

Finder Shale EP 493 Fauna Assessment



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1 Introduction

Bamford Consulting Ecologists (BCE) was commissioned by RPS Environment and Planning Pty Ltd (RPS) to conduct a desktop fauna assessment of the Finder Shale Pty Ltd (Finder) exploration permit area (EP 493) (the permit area), in the Canning Basin. The fauna assessment is in support of Finder's planned 2016 onshore seismic survey scheduled to occur in the dry season of 2016. This report details the findings of the desktop fauna assessment.

The objectives of this desktop fauna assessment were to:

- identify environmentally sensitive fauna within the permit area; and
- review impacting processes with respect to sensitive fauna.

The assessment comprises a desktop study incorporating a review of existing literature and readily available data associated with known fauna within the permit area.

1.1 Description of Exploration Permit Area, EP 493

The permit area lies on the northern edge of the Great Sandy Desert, at the transition between the Dampierland and Great Sandy Desert Interim Biogeographic Regionalisation of Australia (IBRA) Bioregions (Environment Australia, 2000). The permit area is situated approximately 180 km south of Derby and 150 km south-east of Broome (Figure 1).

The general landscape within the permit area includes:

- Low shrubland over grasslands on sandy dunes;
- Small ironstone hills;
- Sparse, low shrubs over grassland on river flats;
- Dense shrubland over dense hummock on flat sandy loam; and
- Dense hummock grasslands with scattered trees and shrubs on flat sandy loam and laterite.

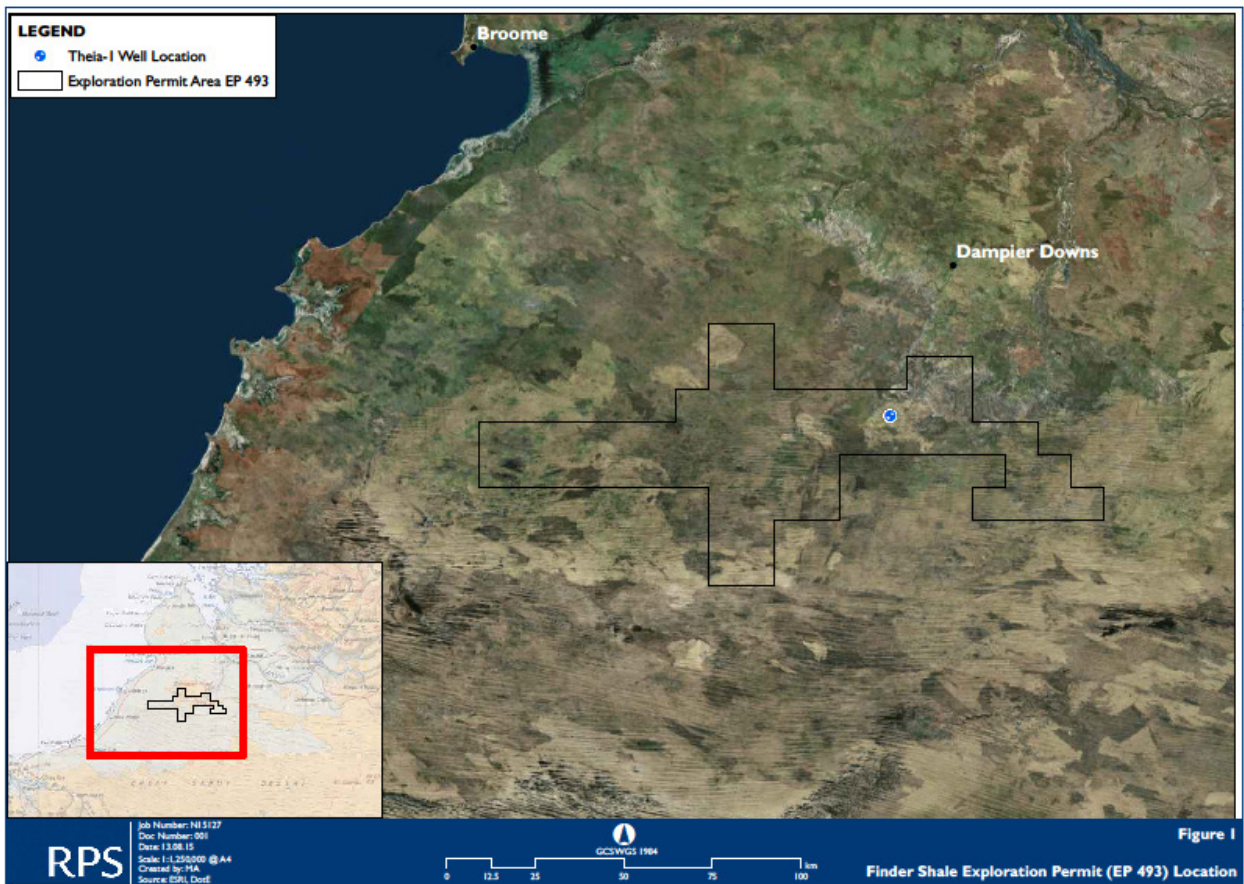


Figure 1. Finder Shale Exploration Permit Area (EP 493) location.

