard	X	
<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk	X	X
<i>Aquila audax</i>	Wedge-tailed Eagle		X
<i>Falco berigora</i>	Brown Falcon		X
<i>Falco cenchroides</i>	Australian Kestrel	X	X
<i>Falco peregrinus</i>	Peregrine Falcon		X
<i>Turnix velox</i>	Little Button-quail		X
<i>Ardeotis australis</i>	Australian Bustard	X	X
<i>Phaps chalcoptera</i>	Common Bronzewing	X	X
<i>Ocyphaps lophotes</i>	Crested Pigeon	X	X
<i>Geopelia cuneata</i>	Diamond Dove		X
<i>Cacatua roseicapilla</i>	Galah	X	X
<i>Platycercus zonarius</i>	Australian Ringneck	X	X
<i>Platycercus varius</i>	Mulga Parrot	X	X
<i>Melopsittacus undulatus</i>	Budgerigar		X
<i>Neophema bourkii</i>	Bourke's Parrot		X
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo		X
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar		X
<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher		X
<i>Malurus splendens</i>	Splendid Fairy-wren	X	X
<i>Pyrrholaemus brunneus</i>	Redthroat	X	X
<i>Smicrornis brevirostris</i>	Weebill		X
<i>Acanthiza apicalis</i>	Broad-tailed Thornbill	X	X
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill	X	X
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	X	X
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	X	X
<i>Aphelocephala leucopis</i>	Southern Whiteface		X
<i>Lichenostomus virescens</i>	Singing Honeyeater	X	X
<i>Manorina flavigula</i>	Yellow-throated Miner	X	X
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	X	X
<i>Petroica goodenovii</i>	Red-capped Robin	X	X
<i>Petroica cucullata</i>	Hooded Robin		X
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	X	X
<i>Pomatostomus superciliosus</i>	White-browed Babbler		X
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush	X	X
<i>Daphoenisitta chrysoptera</i>	Varied Sittella	X	
<i>Oreoica gutturalis</i>	Crested Bellbird	X	X
<i>Pachycephala rufiventris</i>	Rufous Whistler	X	X
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	X	X
<i>Rhipidura leucophrys</i>	Willie Wagtail	X	X
<i>Grallina cyanoleuca</i>	Magpie-lark	X	
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	X	X
<i>Coracina maxima</i>	Ground Cuckoo-shrike		X
<i>Lalage tricolor</i>	White-winged Triller		X
<i>Artamus personatus</i>	Masked Woodswallow		X
<i>Artamus cinereus</i>	Black-faced Woodswallow	X	
<i>Artamus minor</i>	Little Woodswallow	X	X
<i>Cracticus torquatus</i>	Grey Butcherbird	X	X
<i>Cracticus nigrogularis</i>	Pied Butcherbird	X	X
<i>Strepera versicolor</i>	Grey Currawong	X	

BIRD SPECIES		11/05	10/06
<i>Corvus orru</i>	Torresian Crow	X	X
<i>Corvus bennetti</i>	Little Crow		X
<i>Ptilonorhynchus maculatus</i>	Western Bowerbird	X	X
<i>Cheramoeca leucosternum</i>	White-backed Swallow		X
<i>Hirundo neoxena</i>	Welcome Swallow	X	X
<i>Dicaeum hirundinaceum</i>	Mistletoebird	X	
<i>Taeniopygia guttata</i>	Zebra Finch		X
<i>Anthus australis</i>	Australian Pipit	X	
	Number of Species	39	52
		60	

While the 39 species recorded during November 2005 was relatively low, the current species total of 60 is similar to that known from areas such as Wanjarri where 55 species were recorded over three seasons between 1979 and 1981 (McKenzie *et al.* 1994) and 55 species were recorded during an ecological survey conducted by Hart, Simpson and Associates Pty Ltd (HSA) (1999) approximately 30 km west of Wiluna. A detailed discussion of this regional aspect was included in Ninox Wildlife Consulting (2005) and has not been repeated here.

4.2 Native Mammals

Nine species of native mammal were recorded during this survey (Table 5). Two of the most rocky sites (WW08 and WW10) had a similar diversity of species with six and five species respectively. Although site WW07 had only two species recorded, it was the only site where Woolley's Pseudantechinus (*Pseudantechinus woolleyae*) was captured. This animal had six pouch joeys at the unfurred stage of development. The lowest number of species was a relatively degraded creekline where no small native mammals were captured but signs of kangaroo were noted.

Of particular interest was the large number of native rodents captured during this survey. The Sandy Inland Mouse (*Pseudomys hermannsburgensis*) was particularly abundant, mainly in sites WW08, WW12 and WW13-3 (Table 4). The Spinifex Hopping Mouse (*Notomys alexis*) was also abundant particularly in one site (WW12) where 17 individuals were captured. This is a notable change from the November 2005 results when no native rodents were captured. A small number of the females of each rodent species were obviously pregnant.

Table 5 List of native mammal species recorded during the October 2006 survey of the Wiluna West Survey Area #2. (OP – opportunistic recordings only; S – Signs only e.g. scats, tracks, diggings [counted as one individual].)

NATIVE MAMMALS	SITE CODES	WW 07	WW 08	WW 09	WW 10	WW 11	WW 12	WW 13-3	OP
TACHYGLOSSIDAE									
<i>Tachyglossus aculeatus</i>	Echidna	S	S		S				
DASYURIDAE									
<i>Ningauai ridei</i>	Wongai Ningauai		2						
<i>Pseudantechinus woolleyae</i>	Woolley's Antechinus	1							
<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart						1		

NATIVE MAMMALS	SITE CODES	WW 07	WW 08	WW 09	WW 10	WW 11	WW 12	WW 13-3	OP
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart				1	2	1		
MACROPODIDAE									
<i>Macropus robustus</i>	Euro		1		1				
<i>Macropus sp.</i>	Unidentified Kangaroo		S	S	S	S		S	
VESPERTILIONIDAE									
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat								X
MURIDAE									
<i>Notomys alexis</i>	Spinifex Hopping Mouse		2				17		
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse		12		1		9	17	
	Number of Species (9)	2	6	1	5	2	4	2	1
	Number of Individuals	2	19	1	5	3	28	18	

Only a single species of bat: Gould's Wattled Bat (*Chalinolobus gouldii*) was recorded during this current survey (Plate 12). This differed from the species captured in November 2005, the Lesser Long-eared Bat (*Nyctophilus geoffroyi*).

