

Vertebrate Fauna Desktop Assessment for Cane River proposed exploration area, Onslow, WA.



*Cane River Conservation Park, Onslow, WA
Photo: R.Davis*

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Table of Contents

Introduction	4
Site Location	4
Methods	7
Results	10
Conclusions	20
Tables of Fauna species expected	21
References	31
Appendix A: Categories of conservation status	33
Appendix B: EPBC Protected Matters Search Results	36
Appendix C: WA Museum correspondence on land snails	40

Executive Summary

Onslow Metals Pty Ltd. hold two mining leases (Range and Turtle) situated within the Cane River Conservation Park (46122) near Onslow. This report presents the results of a Level 1 desktop assessment and site inspection, concerning vertebrate fauna likely to be impacted by the proposal for exploration drilling and a blue-metal extractive quarry.

Habitats present are degraded in some areas, from past exploration activities, particularly around the hill at Turtle and old mining shafts at Range. The main habitats for fauna comprise spinifex-dominated lowlands with scattered shrubs and small trees to 3m. At Turtle a small rocky hill is the only dominant relief and is degraded to some extent by exploration tracks and past drilling and extractive activities.

The lease areas have the potential to support a wide range of vertebrate species including five amphibians, 112 reptiles, 106 birds and 34 mammal species. A small number of threatened or priority species may also occur, including the Australian Bustard, Bush Stone-Curlew, Grey Flacon, Peregrine Falcon and Mulgara. The Western Pebble-mound Mouse was formerly present in the lease area of Turtle and is now likely to be locally extinct due to the presence of only two mounds both of which appeared long-term inactive.

Given the small size of the lease, general lack of unique landforms apart from the hill at Turtle, and representation of the habitat throughout the surrounding region, it is not considered that the proposed operations will have a major impact on fauna species present at the site.

The following recommendations are made:

- Any developments need to consider habitat connectivity, given the conservation reserve status of the Cane River Conservation Park.
- Clearing should be minimised and infrastructure limited to currently disturbed areas wherever possible.
- Ongoing weed control and rehabilitation would improve the biodiversity value of impacted and degraded areas.
- Environmental inductions should be conducted for all site personnel and educate them on the biodiversity values of the site including significant flora and fauna habitat and species.

Introduction

This report presents the findings of a desktop review and site inspection commissioned by Keith Lindbeck and Associates. The purposes of this assessment are to:

- Produce a list of fauna species predicted to occur at the study sites;
- Identify any species of conservation significance that might be present;
- Assess major fauna habitats present at the site, to place survey data in context.
- To determine the impact of proposed works on any species of conservation concern.

This report and site visit, satisfy the criteria for a Level 1 survey (a background research or 'desk-top' study) according to the Environmental Protection Authority (EPA) Guidance Statement No. 56 on terrestrial fauna surveys (EPA 2004). It includes a review of all fauna records from the study area, as well as a site inspection that assessed habitats or vegetation complexes present, and their value for fauna. A more detailed assessment including fauna surveys in at least 2 seasons could be required if the EPA decides that the level of impact from future proposals is "moderate" as defined under Guidance Statement 56 and Position Statement 3 (EPA, 2002). Although this is not the decision of the consultant, it is considered unlikely that this level of assessment would be set for such a small-scale proposal in an already disturbed area.

Site Location

The areas of interest are situated near Onslow, Western Australia and are situated within the Cane River Conservation Park (46122) and include two mining leases to Onslow Metals Pty Ltd., namely M 08/273 and M 08/272. An overall map showing the site location within the reserve is shown in Figure 1 and detail of the mining tenements in Figure 2.

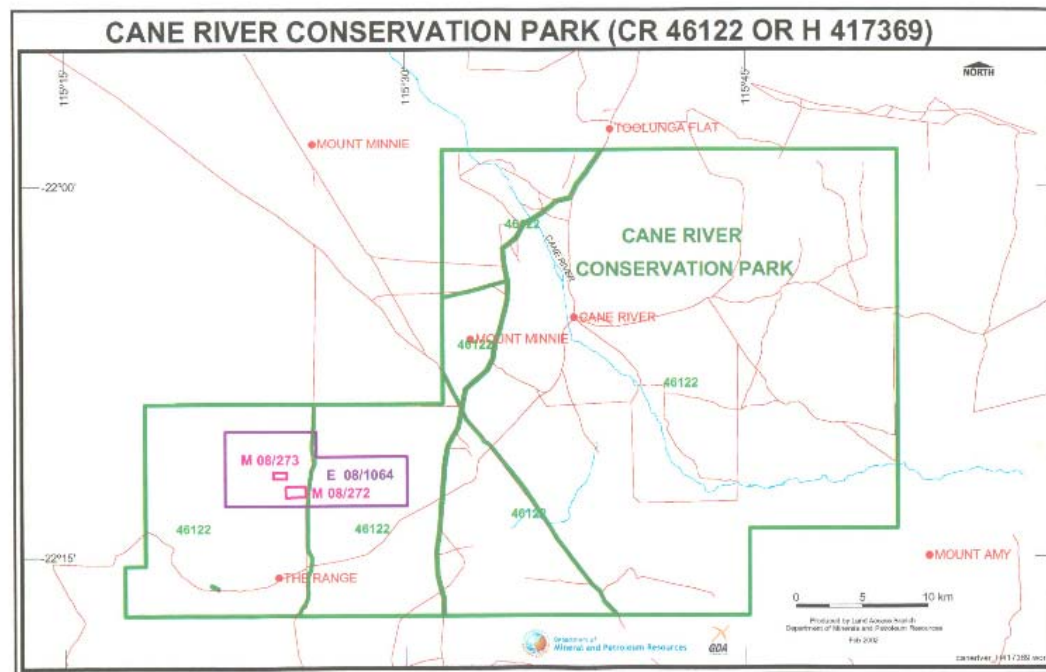


Figure 1: Location of the mining leases within Cane River Conservation Park.