2 Background

2.1 Regional Description

Western Australia includes 26 IBRA bioregions that can be further divided into 58 subregions. Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell, 1995). Bioregions are affected by a range of different threatening processes and have varying levels of sensitivity to impact (EPA, 2004).

The permit area lies across the Pindanland (Dampierland 2, DAL02) and McLarty (Great Sandy Desert 1, GSD01) subregions (DSEWPac 2012) (Figure 2).

The Dampierland Bioregion falls within the Bioregion Group 3 classification of EPA (2004). This group is described as - "Bioregions of the Northern Botanical Province, native vegetation is largely contiguous but is used for commercial grazing." Key threatening processes are identified as grazing and changed fire regimes (McKenzie, May and McKenna 2003).

The Great Sandy Desert Bioregion falls within the Bioregion Group 4 classification of the EPA (2004). This group is described as - "Bioregions of the Eremaean Botanical Province, native vegetation is largely contiguous but is generally not used for commercial grazing." Key threatening processes are identified as grazing by feral herbivores, particularly camels, weed incursion and changed fire regimes (McKenzie, May and McKenna 2003).

The Pindanland subregion has an area of ca. 5,198,904 ha with a climate that is dry, hot tropical and semi-arid with summer rainfall averaging between 450 – 700 mm (Graham 2001a).

"The Pindanland subregion comprises sandplains of the Dampier Peninsula and western part of Dampier Land, including the hinterland of the Eighty Mile Beach. It is a fine-textured sand-sheet with subdued dunes and includes the paleodelta of the Fitzroy River. The vegetation is described primarily as pindan. This is the coastal, semi-arid, north-western margin of the Canning Basin" (McKenzie, May and McKenna 2003; Graham 2001a).

The McLarty subregion has an area of ca. 13,173,266 ha with a climate that is arid tropical, with summer rain and is influenced by monsoonal activity. Morning fogs are recorded during the dry season (Graham 2001b).

"This is mainly tree steppe grading to shrub steppe in south; comprising open hummock grassland with scattered trees and shrubs, on Quaternary red longitudinal sand dune fields overlying Jurassic and Cretaceous sandstones of the Canning and Armadeus Basins. Calcrete and evaporite surfaces are associated with occluded palaeo-drainage systems that traverse the desert; these include extensive salt lake chains with samphire. It includes the Mandora Paleoriver System. Red-brown dunefields with finer texture than further south. Includes gravely surfaces of Anketell Ridge along its northern margin" (McKenzie, May and McKenna 2003; Graham 2001b).