Table 6 shows that there has been a substantial increase in the diversity of native mammals recorded in the Wiluna West Project Area. Five species have been added to the area inventory during the October 2006 survey including two species of small marsupial carnivore (Dasyuridae), two native rodents (Muridae) and one bat (Vespertilionidae). These bring the total number of species known to occur in the Project Area to 11 with a possible 18 additional species (including eight bats) that could also occur (Appendix 1b).

Table 6 List of native mammal species recorded during the November 2005 and October 2006 surveys of the Wiluna West Project Area.

NATIVE MAMMAL SPECIES		11/05	10/06
TACHYGLOSSIDAE			
<i>Tachyglossus aculeatus</i>	Echidna	X	X
DASYURIDAE			
<i>Ningauai ridei</i>	Wongai Ningauai	X	X
<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus		X
<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart		X
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart	X	X
MACROPODIDAE			
<i>Macropus robustus</i>	Euro	X	X
<i>Macropus rufus</i>	Red Kangaroo	X	
VESPERTILIONIDAE			
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	X	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat		X
MURIDAE			
<i>Notomys alexis</i>	Spinifex Hopping-mouse		X
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse		X
	Number of Species	6	9
		11	

Evidence of one species presumed to be extinct on mainland Western Australia was noted: a long-abandoned mound of the small rat-kangaroo, the Burrowing Bettong or Boodie (*Bettongia lesueur*). This mound was located adjacent to the track between sites WW12 and WW13-3. Burbidge (2004) considers that the disappearance of the Burrowing Bettong

from different parts of Australia seems to have coincided with the spread and establishment of the Red Fox (*Vulpes vulpes*).

No small native mammals were captured during a survey approximately 30 km west of Wiluna in spring 1998 (HSA 1999) although Appendix 1b shows that eight small terrestrial species and six species of bat were captured in the Wanjarri Nature Reserve between 1979 and 1981 (McKenzie *et al.* 1994). Three additional, larger species were also recorded in this latter survey. The species accumulation curve graphed for the capture of small, ground-dwelling mammals shown in McKenzie *et al.* (1994) shows that only five species were captured in summer 1979, three species were added to the area inventory in autumn 1980 and no native mammal was added in winter 1981. Only the introduced House Mouse was added in this final trip.



Plate 12
Gould's Wattled Bat (*Chalinolobus gouldii*)

No native mammal of particular conservation significance was recorded during this recent survey although two species could potentially occur (Appendix 1b). These mammals are discussed in Section 4.6.

4.3 Amphibians

No frogs were recorded during this survey although one, the Desert Tree Frog (*Litoria rubella*) was observed in camp during the November 2005 survey. Three species of frog were recorded during the McKenzie *et al.* (1994) survey of the Wanjarri Nature Reserve between 1979 and 1981, but none was recorded during the 1998 survey conducted by HSA (1999) 30 km west of Wiluna. Given favourable conditions, an additional eight species could occur in various habitats within the Wiluna West Survey Area (Appendix 1c). None of these are of particular conservation significance. Confirmation of the presence of most of these species will only occur following rainfall which is sufficient to promote breeding.

Until that time, these frogs survive in underground burrows, usually surrounded by a secreted cocoon to retard water loss.

4.4 Reptiles

Eighteen species of reptile were captured or observed during the October 2006 survey of the Wiluna West Survey Area #2 (Table 6). These comprised six geckos, three dragons, four skinks, two monitors, one blind snake and two elapid (venomous) snakes.

A maximum of six species was recorded from site WW09 and a low of three species from site WW12. No reptiles were captured from site WW07 although this is more likely an artefact of the lack of pitfall traps than for any other reason.

Reptiles were not abundant and in many cases single individuals were captured in only one site (Table 6). In all, seven of the 18 species were represented by only one individual in the systematic sites. The small skink *Lerista muelleri* was the most abundant reptile with 13 individuals captured. However, it was noted that many of the reptiles, geckos in particular, were in extremely good condition, with very fat tails (see Plate 13).



Plate 13
The gecko *Diplodactylus pulcher*

Table 6 List of reptile species recorded during the October 2006 survey of the Wiluna West Survey Area. (OP – opportunistic recordings only; S – Signs only e.g. tracks, diggings [counted as one individual].)

REPTILE SPECIES		WW 07	WW 08	WW 09	WW 10	WW 11	WW 12	WW 13-3	OP
AGAMIDAE	Dragons								
<i>Caimanops amphiboluroides</i>								2	
<i>Ctenophorus caudicinctus</i>					2			1	
<i>Pogona minor</i>									X
GEKKONIDAE	Geckos								
<i>Diplodactylus granariensis</i>			2		1	3			
<i>Diplodactylus pulcher</i>							3		
<i>Diplodactylus squarrosus</i>			1						
<i>Nephrurus wheeleri</i>									X
<i>Gehyra variegata</i>						1			
<i>Heteronotia binoei</i>			1	2					
SCINCIDAE	Skinks								
<i>Cryptoblepharus plagiocephalus</i>				1					
<i>Ctenotus schomburgkii</i>				1					
<i>Lerista muelleri</i>			3	4		4	2		
<i>Menetia greyii</i>			1	2		4			
VARANIDAE	Monitors								
<i>Varanus caudolineatus</i>					1		1	1	
<i>Varanus panoptes</i>									X
<i>Varanus sp.</i>					S			S	
TYPHLOPIDAE	Blind Snakes								
<i>Ramphotyphlops hamatus</i>								1	
ELAPIDAE	Venomous Snakes								
<i>Pseudonaja modesta</i>						1			
<i>Parasuta monachus</i>				1					
	Number of Species	-	5	6	4	5	3	5	3
	Number of Individuals	-	8	11	5	13	6	6	

Although the capture rate of reptiles during this current survey was relatively low, it greatly exceeded the results from November 2005. Eleven species were added to the area inventory (Table 7) and the abundance of individuals was up by 88% (26 in 2005 as against 49 in 2006).