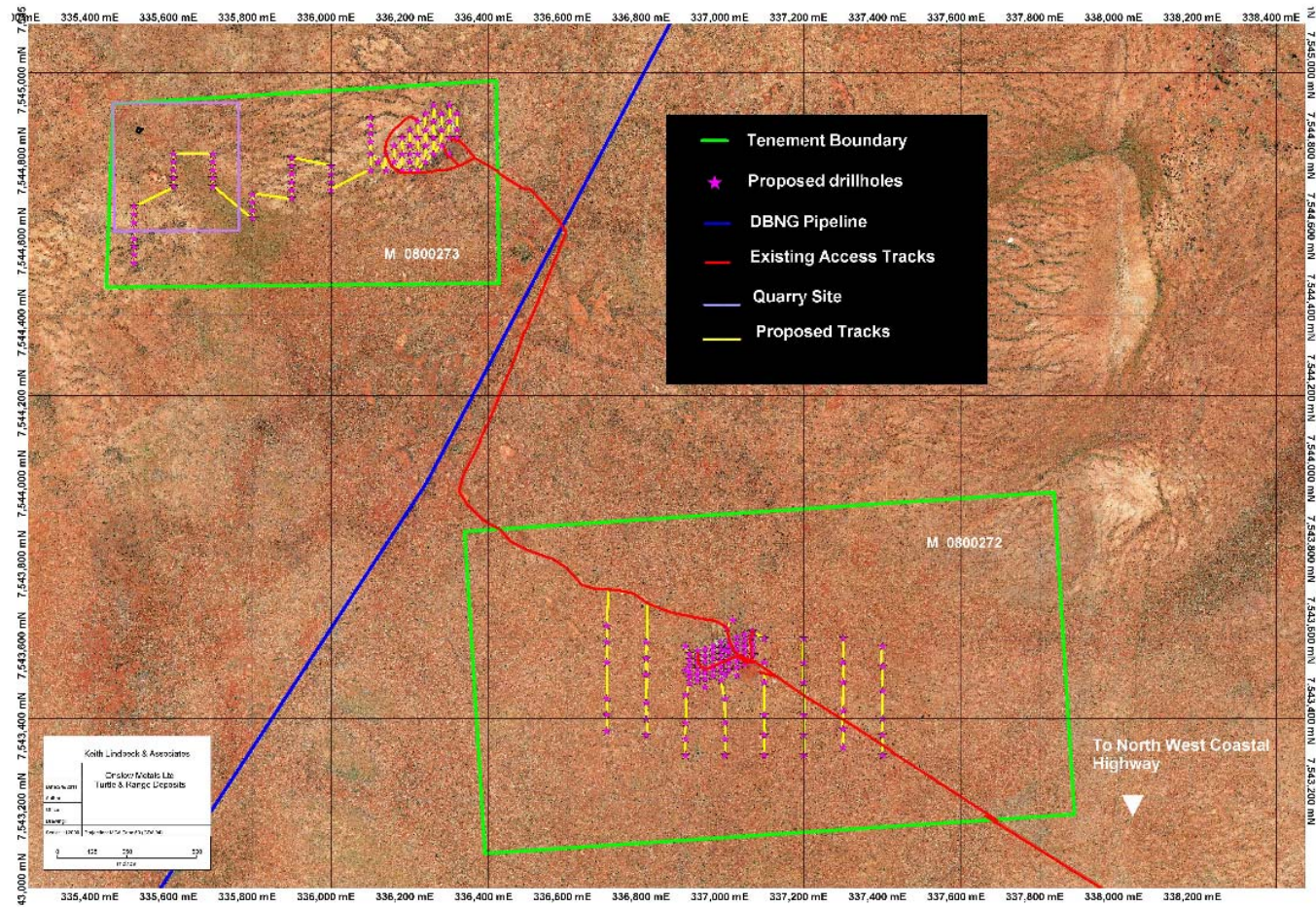


Figure 2: Detail of the two lease areas.

Methods

Personnel and Experience

This report has been prepared by Principal Zoologist of Egernia Environmental - Dr Robert Davis (BSc. Biology/Env. Sc., Hons. Biol, Ph.D. Zool.). Dr Davis has over 15 years of experience as a terrestrial vertebrate ecologist in Western Australia and is a member of the Ecological Society of Australia, Royal Society of Western Australia, Society for Conservation Biology, Birds Australia, Australian Society of Herpetologists and a Fellow of the Linnaean Society of London. He is also a lecturer in wildlife biology at Edith Cowan University and an adjunct Lecturer in Zoology at the University of Western Australia

Site Visit

A site inspection was undertaken by Dr Robert Davis of Egernia Environmental on the 8th and 9th of June, 2011. During the site visit, all major habitats were traversed on foot and any fauna species that were encountered were recorded. All proposed drill lines were walked as well as the proposed quarry area. The primary purpose of the site inspection was to assess the major habitats present for fauna as well as the likelihood of threatened fauna species occurring at the site.

Desktop Assessment

Sources of Information

Lists of vertebrate fauna expected to occur in the study area were produced using information from a number of sources. These included publications that provide information on general patterns of distribution of frogs (Tyler and Doughty 2009), reptiles (Storr *et al.* 1983, 1990, 1999 and 2002), birds (Barrett *et al.* 2003; Johnstone and Storr 1998; Johnstone and Storr 2004), and mammals (Menkhorst and Knight 2001; Van Dyck and Strahan 2008). In addition, the databases listed below in Table 1 were searched for specimen or observational records.

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

Although this report is focused on vertebrate fauna, the results of a Western Australian (WA) Museum search for short-range endemic molluscs, is also included. No other species of threatened invertebrate were recorded on Department of Environment and Conservation (DEC) threatened fauna extracts or on Naturemap which lists all specimen and sight records for WA.

Table 1. Databases used in the preparation of the fauna lists in Table 2.

Database	Type of records held on database	Area searched
Naturemap (specimen and sight records)	Records of specimens held in the WA Museum and DEC Fauna Returns and DEC Threatened Fauna Database. Includes historical data.	40 km circle with central point at 22°10'00"S and 115°19'59"E
DEC Threatened and Priority Fauna Database	Records of threatened species held by the DEC.	10 km buffer around both 22° 11' 35" S, 115° 24' 13" - 22° 11' 50" S, 115° 24' 47" and 22° 12' 10" S, 115° 24' 44" - 22° 12' 33" S, 115° 25' 38".
Birds Australia Atlas Database	Extensive vetted bird survey data from Birds Australia's two major Atlas projects since 1984.	As above
Environment Protection and Biodiversity Conservation Act (EPBC) Protected Matters Search Tool (threatened species)	Records on matters protected under the EPBC Act, including threatened species.	10 km circle with central point at 22°10'00"S and 115°19'59"E
WA Museum Mollusc Database	Short-range Endemic Molluscs	21°55'53" - 22°27'55"S and 115°01'26"- 115°48'34"E

Taxonomy and nomenclature for fauna species used in this report follows that of the WA Museum (2009) with the use of alternative bird taxonomy that follows Christidis and Boles (2008). This is because the WA Museum utilises different bird taxonomy to that which is nationally and more widely accepted (Christidis and Boles, 2008).

Assessment of conservation significance

Three levels of conservation significance are recognised in this report:
(Appendix 1):

Conservation Significance 1:

- Species listed under State or Commonwealth Acts.

Conservation Significance 2:

- Species not listed under State or Commonwealth Acts, but listed in publications on threatened fauna or as Priority species by DEC.

Conservation Significance 3:

- Species not listed under State or Commonwealth Acts or in publications on threatened fauna or as Priority species by DEC, but considered of local significance because of their pattern of distribution or habitat preferences.

At the highest level of conservation significance (Conservation Significance 1) are those species that are protected under State or Commonwealth legislation.

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

International Union for the Conservation of Nature and Natural Resources (IUCN) categories are used to categorise threatened species as 'extinct', 'extinct in the wild', 'critically endangered', 'endangered', 'vulnerable' and 'conservation dependent', with all categories except 'extinct' and 'conservation dependent' listed as matters of National Environmental Significance. A list of migratory species is also maintained, containing mostly bird and marine species. The migratory species listed are those recognised under China-Australia Migratory Bird Agreement (CAMBA), the Japan-Australia Migratory Bird Agreement (JAMBA), Australia-South Korea agreement (ROKAMBA) or species listed under the Bonn Convention for which Australia is a range state. Species listed in JAMBA are also protected under Schedule 3 of the *Western Australian Wildlife Conservation Act 1950*.

The *Western Australian Wildlife Conservation Act 1950* (WA Wildlife Conservation Act) is State legislation for fauna protection administered by the Department of Conservation and Land Management (DEC). The WA Wildlife Conservation Act lists species under a set of Schedules, where threatened species are listed as Schedule 1. Schedule 1 species are further categorised by DEC into the IUCN categories 'extinct', 'extinct in the wild', 'critically endangered', 'endangered', 'vulnerable' and 'conservation dependent' species. The schedules and categories are further described in Appendix 1.

At the second-highest level of conservation significance (Conservation Significance 2) are species that are listed under publications on threatened species, or are listed as Threatened or Priority species by DEC.

Reports on the conservation status of most vertebrate fauna species have been produced by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) in the form of Action Plans. An Action Plan is a review of the conservation status of a taxonomic group against IUCN categories. Action Plans have been prepared for amphibians (Tyler 1998), reptiles (Cogger *et al.* 1993), birds (Garnett and Crowley 2000), monotremes and marsupials (Maxwell *et al.* 1996), rodents (Lee 1995) and bats (Duncan *et al.* 1999). These publications also use categories similar to those used by the EPBC Act. The information presented in some of the earlier Action Plans may be out of date due to changes since publication.

In Western Australia, DEC has also produced a list of Priority Fauna made up of species that are not considered Threatened under the *WA Wildlife Conservation Act*, but for which DEC feels there is cause for concern. Levels of Priority are described in Appendix One.

At the third-highest level of conservation significance (Conservation Significance 3) are species that are not recognised under Federal or State legislation, listed in publications by DSEWPC or listed as Threatened or Priority species by DEC. These are species considered to be of local significance in the study area because they are at the limit of their distribution in the area, they have a very restricted range or they occur in breeding colonies (e.g. waterbirds). This level of significance has no legislative or published recognition and is based on interpretation of information on the species patterns of distribution. Recognition of such species is consistent with the aim of preserving regional biodiversity.

Results

Site Description

A separate botanical inventory has been undertaken, but for the purposes of this report, the major structural habitats for fauna are of relevance. In terms of major fauna habitats, the majority of both mining leases are comprised of sparse open spinifex shrubland with scattered *Acacia* and occasionally *Eucalyptus* species, to 3m. Habitat variation was minimal and there was little in the way of unique regional habitats, with the only major topographical feature being a small rocky hill at Turtle. The major habitats for fauna can be described as follows:

Sparse open shrubland over *Tridodia*



Open spinifex at Range

This was the dominant fauna habitat present at all sites. The substrate was mostly sandy in nature with occasional scattered gravel on the surface in places. Spinifex at the time of the inspection was benefitting from recent rains and was dense and green with plentiful seed available. This habitat is likely to prove ideal for small burrowing and spinifex-inhabiting reptiles and small mammals. Habitat complexity was not great and consequently from a fauna perspective, further lowland habitats are not distinguished.

Small rocky hill with spinifex and scattered shrubs



Small rocky hill at Turtle

The small hill at Turtle is unique in being the only relief in the proposed exploration areas. The hill is primarily rocky scree with dense *Triodia*. A small rock face is apparent on one side of the hill but has been extensively disturbed by past mining and exploration – including a large open vertical shaft, which is a hazard to fauna as well as humans. A dense area of shrubs is present near this exposed face and offers the only real mid-storey habitat on the hill. The entire hill has been disturbed by past mining activities and is bisected by exploration tracks and drill holes. Two inactive mounds of the Western Pebble-mound Mouse were found here on the slopes (see mammal section of this report for more details).



Deep open shaft at Turtle

Disturbed lowlands

Lowland habitats around the hill at Turtle and in a number of places at Range have been extensively disturbed by past mining activities. Numerous drill holes were evident at both leases, and a number were uncapped in Range. There were also old mining shafts closeted in one area of Range. As can be seen in the photographs below, disturbance is manifested as large areas of exposed ground and fragmentation of vegetation by tracks. However, disturbance was generally confined to small areas and overall the extent of weed invasion was low.



Open disturbed areas at Turtle



View from the hill at Turtle, showing tracks and previous disturbance

Notable fauna habitats that were not present, included wetlands of any description, apart from the small highly ephemeral soak observed outside the potential quarry area observed. Major woodland was also absent as were any caves, dense jumbled boulders, sand dunes or major overhangs.

Desktop Assessment

The amphibians, reptiles, birds and mammals that may occur in the study area are listed in Tables 2-5. In each table species recorded in the area by the WA Museum and in other surveys in the region are indicated. The results of the EPBC database search are given in Appendix B. Correspondence from the WA Museum regarding molluscs is listed in Appendix C.

Amphibians

There are five species of frog that have the potential to occur on the lease areas, with four species previously recorded from the general area (Table 2). The list of species expected to occur, reflects the availability of habitats on site, which are characterized by the lack of any free-standing water or watercourses. Consequently, species that have been recorded in the region, such as the Gorge Toadlet *Pseudophryne douglasi* and the Northwest toadlet *Uperoleia russelli*, were not included. All species listed here are opportunistic breeders that emerge after cyclonic rain to breed in any temporary pools of water formed. **No frogs of conservation significance** are known to occur in the area and frogs are not likely to be significantly impacted by the proposed drilling and extraction activities.

Reptiles

There are 112 species of reptile listed in Table 3 as having the potential to occur on the site, with 76 having being recorded within 40 km of the site. One species, the skink *Ctenotus pantherinus*, was observed during the site inspection.

Although a greater number of reptile species have been recorded from the region, the list presented only includes those that may occur on the site. A number of important reptile habitats were not found on the lease areas. For example, many species favour rocky hills, gorges and mesas, but significant areas of uplift were absent, with the exception of the isolated, small and slightly rocky hill on Turtle. Consequently, those reptile species listed in Table 3, are the ones most likely to occupy the loamy spinifex flats of both leases.

There is only one reptile species of conservation significance that may occur on the site.

Conservation Significance 1

- **Pilbara Olive Python** *Morelia olivacea barroni*
This python is listed under Schedule 1 (Vulnerable) of the WA Wildlife Conservation Act, and as Vulnerable under the EPBC Act.

The Pilbara Olive Python is restricted to ranges in the Pilbara and islands in the Dampier Archipelago and is known from relatively few localities. This very large python inhabits rock outcrops, usually close to waterholes, which it uses to hunt. There was a record of this species from the DEC Threatened Fauna Database from about 100 km south-east of Onslow. It is likely that this record was from rocky ranges. Although this species clearly occurs in the region, it is considered **unlikely to occur** on the lease areas due to the lack of suitable rocky habitat.

Birds

There are 106 species of bird listed in Table 4 as having the potential to occur on the site with 82 recorded from the immediate region. A further 16 species were recorded on the lease areas during the site inspection and are indicated in Table 4.

Since the site does not include any permanent water sources or major river systems, all waterbird species and other birds associated with riparian vegetation, have been excluded.

The primary habitat available for most birds at the site consists of spinifex lowlands with scattered Acacia and sparse/rare mallee Eucalypts. The small hill at Turtle offers some habitat for species such as the Striated Grass-wren, which often favours dense spinifex clumps near rocky areas.

A number of waterbird, shorebird and aerial species are listed as migratory under the EPBC Act. Since there are no permanent waterbodies onsite, waterbirds have been excluded from the fauna lists. However, the following species were listed as potentially occurring, based on the EPBC Protected Matters Search Tool (Appendix B):

EPBC Listed species for which suitable aquatic habitats were not present:
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Great Egret	<i>Ardea alba</i>
Cattle Egret	<i>Ardea ibis</i>
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>
Oriental Pratincole	<i>Glareola maldivarum</i>

Additional species listed in the EPBC Protected Matter Search tool (Appendix B) included listed marine species. All have been excluded as this is not a coastal or near-coastal habitat.

Since most birds are highly dispersive, the bird list presented here is likely to be an overestimate, and many species may be simply passing through the site on their way to other habitats, or as part of a larger foraging range (e.g. birds of prey). Since it is difficult to know, they are included, rather than omitted, where habitat is suitable. There are 7 birds of listed conservation significance that may occur on the site. Each species is listed and discussed below.