Table 7 List of frog and reptile species recorded during the November 2005 and October 2006 surveys of the Wiluna West Project Area.

REPTILE SPECIES		11/05	10/06
HYLIDAE	Frogs		
<i>Litoria rubella</i>		X	
GEKKONIDAE	Geckos		
<i>Diplodactylus granariensis</i>			X
<i>Diplodactylus pulcher</i>			X
<i>Diplodactylus squarrosus</i>			X
<i>Diplodactylus ? squarrosus</i>		X	
<i>Nephrurus wheeleri</i>		X	X
<i>Strophurus wellingtonae</i>		X	

REPTILE SPECIES		11/05	10/06
<i>Gehyra variegata</i>		X	X
<i>Heteronotia binoei</i>		X	X
AGAMIDAE	Dragons		
<i>Caimanops amphiboluroides</i>			X
<i>Ctenophorus audicinctus</i>		X	X
<i>Pogona minor</i>			X
SCINCIDAE	Skinks		
<i>Cryptoblepharus plagiocephalus</i>			X
<i>Ctenotus schomburgkii</i>			X
<i>Lerista muelleri</i>		X	X
<i>Menetia greyii</i>		X	X
VARANIDAE	Monitors		
<i>Varanus caudolineatus</i>			X
<i>Varanus panoptes</i>		X	X
TYPHLOPIDAE	Blind Snakes		
<i>Ramphotyphlops hamatus</i>			X
ELAPIDAE	Venomous Snakes		
<i>Pseudonaja modesta</i>			X
<i>Parasuta monachus</i>			X
<i>Simoselaps bertholdi</i>		X	
Number of Species		11	18
		1 frog+ 21 reptiles	

Appendix 1c shows that an additional 69 species are known to occur in the general area. Many of these could potentially occur within the Wiluna West Project Area although a range of species that prefers spinifex on sand are most unlikely to be present in Survey Area #2 as this habitat is not present. While all of the species listed on Appendix 1c have geographic ranges that cover the general area around Wiluna, it is unlikely that all of them will be present in the current study area. However, as the distribution of many species is patchy even within their preferred habitats, it is not possible to predict exactly which species will be present given further sampling, especially after continued favourable weather conditions and increases in population levels.

When compared to other studies in the general area, the results from the two surveys were unexceptional. For example, HSA (1999) recorded 25 species of reptile in their spring 1998 survey 30 km west of Wiluna and McKenzie *et al.* (1994) recorded 36 species over the three years they sampled the Wanjarri Nature Reserve (Appendix 1c). Thirty-one of these species were recorded in the first sampling session (summer 1979) with three species being added in the autumn 1980 survey and two species being added in the final winter 1981 survey. Some of the species recorded by McKenzie *et al.* (1994) are known to inhabit the red sandplains and dunefields that are more common east of Wiluna. None of this type of habitat occurs in the Wiluna West Survey Area; therefore, there are a number of reptiles listed in Appendix 1c that are highly speculative. This includes the one reptile that is of conservation significance and this animal is discussed in more detail in Section 4.6.

4.5 Introduced Fauna

Only one introduced mammal was captured, the House Mouse (*Mus musculus*), all others were noted and identified from tracks or scats (Table 8). None of these introduced mammals appeared to be common. It is likely that four additional stock or introduced animals could occur in Survey Area #2 from time to time: the Horse (*Equus caballus*); Sheep (*Ovis aries*); Goat (*Capra hircus*) and Fox (*Vulpes vulpes*). Appendix 1d shows that three introduced species were recorded during the HSA (1999) survey 30 km west of Wiluna and five species were recorded during the McKenzie *et al.* (1994) survey of Wanjarri Nature Reserve.

Table 8 *List of introduced species recorded during the October 2006 survey of Wiluna West Survey Area #2. (OP – opportunistic recordings only; S – Signs only e.g. tracks, diggings [counted as one individual].)*

	SITE CODES	WW 07	WW 08	WW 09	WW 10	WW 11	WW 12	WW 13-3	OP
INTRODUCED MAMMALS									
MURIDAE									
<i>Mus musculus</i>	House Mouse			22	1	6		2	
LEPORIDAE									
<i>Oryctolagus cuniculus</i>	Rabbit						S	S	
CANIDAE									
<i>Canis lupus familiaris/dingo</i> *	Feral Dog/Dingo		S						

* Dogs in close proximity to towns such as Wiluna are almost certainly feral Dog/Dingo crosses.

Table 9 shows the introduced species recorded during each of the two years of sampling at the Wiluna West Project Area. No additional species were recorded during this recent survey.

Table 9 *List of introduced species recorded during the November 2005 and October 2006 surveys of the Wiluna West Project Area.*

INTRODUCED MAMMALS		11/05	10/06
MURIDAE			
<i>Mus musculus</i>	House Mouse	X	X
LEPORIDAE			
<i>Oryctolagus cuniculus</i>	Rabbit	X	X
CANIDAE			
<i>Canis lupus familiaris/dingo</i>	Feral Dog/Dingo	X	X
FELIDAE			
<i>Felis catus</i>	Feral Cat	X	
CAMELIDAE			
<i>Camelus dromedarius</i>	One-humped Camel	X	
BOVIDAE			
<i>Bos taurus</i>	Cattle	X	
	Number of Species	6	3
		6	

4.6 Species of Conservation Significance

4.6.1 Commonwealth and Western Australia

One bird, one mammal and one reptile listed on Appendix 1a to 1c are listed under both the EPBC Act (1999) and the WC Act (1950). One additional bird is listed on the WC Act (1950). These species are discussed below with an assessment of their potential occurrence within the Wiluna West Survey Area #2.

- Malleefowl (*Leipoa ocellata*): this bird builds very large mounds in which its eggs are incubated and these persist for many years. While no evidence was found during the survey that Malleefowl have been present and breeding in Survey Area #2 in recent times, fresh footprints were noted just west of the current survey area. Further survey work planned in the Wiluna West Project Area will allow for a more detailed assessment of the distribution of this bird and for management recommendations to be formulated.
- Mulgara (*Dasyercus cristicauda*): a small carnivorous marsupial that prefers spinifex, generally on red sand, a habitat that is not present in Survey Area #2. While not captured during the 1979 to 1981 surveys (McKenzie *et al.* 1994) it has subsequently been recorded from Wanjarri Nature Reserve. It appears that some populations of Mulgaras undergo population fluctuations (Woolley 1998) and may not be found in locations where they had previously occurred. Mulgaras have been located on various mine sites in the north-eastern goldfields and a number of management plans, mainly habitat protection, have been put in place at these mines. Given the very low possibility that this animal occurs in Survey Area #2, no impact is predicted during development of a mine and its infrastructure.
- Great Desert Skink (*Egernia kintorei*): the nearest known record of this species is from Wanjarri (Storr *et al.* 1999) approximately 100 km south of the Wiluna West Project Area. The favoured habitat of this large skink is spinifex sandplain with scattered shrubs (McAlpin 2001). As discussed above, there is no spinifex in the Wiluna West Survey Area #2, therefore it is most unlikely that this skink will be present. As a result, no impact is predicted during development of a mine and its infrastructure.
- Peregrine Falcon (*Falco peregrinus*): listed as Other Specially Protected Fauna on the Western Australian WC Act (1950), this bird of prey was observed flying over camp during the October 2006 survey. The extensive rocky outcropping within the Wiluna West Survey Area #2 may provide suitable roosting and nesting sites for this bird. It is likely that there will be a loss of roosting and/or nesting sites following development of a mine in the rocky ridges of Survey Area #2. However, Peregrine Falcons may often be observed using the artificial cliff-faces of abandoned open-cut mines for both nesting and roosting (personal observations). Therefore, in the Western Australian goldfields, it may have been benefited in recent years as long as its food resources are also present.

4.6.2 JAMBA/CAMBA

Two birds listed on either JAMBA or CAMBA or both, could be observed occasionally in Wiluna West Survey Area #2.

- Rainbow Bee-eater (*Merops ornatus*): listed on JAMBA, this bird may be present seasonally but is unlikely to breed in the Wiluna area. Known breeding areas include the Kimberley and south-west of Western Australia (Johnstone and Storr 1998). Unlikely to be affected by development of a mine and its infrastructure.
- Fork-tailed Swift (*Apus pacificus*): this bird rarely lands in Australia but may be seen overhead, often flying ahead of storm fronts. Unlikely to be affected by development of a mine and its infrastructure.

4.6.3 CALM Priority Species

Four birds and one marsupial are listed as P4 on CALM's Priority Fauna list and have been recorded, or could occur, within the habitats assessed during this survey (Appendix 1a and b).

- Australian Bustard (*Ardeotis australis*): this bird was recorded during the November 2005 survey but not this current survey (Table 4). Given the largely nomadic habitats of this bird, it is likely to occur in many of the habitats within Wiluna West Survey Area #2 at some time. It prefers open or lightly wooded country, including sandplains with spinifex (Johnstone and Storr 1998). Its distribution takes in much of the State, excluding the heavily wooded areas in the South-west and as a result, the loss of some habitat within the Wiluna West Project Area is unlikely to have a detrimental affect on this species.
- Bush Stone-curlew (*Burhinus grallarius*): this mainly nocturnal bird is distributed over much of the western and northern part of the State; like the Australian Bustard, it prefers lightly wooded country but requires thickets or long grass for daytime shelter (Johnstone and Storr 1998). Not recorded during either the November 2005 or October 2006 surveys in the Wiluna West Project Area. The loss of some habitat within the area surveyed to date is unlikely to have a detrimental affect on this species.
- Striated Grasswren (*Amytornis striatus*): the nominate race of this bird is known mainly from the eastern deserts although there is an apparently isolated population between Meekatharra and Wiluna (Johnstone and Storr 2004). The preferred habitat of this small bird is mainly spinifex, with or without a shrub overstorey, bushy *Acacia* shrublands on sandridges and interdunes, usually with spinifex (Johnstone and Storr 2004). This habitat is not present within the Wiluna West Survey Area #2, therefore it is unlikely that this species is present and, as a result, no impact is predicted.
- Long-tailed Dunnart (*Sminthopsis longicaudata*): a specimen of this marsupial was registered in the WAM collection in 2003 from approximately 70 km

north-east of Wiluna. Although more common in the desert areas to the east, the rocky outcrops and scree of the northern goldfields provide habitat for this animal. Therefore, this habitat within Wiluna West Survey Area #2 could potentially support this small mammal. Should this animal occur, there may be some local impact from development of a mine in the rocky and scree habitats within the Project Area. However, given that the core distribution of this animal is to the east, the impact on the species is likely to be minimal.

4.7 Significant Habitats

Based on the results of this October 2006 survey, none of the habitats surveyed appear to have any particular conservation significance.

5 CONCLUSIONS

The results from this current field assessment were relatively good, probably as a result of the previous summer's rainfall (Figure 2) and its effect on habitat condition, food resources and fauna population levels. The diversity of species now known to occur in the Wiluna West Project Area is similar to other areas such as Wanjarri Nature Reserve even though the range of habitats does not include the spinifex on sand that supports a large range of small, terrestrial species.

6 MANAGEMENT RECOMMENDATIONS

6.1 General Recommendations

While a range of general recommendations were given in Ninox Wildlife Consulting (2005) they have been repeated in this current document.

The effect of mine development on fauna can be divided into three primary areas of impact. These are:

- ◆ clearing for exploration grid lines and drill pads;
- ◆ removal of vegetation for mining;
- ◆ changes to drainage patterns and subsequent effects on adjacent vegetation and fauna habitats.

While most birds, larger mammals and reptiles will be able to avoid the impact of clearing for exploration, mining and construction of infrastructure, most small mammals, reptiles and burrowing frogs will be unavoidably killed by the large machinery used for vegetation removal and ground preparation, or by exposure to predators. While the local impact on individual animals is high, the clearing will have very little impact on the species overall. However, exploration drilling and future mining should be carefully managed to avoid unnecessary and widespread damage to fauna habitats through clearing or damage to vegetation where this is not essential for safe operations.

In order to minimise the impact on vertebrate fauna, a series of general recommendations are given below.