Conservation Significance 1

- **Peregrine Falcon** *Falco peregrinus*
This falcon is listed under Schedule 4 (other specially protected fauna) of the WA Wildlife Conservation Act.

Migratory Species

- **Fork-tailed Swift** *Apus pacificus*
This species is listed as migratory under the EPBC Act.
- **Barn Swallow** *Hirundo rustica*
This species is listed as migratory under the EPBC Act.
- **Oriental Plover** *Charadrius veredus*
This species is listed as migratory under the EPBC Act.
- **Rainbow Bee-eater** *Merops ornatus*
This species is listed as migratory under the EPBC Act.

The Peregrine Falcon is a widespread bird of prey and had been recorded on other fauna surveys in the nearby area. This falcon nests mainly on ledges on cliffs, rocky outcrops and quarries, although it may also use tall trees (Johnstone and Storr 1998). This species **is likely to occur** in the study area.

The Fork-tailed Swift is a largely aerial and rare species, and is therefore unlikely to be affected by any proposed development. It has not been recorded on recent surveys in the area, but **may occur** in the region on rare occasions.

The Barn Swallow is a rare visitor to Australia and has not been recorded from the area. It is considered highly unlikely to occur.

The Rainbow Bee-eater **has been recorded** from the area in Birds Australia atlas surveys. It is a common species that migrates southwards in summer to breed. It is likely to use the site for feeding, but there are not predicted to be any major impacts on this species. It is possible that this species could utilise sandy banks, such as those around old diggings on Range, for constructing nesting burrows. Any impacts could be minimized by not undertaking any groundworks during the breeding period.

The Oriental Plover is found in open grasslands in arid areas. It was listed on the EPBC database search but is considered to be **rare** in the study area. Due to the nomadic nature of this species it has been retained on the list although it is considered unlikely to occur.

Several priority species of bird also occur as follows:

<u>Conservation Significance 2</u>	
<ul style="list-style-type: none"> • Grey Falcon This falcon is listed as Priority 4 by DEC. 	<i>Falco hypoleucos</i>
<ul style="list-style-type: none"> • Australian Bustard This species is listed as Priority 4 by DEC. 	<i>Ardeotis australis</i>
<ul style="list-style-type: none"> • Bush Stone-Curlew This species is listed as Priority 4 by DEC. 	<i>Burhinus grallarius</i>

The Grey Falcon is an uncommon bird that inhabits lightly wooded areas in the northern part of Western Australia (Johnstone and Storr 1998). This species nests in eucalypts along rivers. Grey Falcons **have been recorded** within 40 km of the study site and since they are relatively wide-ranging, they may occur in the lease area. This species generally prefer lightly wooded country and since this habitat type is not present at the site, it is considered that it is unlikely to occur. Given the lack of suitable breeding habitat in the lease area it is also unlikely to breed in the area of impact.

Australian Bustards **have been recorded** within 40 km of the study area. The Australian Bustard inhabits grasslands and savannah grasslands, moving nomadically in response to the presence of food (Johnstone and Storr 1998). This species is considered highly likely to be seasonally common in the area. The Australian Bustard is threatened by hunting and habitat degradation in the region. The species is also clumsy when taking off and is vulnerable to colliding with vehicles and overhead powerlines.

The Bush Stone-Curlew inhabits lightly wooded plains, sheltering during the day in thickets of grass or under shrubs (Johnstone and Storr 1998). This species roosts and nests on the ground and is vulnerable to feral predators such as the fox. The Bush Stone-Curlew **has been recorded** from the area but is generally only present where there is woodland or tree cover. Since the sites are lacking tree-cover it is considered **unlikely to occur in the area of impact**. The main threatening processes listed by Garnett and Crowley (2000) for this species, are loss of habitat and predation by foxes.

Mammals

There are 34 species of mammal that have the potential to occur in the project area with 19 recorded from the nearby region (Table 5). Three species were

recorded during the site inspection. The Red Kangaroo *Macropus rufus* was recorded at Turtle, and tracks of the feral cat were recorded at Range. Two old and now disused mounds of the Western Pebble-mound Mouse *Pseudomys chapmani* were recorded on the hill at Turtle.



Evidence of feral cats at Range

There are some species, particularly medium-sized mammals, that occurred in the area historically but have become extinct since European settlement. The mammal lists presented are based on the major habitats and landforms present at the site. The lack of significant rocky uplands, caves and gorges, precludes the likelihood of threatened species such as the Northern Quoll, Ghost Bat and Pilbara Orange Leaf-nosed bat so these have been omitted, even though they appear on species lists for the region, including the EPBC database (see Appendix B). Consequently, the list includes those mammals most likely to occur based upon their known ecology and habitat preferences.

There are six mammals of conservation significance that may occur on the site. Each species is listed and discussed below.

Conservation Significance 1

- **Mulgara** *Dasymercus blythi*
This species is listed as Schedule 1 (Vulnerable) under the Wildlife Conservation Act (WA) and Vulnerable under the EPBC Act.

The taxonomic differences between the two species of Mulgara, the Crest-tailed Mulgara *Dasymercus cristicauda* and the Brush-tailed Mulgara *D. blythi* have only recently been determined. The Mulgara was previously known under the species name of *Dasymercus cristicauda* but has now been changed to *Dasymercus blythi* following some recent taxonomic work (Van Dyck and Strahan, 2008). The Brush-tailed Mulgara inhabits spinifex

grasslands and excavates burrows on flats between low sand dunes or on the slopes of high dunes (Van Dyck and Strahan, 2008). Fauna surveys in the region have recorded Mulgara to the south-west of the study area between Nanaturra and Exmouth. The species is likely to be under-surveyed in the region and could occur where suitable habitats exist. Extensive surveys on foot (all areas were traversed on foot) failed to detect any evidence of the Mulgara. Although sandy soils were present, these were mostly on loamy flats and not on the low dunes preferred by Mulgaras. Given this and the lack of evidence noted on-ground, Mulgara are considered **unlikely to occur on the lease areas**.

Conservation Significance 2

- **Short-tailed Mouse** *Leggadina lakedownensis*
This mouse is listed as Priority 4 by DEC.
- **Western Pebble-mound Mouse** *Pseudomys chapmani*
This mouse is listed as Priority 4 by DEC.

The Lakeland Downs Mouse appears to be increasing in range in the Pilbara but prefers riverine flats with clay-based soils. Consequently although it may be in the area (it was recorded within 40 km of the study area), it is **unlikely to occur** at the site due to the lack of these habitats.

The Western Pebble-mound Mouse generally occurs on rocky hillslopes where it constructs its unique pebble mounds.

This species has retracted greatly in range since the 1950's, and is now patchily distributed throughout the Pilbara, east to Rudall River National Park (Van Dyck and Strahan, 2008). This species **was present historically on the hill at Turtle**, as evidenced by the presence of two long-abandoned (non-active) mounds. Despite further extensive searches of the hill and surrounding areas of suitable habitat, no further evidence was found. This species is **now unlikely to still occur within the proposed disturbance footprint**.

Invertebrates

The WA Museum indicate the paucity of research on short-range endemic invertebrates in the region of interest. A database search revealed three species of terrestrial mollusk recorded from the region, of which only one, an undescribed species of *Rhagada*, is considered to have potential for being a short-range endemic. No other species of threatened invertebrate were listed on Naturemap searches, however invertebrates are not the target of this report and specialist expertise should be sought.

Limitations

The field and desktop surveys were undertaken by an appropriately skilled vertebrate zoologist, with extensive fauna survey expertise in the Pilbara. Dr Davis assisted with the DEC/WA Museum Pilbara Biological Survey in 2005 and has undertaken over 25 fauna surveys in the Pilbara since 1995.

All site areas were traversed on foot and consequently there are not considered to be any major limitations to the interpretation or presentation of data for this report. The zoologist undertaking this report does not have expertise in invertebrates and consequently this report is only focused on vertebrate fauna. Although results of the WA Museum correspondence on land snails is presented, no other attempt has been made to present data on invertebrates due to the high level of expertise that is required in this area.

Conclusions and Recommendations

In summary, the lease area has the potential to support a wide range of vertebrate species including five amphibian, 112 reptile, 106 bird and 34 mammal species.

The proposed disturbances will primarily impact lowland habitats with sparse vegetation cover. The lack of rocky upland habitats means that a suite of species including the Northern Quoll, Olive Python and Ghost Bat, are unlikely to occur. However an assemblage of species representative of lowland lightly wooded plains may occur, including the species of conservation concern such as the Australian Bustard, Bush Stone-Curlew, Grey Flacon, Peregrine Falcon and Mulgara. The Western Pebble-mound Mouse was formerly present in the lease area of Turtle and is now unlikely to occur.

In general, given the small size of the leases, lack of unique landforms within the lease area, previous exploration activities and representation of the habitat throughout the surrounding region, it is not considered that the proposed disturbances will have any major impact on fauna species present at the site.

The fauna of the region is generally well-studied (although not as well as other parts of the Pilbara), and comprehensive data sources including WA Museum collections, have allowed the expected occurrence lists to be compiled with a high degree of certainty.

The following recommendations are made:

- Any developments need to consider habitat connectivity, given the conservation reserve status of the Cane River Conservation Park.
- Clearing should be minimised and infrastructure limited to currently disturbed areas wherever possible.
- Ongoing weed control and rehabilitation would improve the biodiversity value of impacted and degraded areas.
- Environmental inductions should be conducted for all site personnel and educate them on the biodiversity values of the site including significant flora and fauna species.

Table 2. Amphibians that have the potential to occur in the study area.
 NM = species recorded in the area according to Naturemap (see Table 1).

Species	Status	Recorded
Hylidae (tree frogs and water-holding frogs)		
Main's Frog <i>Cyclorana maini</i>		NM
Water-holding Frog <i>Cyclorana platycephala</i>		
Desert Tree Frog <i>Litoria rubella</i>		NM
Myobatrachidae (ground frogs)		
Centralian Burrowing Frog <i>Opisthodon spenceri</i>		NM
Northern Burrowing Frog <i>Neobatrachus aquilonius</i>		NM
Number of frogs expected:		5
Recorded:		4

Table 3. Reptiles that have the potential to occur in the study area.
 NM = species recorded in the area according to Naturemap (see Table 1)
 + = species recorded during the site inspection.

Species	Status	Recorded
Agamidae (dragon lizards)		
<i>Amphibolurus longirostris</i>		NM
Ring-tailed Dragon <i>Ctenophorus caudicinctus</i>		NM
Dune Dragon <i>Ctenophorus femoralis</i>		NM
Military Dragon <i>Ctenophorus isolepis</i>		NM
Central Netted Dragon <i>Ctenophorus nuchalis</i>		NM
<i>Ctenophorus reticulatus</i>		NM
<i>Ctenophorus rubens</i>		
Red Dragon <i>Ctenophorus scutulatus</i>		
<i>Diporiphora valens</i>		
Blue-lined Dragon <i>Diporiphora winnecki</i>		NM
Thorny Devil <i>Moloch horridus</i>		
Bearded Dragon <i>Pogona minor</i>		NM
Pebble Dragon <i>Tympanocryptis cephalus</i>		NM
Diplodactylidae (geckoes)		
Clawless Gecko <i>Crenadactylus ocellatus</i>		
Fat-tailed Gecko <i>Diplodactylus conspicillatus</i>		NM
<i>Diplodactylus pulcher</i>		NM
<i>Diplodactylus savagei</i>		
<i>Lucasium stenodactylum</i>		NM
<i>Lucasium wombeyi</i>		NM
Marbled Velvet Gecko <i>Oedura marmorata</i>		
Beaked Gecko <i>Rhynchoedura ornata</i>		NM
Jewelled Gecko <i>Strophurus elderi</i>		NM
<i>Strophurus jeanae</i>		
<i>Strophurus strophurus</i>		NM
<i>Strophurus wellingtonae</i>		
Gekkonidae (true geckoes)		
Pilbara Dtella <i>Gehyra pilbara</i>		NM
Spotted Dtella <i>Gehyra punctata</i>		NM
<i>Gehyra purpurascens</i>		NM
Variiegated Dtella <i>Gehyra variegata</i>		NM
Bynoe's Gecko <i>Heteronotia binoei</i>		NM
Carphodactylidae (knob-tailed geckoes)		
<i>Nephrurus levis</i>		NM
<i>Nephrurus wheeleri</i>		NM
Pygopodidae (legless lizards)		
<i>Delma butleri</i>		
<i>Delma elegans</i>		
<i>Delma haroldi</i>		

Table 3 (cont.).

Species	Status	Recorded
	<i>Delma nasuta</i>	NM
	<i>Delma pax</i>	NM
	<i>Delma tinctoria</i>	NM
Burton's Legless Lizard	<i>Lialis burtonis</i>	NM
Hooded Scaly-foot	<i>Pygopus nigriceps</i>	NM
Scincidae (skink lizards)		
	<i>Carlia munda</i>	NM
	<i>Carlia triacantha</i>	
	<i>Cryptoblepharus carnabyi</i>	
	<i>Cryptoblepharus plagiocephalus</i>	
	<i>Ctenotus duricola</i>	NM
	<i>Ctenotus grandis</i>	NM
	<i>Ctenotus hanloni</i>	NM
	<i>Ctenotus helenae</i>	NM
	<i>Ctenotus iapetus</i>	NM
	<i>Ctenotus leonhardii</i>	
	<i>Ctenotus maryani</i>	NM
	<i>Ctenotus pantherinus</i>	NM +
	<i>Ctenotus rubicundus</i>	
	<i>Ctenotus rufescens</i>	NM
	<i>Ctenotus rutilans</i>	
	<i>Ctenotus saxatilis</i>	NM
	<i>Ctenotus schomburgkii</i>	
	<i>Ctenotus serventyi</i>	
	<i>Ctenotus uber</i>	NM
	<i>Cyclodomorphus melanops</i>	NM
Pygmy Spiny-tailed Skink	<i>Egernia depressa</i>	NM
	<i>Egernia formosa</i>	
	<i>Eremiascincus fasciolatus</i>	NM
Sand Swimmer	<i>Eremiascincus richardsonii</i>	
	<i>Lerista bipes</i>	NM
	<i>Lerista clara</i>	NM
	<i>Lerista elegans</i>	NM
	<i>Lerista flammicauda</i>	
	<i>Lerista muelleri</i>	NM
	<i>Lerista onsloviana</i>	NM
	<i>Lerista petersoni</i>	
	<i>Lerista rolfei</i>	NM
	<i>Lerista uniduo</i>	
	<i>Lerista verhmens</i>	NM
	<i>Lerista zietzi</i>	
Dwarf Skink	<i>Menetia greyii</i>	NM
	<i>Menetia surda</i>	
	<i>Morethia ruficauda</i>	NM

Table 3 (cont).