- ◆ Avoidance of unnecessary clearing of vegetation beyond that strictly required.
- ◆ Windrows of topsoil, log debris and leaf litter formed during clearing should be retained, as they create extremely good microhabitat for a large range of fauna, particularly reptiles.
- ◆ Rapid rehabilitation of cleared areas such as laydown sites, access tracks and grid lines where these are no longer required.
- ◆ All subcontracting teams are adequately briefed and made aware of the environmental constraints imposed on the project and themselves.
- ◆ Firearms, trail bikes and pets should be excluded from the Project Area.
- ◆ Adequate rubbish disposal procedures should be applied, especially for food refuse, in order to discourage scavenging by crows, foxes and feral cats. Large numbers of these animals can have an adverse impact on other fauna.
- ◆ Regular spot-checks for breaches of sound environmental practises are carried out by delegated individuals so that problems can be anticipated or rectified at an early stage.
- ◆ Consideration to preparing a brief handout on sound environmental practices which will be given to all members of subcontracting teams and permanent employees during site induction. The pamphlet should cover relevant aspects defined above.
- ◆ A penalty system for breaches of sound environmental practices is introduced.

6.2 Site Specific Recommendations

Site specific recommendations depend on the method of mining in a particular Project Area. Progressive mining along a shallow, linear ore body requires different rehabilitation techniques to those in an open, ever-deepening pit and associated overburden. In addition, the composition and structure of the overlying vegetation and presence of rare fauna may necessitate more detailed plans for rehabilitation and management techniques.

In addition, safety requirements for the project should include a fire management system to prevent the spread of wildfire through the adjacent country. Many of the points made in Sections 6.1 and 6.2 will assist in the maintenance of a healthy vertebrate fauna population in the country surrounding the mining area. However, some animals, particularly those considered rare, threatened or vulnerable may require particular attention and these are discussed in Section 6.2.2.

If safety procedures allow, and where practical, the following rehabilitation and management procedures should be followed.

- ◆ Rehabilitation should be structured to encourage the return of fauna by providing micro-relief and dense vegetation cover. This may be achieved, particularly in temporary laydown areas, by:

- leaving patches or strips of vegetation;
 - retention of root stock in the ground by shallow scraping during essential temporary clearing; and,
 - retaining stockpiled vegetation debris in windrows. Windrows and flattened vegetation provide substantial microhabitat and increased humidity for small vertebrates. They also provide a trap for windblown seed and protection for seedlings following germination. Placement of windrows across the prevailing wind direction may reduce erosion and facilitate rehabilitation success.
- ◆ A feral predator control program should be implemented, particularly in the vicinity of the messing facilities where food scraps and introduced mice may attract feral cats.

6.2.1 *Management of Vertebrate Fauna*

The results of this second field survey which followed substantial summer rainfall clearly demonstrate the inadequacy of single season surveys, particularly in the arid zone. There was a considerable increase in species recorded in all faunal groups: from 39 to 60 bird species; from six to 11 species of native mammal and from 10 to 21 reptile species. The accumulation of species to the area inventory will continue to increase, especially if cyclonic activity results in significant rainfall this coming summer.

Several authors including Thompson and Thompson (2002) and How (1998) discuss the need for extensive sampling in both temporal and spatial scales in order to more fully document the biodiversity of the fauna of an area. In addition, Cowan and How (2004) conclude that short-term studies infrequently encounter threatened and/or rare ground-dwelling vertebrate fauna species and therefore do not provide adequate information to assist land managers. As a result, a major change in land use requires that the issue of impact on rare, threatened or vulnerable species be addressed as if they are present. In terms of land disturbance such as mining, this invariably relies on the rapid and expert rehabilitation of land following mineral extraction.

As part of the environmental management of the Project Area consideration should be given to monitoring of vertebrate fauna. This should be arranged to gain sufficient data to assess the progress and success of rehabilitation and to monitor the adjacent country for any possible impact from mining on fauna populations. Therefore, permanent fauna sampling sites should be established in association with flora and vegetation monitoring plots. A sampling program should be designed to adequately address any vertebrate fauna issues that may arise during the environmental assessment process and to prepare guidelines for future monitoring. Further baseline sampling to the west of the current survey area is planned for spring 2007 to more fully document the vertebrate fauna of the Wiluna West Project Area and to clarify their habitat use.

7 REFERENCES

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APPENDIX 1a List of bird species recorded and predicted to occur in the habitats of the Wiluna West Project Area during November 2005 and October 2006.

Key

Data Sources

- NX = Recorded during the Ninox survey
 NXP = Ninox personal data from the Wiluna area
 McK = McKenzie *et al.* (1994)
 WAM = WA Museum records
 BA = Birds Australia (including Barrett *et al.* 2003)

Conservation Status - Western Australia

- CR = Critically Endangered under the Wildlife Conservation Act 1950
 VU = Vulnerable under the Wildlife Conservation Act 1950
 OP = Other Specially Protected Fauna under the Wildlife Conservation Act 1950
 P# = Listed under CALM's Priority Fauna list

Conservation Status - Commonwealth

- V = Vulnerable under the EPBC Act 1999
 E = Endangered under the EPBC Act 1999
 J = JAMBA treaty
 C = CAMBA treaty

BIRDS	STATUS	RECORDED				
		NX	NXP	McK	BA	WAM
DROMAIIDAE						
<i>Dromaius novaehollandiae</i>	Emu	X	X	X	X	
MEGAPODIDIDAE						
<i>Leipoa ocellata</i>	Malleefowl	VU/V	X		X	X
ACCIPITRIDAE						
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard		X		X	
<i>Haliastur sphenurus</i>	Whistling Kite			X	X	
<i>Accipiter fasciatus</i>	Brown Goshawk				X	
<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk		X		X	
<i>Hieraaetus morphnoides</i>	Little Eagle				X	
<i>Aquila audax</i>	Wedge-tailed Eagle		X	X	X	X
<i>Circus assimilis</i>	Spotted Harrier				X	X
FALCONIDAE						
<i>Falco berigora</i>	Brown Falcon		X	X	X	X
<i>Falco cenchroides</i>	Australian Kestrel		X		X	X
<i>Falco longipennis</i>	Australian Hobby				X	X
<i>Falco peregrinus</i>	Peregrine Falcon	OP	X		X	
OTIDIDAE						
<i>Ardeotis australis</i>	Australian Bustard	P4	X		X	X
TURNICIDAE						
<i>Turnix velox</i>	Little Button-quail		X			
BURHINIDAE						
<i>Burhinus magnirostris</i>	Bush Stone-curlew	P4			X	X
CHARADRIIDAE						
<i>Vanellus tricolor</i>	Banded Lapwing				X	X
COLUMBIDAE						
<i>Phaps chalcoptera</i>	Common Bronzewing		X	X	X	X
<i>Ocyphaps lophotes</i>	Crested Pigeon		X	X	X	X
<i>Geopelia cuneata</i>	Diamond Dove		X		X	
PSITTACIDAE						
<i>Cacatua roseicapilla</i>	Galah		X	X	X	X
<i>Nymphicus hollandicus</i>	Cockatiel			X	X	
<i>Cacatua sanguinae</i>	Little Corella				X	
<i>Barnardius zonarius</i>	Port Lincoln Ringneck		X	X	X	X