Species	Status	Recorded
	<i>Notoscincus ornatus</i>	NM
	<i>Proablepharus reginae</i>	NM
Central Blue-tongue	<i>Tiliqua multifasciata</i>	NM
Western Blue-tongue	<i>Tiliqua occipitalis</i>	NM
Varanidae (goanna or monitor lizards)		
Ridge-tailed Monitor	<i>Varanus acanthurus</i>	NM
Short-tailed Monitor	<i>Varanus brevicauda</i>	NM
	<i>Varanus bushi</i>	
	<i>Varanus caudolineatus</i>	NM
Pygmy Desert Monitor	<i>Varanus eremius</i>	NM
Perentie	<i>Varanus giganteus</i>	
Sand Monitor	<i>Varanus gouldii</i>	NM
	<i>Varanus panoptes</i>	NM
Black-tailed Monitor	<i>Varanus tristis</i>	NM
Typhlopidae (blind snakes)		
	<i>Ramphotyphlops ammodytes</i>	NM
	<i>Ramphotyphlops grypus</i>	NM
	<i>Ramphotyphlops hamatus</i>	
	<i>Ramphotyphlops pilbarensis</i>	
Boidae (pythons)		
Pygmy Python	<i>Antaresia perthensis</i>	NM
Stimson's Python	<i>Antaresia stimsoni</i>	NM
Black-headed Python	<i>Aspidites melanocephalus</i>	
Olive Python (Pilbara)	<i>Liasis olivaceus barroni</i>	CS1 DEC
Elapidae (front-fanged snakes)		
Pilbara Death Adder	<i>Acanthophis wellsi</i>	NM
Northwestern Shovel-nosed Snake	<i>Brachyuropsis approximans</i>	
Yellow-faced Whipsnake	<i>Demansia psammophis</i>	
Rufous Whipsnake	<i>Demansia rufescens</i>	NM
Moon Snake	<i>Furina ornata</i>	NM
	<i>Parasuta monachus</i>	
Mulga Snake	<i>Pseudechis australis</i>	NM
Ringed Brown Snake	<i>Pseudonaja modesta</i>	NM
Gwardar	<i>Pseudonaja nuchalis</i>	NM
Desert Banded Snake	<i>Simoselaps anomalus</i>	NM
Rosen's Snake	<i>Suta fasciata</i>	NM
Spotted Snake	<i>Suta punctata</i>	NM
Pilbara Bandy-bandy	<i>Vermicella snelli</i>	
Number of reptile species expected:		112
Recorded:		76

Table 4. Birds that have the potential to occur in the study area.
 NM= species recorded in the area according to Naturemap (see Table 1).
 BA = species recorded by Birds Australia
 + = bird species seen during the site inspection at Turtle and
 * = birds seen during the site inspection at Range.

Species	Status	Recorded
Dromaiidae (emus) Emu <i>Dromaius novaehollandiae</i>		BA
Phasianidae (pheasants and quails) Stubble Quail <i>Coturnix pectoralis</i>		NM
Columbidae (pigeons and doves) Common Bronzewing <i>Phaps chalcoptera</i> Crested Pigeon <i>Ocyphaps lophotes</i> Spinifex Pigeon <i>Geophaps plumifera</i> Diamond Dove <i>Geopelia cuneata</i> Peaceful Dove <i>Geopelia striata</i>		BA NM+ NM BA NM+
Podargidae (frogmouths) Tawny Frogmouth <i>Podargus strigoides</i>		
Eurostopodidae (nightjars) Spotted Nightjar <i>Eurostopodus argus</i>		NM
Aegothelidae (owlet-nightjars) Australian Owlet-nightjar <i>Aegotheles cristatus</i>		NM
Apodidae (swifts) Fork-tailed Swift <i>Apus pacificus</i>	Mig.	
Accipitridae (kites, hawks and eagles) Black-shouldered Kite <i>Elanus axillaris</i> Brahminy Kite <i>Haliastur indus</i> Black-breasted Buzzard <i>Hamirostra melanosternon</i> Whistling Kite <i>Haliastur sphenurus</i> Black Kite <i>Milvus migrans</i> Square-tailed Kite <i>Lophoictinia isura</i> Brown Goshawk <i>Accipiter fasciatus</i> Collared Sparrowhawk <i>Accipiter cirrhocephalus</i> Spotted Harrier <i>Circus assimilis</i> Wedge-tailed Eagle <i>Aquila audax</i> Little Eagle <i>Hieraaetus morphnoides</i>		NM NM BA BA NM NM BA BA BA BA NM
Falconidae (falcons) Australian Kestrel <i>Falco cenchroides</i> Brown Falcon <i>Falco berigora</i> Australian Hobby <i>Falco longipennis</i> Grey Falcon <i>Falco hypoleucos</i> Black Falcon <i>Falco subniger</i> Peregrine Falcon <i>Falco peregrinus</i>	CS2 CS3 CS1	BA BA NM DEC DEC DEC
Otididae (bustards) Australian Bustard <i>Ardeotis australis</i>	CS2	DEC

Table 4 (cont).

Species	Status	Recorded
Burhinidae (stone-curlews)		
Bush Stone-curlew <i>Burhinus grallarius</i>	CS2	DEC
Charadriidae (lapwings and plovers)		
Oriental Plover <i>Charadrius veredus</i>	Mig.	
Inland Dotterel <i>Charadrius australis</i>	CS3	
Turnicidae (button-quails)		
Little Button-quail <i>Turnix velox</i>		BA *
Cacatuidae (cockatoos)		
Galah <i>Eolophus roseicapillus</i>		BA
Little Corella <i>Cacatua sanguinea</i>		NM
Cockatiel <i>Nymphicus hollandicus</i>		BA +
Psittacidae (lorikeets and parrots)		
Australian Ringneck <i>Barnardius zonarius</i>		NM
Mulga Parrot <i>Psephotus varius</i>		
Budgerigar <i>Melopsittacus undulatus</i>		BA +*
Bourke's Parrot <i>Neopsephotus bourkii</i>		
Cuculidae (cuckoos)		
Horsfield's Bronze-Cuckoo <i>Chalcites basalis</i>		NM
Black-eared Cuckoo <i>Chalcites osculans</i>		
Pallid Cuckoo <i>Cacomantis pallidus</i>		BA
Strigidae (hawk-owls)		
Southern Boobook Owl <i>Ninox novaeseelandiae</i>		NM
Tytonidae (barn owls)		
Eastern Barn Owl <i>Tyto javanica</i>		
Halcyonidae (forest kingfishers)		
Red-backed Kingfisher <i>Todiramphus pyrrhopygius</i>		NM+
Meropidae (bee-eaters)		
Rainbow Bee-eater <i>Merops ornatus</i>	Mig.	BA
Climacteridae (treecreepers)		
Black-tailed Treecreeper <i>Climacteris melanura</i>		
Ptilonorhynchidae (bowerbirds)		
Western Bowerbird <i>Ptilonorhynchus guttatus</i>		
Maluridae (fairy-wrens)		
White-winged Fairy-wren <i>Malurus leucopterus</i>		NM + *
Variiegated Fairy-wren <i>Malurus lamberti</i>		NM + *
Rufous-crowned Emu-wren <i>Stipiturus ruficeps</i>		
Striated Grasswren <i>Amytornis striatus</i>		
Acanthizidae (thornbills, scrubwrens and gerygones)		
Redthroat <i>Pyrrholaemus brunneus</i>		NM
Weebill <i>Smicronis brevirostris</i>		
Western Gerygone <i>Gerygone fusca</i>		NM
Slaty-backed Thornbill <i>Acanthiza robustirostris</i>		

Table 4 (cont.).