BIRDS		STATUS	RECORDED				
			NX	NXP	McK	BA	WAM
<i>Psephotus varius</i>	Mulga Parrot		X	X	X	X	
<i>Neophema bourkii</i>	Bourke's Parrot		X		X	X	X
<i>Melopsittacus undulatus</i>	Budgerigar		X		X	X	
CUCULIDAE							
<i>Cuculus pallidus</i>	Pallid Cuckoo				X	X	
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo		X			X	
<i>Chrysococcyx basalus</i>	Horsfield's Bronze-Cuckoo				X	X	X
STRIGIDAE							
<i>Ninox novaeseelandiae</i>	Boobook Owl					X	
TYTONIDAE							
<i>Tyto alba</i>	Barn Owl					X	
PODARGIDAE							
<i>Podargus strigoides</i>	Tawny Frogmouth					X	
AEGOTHELIDAE							
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar		X		X		
CAPRIMULGIDAE							
<i>Eurostopodus argus</i>	Spotted Nightjar					X	X
APODIDAE							
<i>Apus pacificus</i>	Fork-tailed Swift	J/C					
ALCEDINIDAE							
<i>Todiramphus pyrropygia</i>	Red-backed Kingfisher		X	X	X	X	
MEROPIDAE							
<i>Merops ornatus</i>	Rainbow Bee-eater	J				X	
CLIMACTERIDAE							
<i>Climacteris affinis</i>	White-browed Treecreeper				X	X	X
MALURIDAE							
<i>Malurus splendens</i>	Splendid Fairy-wren		X	X		X	X
<i>Malurus lamberti</i>	Variiegated Fairy-wren			X		X	X
<i>Malurus leucopterus</i>	White-winged Fairy-wren			X	X	X	
<i>Stipiturus ruficeps</i>	Rufous-crowned Emu-wren						X
<i>Amytornis striatus</i>	Striated Grasswren	P4			X		X
PARDALOTIDAE							
<i>Pardalotus rubricatus</i>	Red-browed Pardalote						X
<i>Pardalotus striatus</i>	Striated Pardalote				X	X	X
ACANTHIZIDAE							
<i>Pyrrholaemus brunneus</i>	Redthroat		X	X			X
<i>Smicrornis brevirostris</i>	Weebill		X		X	X	
<i>Gerygone fusca</i>	Western Gerygone					X	X
<i>Acanthiza apicalis</i>	Broad-tailed Thornbill		X	X		X	X
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill		X	X	X	X	X
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill		X	X	X	X	X
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill		X	X	X	X	X
<i>Aphelocephala leucopsis</i>	Southern Whiteface		X		X	X	X
MELIPHAGIDAE							
<i>Lichmera indistincta</i>	Brown Honeyeater				X	X	
<i>Certhionyx niger</i>	Black Honeyeater					X	
<i>Certhionyx variegatus</i>	Pied Honeyeater				X	X	X
<i>Lichenostomus virescens</i>	Singing Honeyeater		X	X	X	X	X
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater				X		X
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater			X	X	X	X
<i>Phylidonyris albifrons</i>	White-fronted Honeyeater				X	X	
<i>Lacustroica whitei</i>	Grey Honeyeater						
<i>Manorina flavigula</i>	Yellow-throated Miner		X	X	X	X	X
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater		X	X	X	X	X
<i>Ephthianura tricolor</i>	Crimson Chat				X	X	

BIRDS		STATUS	RECORDED				
			NX	NXP	McK	BA	WAM
PETROICIDAE							
<i>Microeca fascinans</i>	Jacky Winter					X	
<i>Petroica goodenovii</i>	Red-capped Robin		X		X	X	
<i>Melanodryas cucullata</i>	Hooded Robin		X		X	X	
POMATOSTOMIDAE							
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler		X	X		X	X
<i>Pomatostomus superciliosus</i>	White-browed Babbler		X	X	X	X	X
CINCLOSOMATIDAE							
<i>Psophodes occidentalis</i>	Western Wedgebill						
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush		X		?X	X	X
NEOSITTIDAE							
<i>Daphoenositta chrysoptera</i>	Varied Sittella		X		X		
PACHYCEPHALIDAE							
<i>Oreoica gutturalis</i>	Crested Bellbird		X	X	X	X	
<i>Pachycephala rufiventris</i>	Rufous Whistler		X	X	X	X	
<i>Colluricincla harmonica</i>	Grey Shrike-thrush		X	X	X	X	
DICRURIDAE							
<i>Rhipidura leucophrys</i>	Willie Wagtail		X	X	X	X	X
<i>Grallina cyanoleuca</i>	Australian Magpie-lark		X		X	X	X
CAMPEPHAGIDAE							
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		X		X	X	X
<i>Coracina maxima</i>	Ground Cuckoo-shrike		X			X	
<i>Lalage sueurii</i>	White-winged Triller		X		X	X	X
ARTAMIDAE							
<i>Artamus personatus</i>	Masked Woodswallow		X		X	X	
<i>Artamus superciliosus</i>	White-browed Woodswallow				X		
<i>Artamus cinereus</i>	Black-faced Woodswallow		X	X	X	X	
<i>Artamus minor</i>	Little Woodswallow		X		X		
CRACTICIDAE							
<i>Cracticus torquatus</i>	Grey Butcherbird		X	X		X	
<i>Cracticus nigrogularis</i>	Pied Butcherbird		X		X	X	X
<i>Gymnorhina tibicen</i>	Australian Magpie			X		X	X
<i>Strepera versicolor</i>	Grey Currawong		X		X		
CORVIDAE							
<i>Corvus orru</i>	Torresian Crow		X	X		X	X
<i>Corvus bennetti</i>	Little Crow		X		X	X	
PTILONORHYNCHIDAE							
<i>Ptilonorhynchus maculatus</i>	Spotted Bowerbird		X		X	X	X
HIRUNDINIDAE							
<i>Cheramoeca leucosternus</i>	White-backed Swallow		X				
<i>Hirundo neoxena</i>	Welcome Swallow		X			X	
<i>Cecropis nigricans</i>	Tree Martin			X		X	
<i>Cecropis ariel</i>	Fairy Martin					X	
SYLVIIDAE							
<i>Cinclorhamphus mathewsi</i>	Rufous Songlark				X	X	
<i>Cinclorhamphus cruralis</i>	Brown Songlark				X	X	
DICAEIDAE							
<i>Dicaeum hirundinaceum</i>	Mistletoebird		X		X	X	
PASSERIDAE							
<i>Taeniopygia guttata</i>	Zebra Finch		X	X	X	X	X
<i>Emblema pictum</i>	Painted Finch						
MOTACILLIDAE							
<i>Anthus novaeseelandiae</i>	Richard's Pipit		X	X	X	X	
TOTAL NUMBER OF SPECIES (102)			60				

APPENDIX 1b *List of native mammal species recorded and predicted to in the habitats of the Wiluna West Project Area during November 2005 and October 2006.*

Key

Data Sources

- NX = Recorded during the Ninox survey
 HAS = Hart, Simpson and Associates Pty Ltd (1999)
 McK = McKenzie *et al.* (1994)
 WAM = WA Museum records

Conservation Status - Western Australia

- CR = Critically Endangered under the Wildlife Conservation Act 1950
 VU = Vulnerable under the Wildlife Conservation Act 1950
 OP = Other Specially Protected Fauna under the Wildlife Conservation Act 1950
 P# = Listed under CALM's Priority Fauna list

Conservation Status - Commonwealth

- V = Vulnerable under the EPBC Act 1999
 E = Endangered under the EPBC Act 1999

NATIVE MAMMALS		STATUS	RECORDED			
			NX	HSA	McK	WAM
TACHYGLOSSIDAE						
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna		X	X	X	
DASYURIDAE						
<i>Pseudantechinus woolleyae</i>	Woolley's Antechinus		X		X	X
<i>Antechinomys laniger</i>	Kultarr				X	X
<i>Dasyercus cristicauda</i>	Mulgara	VU/V				X
<i>Ninguai ridei</i>	Wongai Ningau		X		X	X
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart					X
<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart		X			X
<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart				X	X
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart	P4				X
<i>Sminthopsis. macroura</i>	Stripe-faced Dunnart		X		X	X
<i>Sminthopsis ooldea</i>	Ooldea Dunnart				X	X
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart					X
MACROPODIDAE						
<i>Macropus robustus</i>	Euro		X	X	X	X
<i>Macropus rufus</i>	Red Kangaroo		X	X	X	X
EMBALLONURIDAE						
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat					X
<i>Taphozous georgianus</i>	Common Sheathtail-bat					X
<i>Taphozous hilli</i>	Hill's Sheathtail-bat					X
MOLOSSIDAE						
<i>Mormopterus beccarii</i>	Beccari's Mastiff-bat					X
<i>Mormopterus planiceps</i>	Southern Freetail-bat				X	
<i>Nyctinomous australis</i>	White-striped Mastiff-bat				X	X
VESPERTILIONIDAE						
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat		X		X	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat		X		X	
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat				X	
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat				X	
MURIDAE						
<i>Notomys alexis</i>	Spinifex Hopping-mouse		X		X	X
<i>Pseudomys bolami</i>	Bolam's Mouse					X
<i>Pseudomys desertor</i>	Desert Mouse					X
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse		X		X	X
<i>Zyzomys argusus</i>	Common Rock-rat					X

	(29)	11	3	17	23
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APPENDIX 1c List of frog and reptile species recorded and predicted to occur in the habitats of the Wiluna West Project Area during November 2005 and October 2006.

Key

Data Sources

- NX = Recorded during the Ninox survey
 HSA = Hart, Simpson and Associates Pty Ltd (1999)
 McK = McKenzie *et al.* (1994)
 WAM = WA Museum records

Conservation Status - Western Australia

- CR = Critically Endangered under the Wildlife Conservation Act 1950
 VU = Vulnerable under the Wildlife Conservation Act 1950
 OP = Other Specially Protected Fauna under the Wildlife Conservation Act 1950
 P# = Listed under CALM's Priority Fauna list

Conservation Status - Commonwealth

- V = Vulnerable under the EPBC Act 1999
 E = Endangered under the EPBC Act 1999

AMPHIBIANS & REPTILES		STATUS	RECORDED			
			NX	HSA	McK	WAM
LEPTODACTYLIDAE	Frogs					
<i>Limnodynastes spenceri</i>						X
<i>Neobatrachus aquilonius</i>						X
<i>Neobatrachus kunapalari</i>				X?		X
<i>Neobatrachus sutor</i>						X
<i>Neobatrachus wilsmorei</i>						X
<i>Pseudophryne occidentalis</i>						X
HYLIDAE	Frogs					
<i>Cyclorana maini</i>				X		X
<i>Cyclorana platycephala</i>				X		X
<i>Litoria rubella</i>			X			X
TOTAL NUMBER OF SPECIES (11)			1	0	3	9
GEKKONIDAE	Geckos					
<i>Diplodactylus conspicillatus</i>				X		X
<i>Diplodactylus granariensis</i>			X			X
<i>Diplodactylus pulcher</i>			X		X	X
<i>Diplodactylus squarrosus</i>			X	X		X
<i>Diplodactylus stenodactylus</i>			X			X
<i>Genyra punctata</i>						X
<i>Genyra purpurascens</i>						X
<i>Genyra variegata</i>			X	X	X	X
<i>Heteronotia binoei</i>			X	X	X	X
<i>Nephrurus laevis</i>						X
<i>Nephrurus levis</i>						X
<i>Nephrurus vertebralis</i>				X		X
<i>Nephrurus wheeleri</i>			X	X		X
<i>Rhynchoedura ornata</i>				X	X	X
<i>Strophurus elderi</i>				X		X
<i>Strophurus strophurus</i>					X	X
<i>Strophurus wellingtonae</i>			X	X	X	X
<i>Oedura marmorata</i>						X
<i>Underwoodisaurus milii</i>						X
PYGOPODIDAE	Legless Lizards					
<i>Delma butleri</i>				X	X	X
<i>Delma fraseri</i>						X