Species	Status	Recorded
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>	NM
Inland Thornbill	<i>Acanthiza apicalis</i>	
Pardalotidae (pardalotes)		
Red-browed Pardalote	<i>Pardalotus rubricatus</i>	NM
Striated Pardalote	<i>Pardalotus striatus</i>	NM
Meliphagidae (honeyeaters)		
Pied Honeyeater	<i>Certhionyx variegatus</i>	NM
Singing Honeyeater	<i>Lichenostomus virescens</i>	BA + *
Grey-headed Honeyeater	<i>Lichenostomus keartlandi</i>	BA
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	BA
Grey-fronted Honeyeater	<i>Lichenostomus plumulus</i>	
White-fronted Honeyeater	<i>Purnella albifrons</i>	
Yellow-throated Miner	<i>Manorina flavigula</i>	BA
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>	BA
Crimson Chat	<i>Epthianura tricolor</i>	BA
Black Honeyeater	<i>Sugomel niger</i>	NM
Brown Honeyeater	<i>Lichmera indistincta</i>	NM
Pomatostomidae (Australian babblers)		
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	NM
White-browed Babbler	<i>Pomatostomus superciliosus</i>	
Cinclosomatidae (quail-thrushes and allies)		
Chiming Wedgebill	<i>Psophodes occidentalis</i>	BA
Neosittidae (sittellas)		
Varied Sittella	<i>Daphoenositta chrysoptera</i>	
Campephagidae (cuckoo-shrikes)		
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	BA
White-winged Triller	<i>Lalage sueurii</i>	NM+
Pachycephalidae (whistlers)		
Rufous Whistler	<i>Pachycephala rufiventris</i>	NM
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	BA
Crested Bellbird	<i>Oreoica gutturalis</i>	BA
Artamidae (woodswallows)		
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>	NM
Masked Woodswallow	<i>Artamus personatus</i>	NM+
Black-faced Woodswallow	<i>Artamus cinereus</i>	BA + *
Little Woodswallow	<i>Artamus minor</i>	
Grey Butcherbird	<i>Cracticus torquatus</i>	
Pied Butcherbird	<i>Cracticus nigrogularis</i>	NM
Australian Magpie	<i>Gymnorhina tibicen</i>	BA
Rhipiduridae (flycatchers)		
Grey Fantail	<i>Rhipidura albiscapa</i>	
Willie Wagtail	<i>Rhipidura leucophrys</i>	BA

Table 4 (cont.).

Species	Status	Recorded
Corvidae (ravens and crows)		
Little Crow <i>Corvus bennetti</i>		BA
Torresian Crow <i>Corvus orru</i>		BA +
Monarchidae (monarchs and flycatchers)		
Magpie-lark <i>Grallina cyanoleuca</i>		NM
Petroicidae (robins)		
Red-capped Robin <i>Petroica goodenovii</i>		NM
Hooded Robin <i>Melanodryas cucullata</i>		
Alaudidae (larks)		
Horsfield's Bushlark <i>Mirafrja javanica</i>		NM
Megaluridae (Old World warblers)		
Rufous Songlark <i>Cincloramphus mathewsi</i>		
Brown Songlark <i>Cincloramphus cruralis</i>		BA
Spinifexbird <i>Eremiornis carteri</i>		BA
Hirundinidae (swallows)		
White-backed Swallow <i>Cheramoeca leucosterna</i>		NM
Welcome Swallow <i>Hirundo neoxena</i>		NM
Fairy Martin <i>Petrochelidon ariel</i>		NM+
Tree Martin <i>Petrochelidon nigricans</i>		BA
Nectariniidae (sunbirds and flower-peckers)		
Mistletoebird <i>Dicaeum hirundinaceum</i>		NM
Estrildidae (finches and allies)		
Zebra Finch <i>Taeniopygia guttata</i>		BA + *
Painted Finch <i>Emblema pictum</i>		BA + *
Star Finch <i>Neochima ruficauda</i>		NM
Motacillidae (pipits and true wagtails)		
Australasian Pipit <i>Anthus novaeseelandiae</i>		BA
Number of bird species that may occur:		106
Recorded:		82

Table 5. Mammals that have the potential to occur in the study area.
 FS = species recorded on other fauna surveys in the region (see methods)
 WAM = species recorded in the area by the WA Museum (see Table 1)
 DEC = species recorded on the DEC threatened fauna database
 Int. = introduced species
 + = species recorded during the site inspection at Turtle and
 * = mammals recorded during the site inspection at Range.

Species	Status	Recorded
Tachyglossidae (echidnas)		
Echidna <i>Tachyglossus aculeatus</i>		NM
Dasyuridae (dasyurid marsupials)		
Mulgara <i>Dasyercus blythi</i>	CS1	
Little Red Kaluta <i>Dasykaluta rosamondae</i>		NM
Pilbara Ningauai <i>Ningauai timealeyi</i>		NM
Long-tailed Planigale <i>Planigale ingrami</i>		
Striped-faced Dunnart <i>Sminthopsis macroura</i>		NM
Lesser Hairy-footed Dunnart <i>Sminthopsis youngsoni</i>		NM
Macropodidae (kangaroos and wallabies)		
Euro <i>Macropus robustus</i>		NM
Red Kangaroo <i>Macropus rufus</i>		NM +
Emballonuridae (sheathtail bats)		
Yellow-bellied Sheathtail Bat <i>Saccolaimus flaviventris</i>		
Common Sheathtail Bat <i>Taphozous georgianus</i>		
Vespertilionidae (ordinary bats)		
Gould's Wattled Bat <i>Chalinolobus gouldii</i>		
Arnhem Land Long-eared Bat <i>Nyctophilus arnhemensis</i>		
Lesser Long-eared Bat <i>Nyctophilus geoffroyi</i>		
Little Broad-nosed Bat <i>Scotorepens greyii</i>		
Findlayson's Cave Bat <i>Vespadelus finlaysoni</i>		
Molossidae (freetail bats)		
Northern Freetail Bat <i>Chaerephon jobensis</i>		NM
Beccari's Freetail Bat <i>Mormopterus beccarii</i>		
White-striped Freetail Bat <i>Tadarida australis</i>		
Muridae (rats and mice)		
Short-tailed Mouse <i>Leggadina lakedownensis</i>	CS2	DEC
House Mouse <i>Mus musculus</i>	Int.	NM
Spinifex Hopping Mouse <i>Notomys alexis</i>		NM
Western Pebble-mound Mouse <i>Pseudomys chapmani</i>	CS2	DEC +
Delicate Mouse <i>Pseudomys delicatulus</i>		NM
Desert Mouse <i>Pseudomys desertor</i>		
Sandy Inland Mouse <i>Pseudomys hermannsburgensis</i>		NM
Common Rock-Rat <i>Zyomys argurus</i>		NM
Leporidae (rabbits and hares)		
Rabbit <i>Oryctolagus cuniculus</i>	Int.	

Table 5 (cont.).