AMPHIBIANS & REPTILES		STATUS	RECORDED			
			NX	HSA	McK	WAM
<i>Delma haroldi</i>						X
<i>Delma nasuta</i>					X	X
<i>Lialis burtonis</i>						X
<i>Pygopus nigriceps</i>						X
AGAMIDAE	Dragon Lizards					
<i>Caimanops amphiboluroides</i>			X		X	X
<i>Ctenophorus caudicinctus</i>			X	X	X	X
<i>Ctenophorus fordi</i>						X
<i>Ctenophorus isolepis</i>					X	X
<i>Ctenophorus nuchalis</i>					X	X
<i>Ctenophorus ornatus</i>						X
<i>Ctenophorus reticulatus</i>				X	X	X
<i>Ctenophorus scutulatus</i>				X		X
<i>Diporiphora winneckeii</i>						X
<i>Lophognathus longirostris</i>						X
<i>Moloch horridus</i>					X	X
<i>Pogona minor</i>			X	X	X	X
<i>Tympanocryptis cephalala</i>						X
SCINCIDAE	Skinks					
<i>Cryptoblepharus plagiocephalus</i>			X			X
<i>Ctenotus ariadne</i>					X	X
<i>Ctenotus calurus</i>					X	X
<i>Ctenotus dux</i>						X
<i>Ctenotus grandis</i>					X	X
<i>Ctenotus helenae</i>					X	X
<i>Ctenotus leonhardii</i>				X	X	X
<i>Ctenotus pantherinus</i>				X	X	X
<i>Ctenotus quattuordecimlineatus</i>					X	X
<i>Ctenotus saxatilis</i>						X
<i>Ctenotus schomburgkii</i>			X	X	X	X
<i>Ctenotus uber</i>						X
<i>Cyclodomorphus melanops</i>						X
<i>Egernia depressa</i>					X	X
<i>Egernia formosa</i>					X	
<i>Egernia inornata</i>				X		X
<i>Egernia kintorei</i>		VU/V				X
<i>Egernia striata</i>						X
<i>Eremiascincus richardsonii</i>					X	X
<i>Lerista bipes</i>					X	X
<i>Lerista desertorum</i>						X
<i>Lerista macropisthopus</i>						X
<i>Lerista muelleri</i>			X	X	X	X
<i>Menetia greyii</i>			X	X	X	X
<i>Morethia butleri</i>					X	X
<i>Morethia ruficauda</i>						X
<i>Tiliqua multifasciata</i>					X	X
<i>Tiliqua occipitalis</i>						X
VARANIDAE	Monitors or Goannas					
<i>Varanus bevicauda</i>						X
<i>Varanus caudolineatus</i>			X		X	X
<i>Varanus eremius</i>						X
<i>Varanus giganteus</i>						X
<i>Varanus gouldii</i>				X		X
<i>Varanus panoptes</i>			X	X	X	X
<i>Varanus tristis</i>						X

AMPHIBIANS & REPTILES		STATUS	RECORDED			
			NX	HSA	McK	WAM
TYPHLOPIDAE	Blind Snakes					
<i>Ramphotyphlops grypus</i>						X
<i>Ramphotyphlops hamatus</i>			X		X	X
<i>Ramphotyphlops waitii</i>				X		X
BOIDAE	Pythons					
<i>Antaresia perthensis</i>						X
<i>Antaresia stimsoni</i>						X
ELAPIDAE	Venomous Land Snakes					
<i>Acanthophis pyrrhus</i>						X
<i>Brachyuropis approximans</i>				X		X
<i>Brachyuropis fasciolata</i>						X
<i>Brachyuropis semifasciata</i>						X
<i>Demasia psammophis</i>						X
<i>Furina ornata</i>						
<i>Parasuta monachus</i>			X	X		X
<i>Pseudechis australis</i>						X
<i>Pseudechis butleri</i>						X
<i>Pseudonaja modesta</i>			X			X
<i>Pseudonaja nuchalis</i>					X	X
<i>Simoselaps bertholdi</i>			X	X		X
<i>Suta fasciata</i>						X
TOTAL NUMBER OF SPECIES (91)			21	25	36	89

APPENDIX 1d *List of introduced species recorded and predicted to occur in the habitats of the Wiluna West Project Area during November 2005 and October 2006.*

KEY

Data Sources

NX	=	Recorded during the Ninox survey
HSA	=	Hart, Simpson and Associates Pty Ltd (1999)
McK	=	McKenzie <i>et al.</i> (1994)
WAM	=	WA Museum records

INTRODUCED MAMMALS		RECORDED			
		NX	HSA	McK	WAM
CANIDAE					
<i>Canis lupus dingo/familiaris</i>	* Dingo/Feral Dog	X			
MURIDAE					
<i>Mus musculus</i>	House Mouse	X	X	X	X
FELIDAE					
<i>Felis catus</i>	Feral Cat	X	X		
CANIDAE					
<i>Vulpes vulpes</i>	Fox				
BOVIDAE					
<i>Bos taurus (or indicus)</i>	Cattle	X	X	X	
<i>Ovis aries</i>	Sheep			X	
<i>Capra hircus</i>	Feral Goat				
LEPORIDAE					
<i>Oryctolagus cuniculus</i>	Rabbit	X			
EQUIDAE					
<i>Equus caballus</i>	Horse			X	
CAMELIDAE					
<i>Camelus dromedarius</i>	One-humped Camel	X		X	
TOTAL NUMBER OF SPECIES (10)		6	3	5	1

* Dogs in close proximity to towns such as Wiluna are almost certainly Dingo/feral Dog crossbreds.