Species	Status	Recorded
Canidae (dogs and foxes)		
Dingo <i>Canis lupus dingo</i>		NM
Fox <i>Vulpes vulpes</i>	Int.	
Felidae (cats)		
Feral/House Cat <i>Felis catus</i>	Int.	NM *
Equidae (horses)		
Donkey <i>Equus asinus</i>	Int.	NM
Camelidae (camels)		
Camel <i>Camelus dromedarius</i>	Int.	
Bovidae (horned ruminants)		
Cow <i>Bos taurus</i>	Int.	NM
Number of mammals possible:		34
Recorded:		19

References

- Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). *The New Atlas of Australian Birds*. Royal Australasian Ornithologists Union, Victoria.
- Christidis, L. and Boles, W.E. (2008). *Systematics and Taxonomy of Australian Birds*. CSIRO Publishing, Collingwood, VIC.
- Churchill, S. (1998). *Australian Bats*. Reed New Holland, Sydney.
- Cogger, H.G., Cameron, E.E., Sadler, R.A. and Egger, P. (1993). *The Action Plan for Australian Reptiles*. Endangered Species Programme Project Number 124, Australian Nature Conservation Agency, Canberra.
- Davis, R.A. and Metcalf, B.M. (2008). The Night Parrot (*Pezoporus occidentalis*) in northern Western Australia: a recent sighting from the Pilbara region. *Emu* 108: 233-36.
- Duncan, A., Baker, G.B. and Montgomery, N. (1999). *The Action Plan for Australian Bats*. Environment Australia, Canberra.
- Environmental Protection Authority (2002). *Terrestrial Biological Surveys as an Element of Biodiversity Protection*. Position Statement No. 3. March 2002, Perth Western Australia.
- Environmental Protection Authority (2004). *Guidance for the assessment of environmental factors*. Guidance Statement No. 56. June 2004, Perth Western Australia.
- Garnett, S. and Crowley, G. (2000). *The Action Plan for Australian Birds*. Environment Australia and the Royal Australasian Ornithologists Union.
- Lee, A.K. (1995). *The Action Plan for Australian Rodents*. Environment Australia, Canberra.
- Johnstone, R.E. & Storr, G.M. (1998). *Handbook of Western Australian Birds. Volume 1: Non-passerines (Emu to Dollarbird)*. Western Australian Museum, Perth.
- Johnstone, R.E. & Storr, G.M. (2004). *Handbook of Western Australian Birds. Volume 2: Passerines (Blue-winged Pitta to Goldfinch)*. Western Australian Museum, Perth.

- Maxwell, S., Burbidge, A.A. and Morris, K. (1996). *Action Plan for Australian Marsupials and Monotremes*. Environment Australia, Canberra.
- Menkhorst, P. and Knight, F. (2001). *A field guide to the mammals of Australia*. Oxford University Press, South Melbourne.
- Storr, G.M., Smith, L.A. and Johnstone, R.E. (1983). *Lizards of Western Australia. II. Dragons and Monitors*. W.A. Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone, R.E. (2002). *Snakes of Western Australia*. W.A. Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone, R.E. (1990). *Lizards of Western Australia. III. Geckoes and Pygopods*. W.A. Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone, R.E. (1999). *Lizards of Western Australia. I. Skinks*. 2nd edition. W.A. Museum, Perth.
- Tyler, M.J. (1998). *The Action Plan for Australian Frogs*. Environment Australia, Canberra.
- Tyler, M.J. and Doughty, P. (2009). *Field Guide to Frogs of Western Australia*. 4th Edition. W.A. Museum, Perth.
- Van Dyck, S. and Strahan, R. (2008). *The Mammals of Australia*. 3rd Edition. New Holland, Sydney.
- WA Museum. (2008). Checklists of the Vertebrates of Western Australia. Available from the WA Museum Website.

Appendix A

Categories used in the assessment of conservation status.

EPBC Act and WA Wildlife Conservation Act definitions

Schedule 1: Fauna that are rare or likely to become extinct.
Schedule 2: Fauna presumed to be extinct.
Schedule 3: Migratory birds that are listed under JAMBA.
Schedule 4: Other specially protected fauna.

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

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.

Appendix B

Species listed on the EPBC Protected Matters Search Tool.



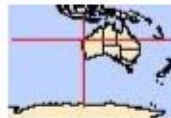
EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

Report created: 17/06/11 18:39:03



[Summary](#)

[Details](#)

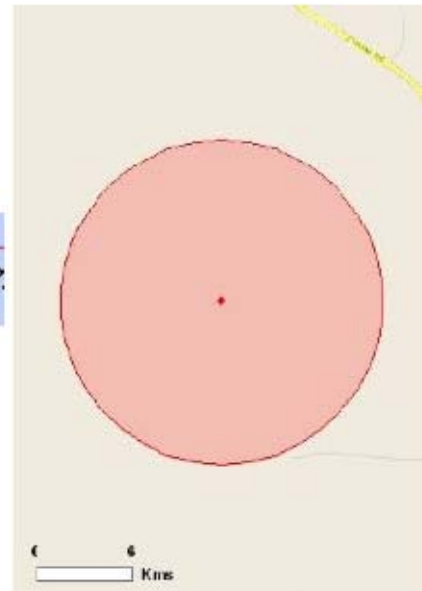
[Matters of NES](#)

[Other matters protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km

Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	None
State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	8
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species [Resource Information]

Name	Status	Type of Presence
MAMMALS		
Dasyurus cristicauda Mulgara [328]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
Rhinorictes aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat likely to occur within area

Migratory Species [Resource Information]

Name	Status	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		

Great Egret, White Egret [59541] Ardea ibis	Species or species habitat may occur within area
Cattle Egret [59542] Charadrius veredus	Species or species habitat may occur within area
Oriental Plover, Oriental Dotterel [882] Glareola maldivarum	Species or species habitat may occur within area
Oriental Pratincole [840]	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

Name	Status	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678] Ardea alba		Species or species habitat may occur within area
Great Egret, White Egret [59541] Ardea ibis		Species or species habitat may occur within area
Cattle Egret [59542] Charadrius veredus		Species or species habitat may occur within area
Oriental Plover, Oriental Dotterel [882] Glareola maldivarum		Species or species habitat may occur within area
Oriental Pratincole [840] Haliaeetus leucogaster		Species or species habitat may occur within area
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica		
Barn Swallow [662] Merops ornatus		Species or species habitat may occur within area
Rainbow Bee-eater [670]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Cane River, WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Mammals		
Capra hircus		
Goat [2]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area

Appendix C

Correspondence from the WA Museum concerning land snails

Species List from Western Australian Museum Mollusc Database
07/06/2011



Keith Lindbeck and Associates SRE Assessment

Latitude: 21°55'53"S to 22°27'55"S
Longitude: 115°01'26"E to 115°48'34"E

Family	Taxa	Comment
Camaenidae	<i>Rhagada convicta</i> (Cox, 1870)	Widespread distribution. Low-level potential for SRE
Camaenidae	<i>Rhagada</i> sp.	Medium-level potential for SRE.
Pupillidae	<i>Pupoides lepidulus</i> Adams & Angas, 1864	Widespread distribution

General Comments

The original search coordinates provided by *Keith Lindbeck and Associates* did not produce any records from the WA Museum's Mollusc Section database. The search area was expanded approximately 50km in either direction and produced just 14 records.

The tenement area, centred approximately 70km south-east of Onslow, is an area in which the WA Museum's Mollusc Section has not been able to carry out fieldwork and from which **extremely** few records of land snails have been collected and added to its Mollusc Collection from other sources. It should also be noted that, at present, only a limited proportion of the land snail material in the WA Museum's Mollusc Collection has been electronically registered. Unregistered material is, therefore, not available for this type of searching.

As a consequence, we cannot dismiss the possibility of short-range endemic (SRE) species (or of isolated and genetically distinct populations of wide-ranging mollusc species) in this area.

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