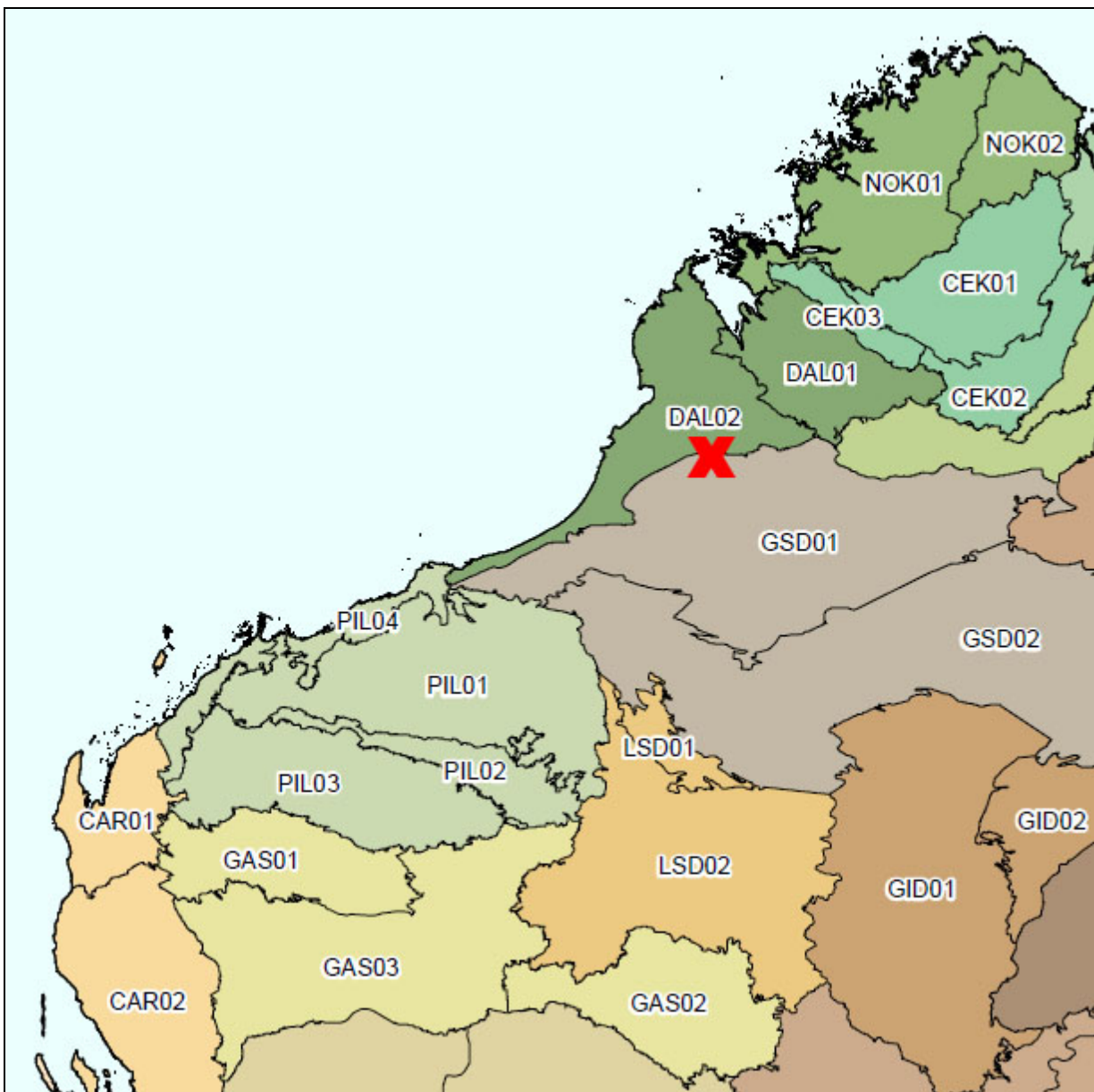


Figure 2. IBRA Subregions in north Western Australia and approximate location of the permit area, EP 493 (red cross)

3 Methods

3.1 Overview

The methods used in these investigations are based upon the general approach to fauna investigations for impact assessment as outlined in EPA Guidance Statement 56 (EPA 2004), with reference to Appendices 1 to 4 in this report. The goals of these investigations are consistent with the objectives of the EPA position statement on terrestrial biological surveys as an element of biodiversity protection (EPA 2002).

The EPA proposes two levels of investigation that differ in the approach to field investigations, Level 1 being a review of data and a site reconnaissance to place data into the perspective of the site, and Level 2 being a literature review and intensive field investigations (e.g. trapping and other intensive sampling). The level of assessment recommended by the EPA is determined by the size and location of the proposed disturbance, the sensitivity of the surrounding environment in which the disturbance is planned, and the availability of pre-existing data. As a Level 1 fauna investigation has previously been conducted in the permit area and the areas to be disturbed have yet to be identified, an updated desktop study incorporating observations made during the previous Level 1 was considered suitable.

The main objective of the desktop fauna review was to identify environmentally sensitive fauna potentially occurring within the vicinity of the permit area. The assessment was based on both unpublished and published data utilising a precautionary approach. From this, a species list was generated that can be considered to represent the vertebrate fauna assemblage of the permit area.

Note that field investigations cannot confirm the presence of an entire assemblage, or confirm the absence of a species. This requires far more work than is possible in the EIA process. For example, in an intensive trapping study, How and Dell (1990) recorded in any one year only about 70% of the vertebrate species found over three years. In a study spanning over two decades, Bamford, Bancroft and Sibbell (2010) has found that the vertebrate assemblage varies over time and space, meaning that even complete sampling at a set of sites only defines the assemblage of those sites at the time of sampling.

3.2 Desktop Assessment

3.2.1 Sources of information

Information on the fauna assemblage of the permit area was drawn from a wide range of sources. These included state and federal government databases and results of regional studies. Databases accessed included (Table 1):

- DPaW Naturemap (incorporating the Western Australian Museum's FaunaBase and the DPaW Threatened and Priority Fauna Database)
- BirdLife Australia's Atlas Database (BA)
- EPBC Protected Matters Search Tool
- BCE database.

Information from the above sources was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns were:

- Frogs: Tyler, Smith and Johnstone (2000)
- Reptiles: Storr *et al.* (1983); Storr *et al.* (1990); Storr *et al.* (1999); Storr *et al.* (2002); Wilson & Swan (2008)
- Birds: Blakers, Davies and Reilly (1984); Johnstone and Storr (1998; 2004); Barrett *et al.* (2003)
- Mammals: Menkhorst & Knight (2001); Strahan (2004); Churchill (2008); Van Dyck and Strahan (2008).

Table 1. Sources of information used for the desktop assessment.

Note: the permit area is larger than the maximum area searchable on Naturemap, thus three searches were required in order to cover the extents of EP 493. Searched August 2015.

Database	Type of records held on database	Area searched
NatureMap (DPaW 2015)	Records in the WAM and DPaW databases. Includes historical data and records on Threatened and Priority species in WA.	122°33' 19" E,18°58' 05" S – plus 40 km buffer, 122°50' 21" E,18°58' 49" S – plus 40 km buffer and 123°25' 55" E,18°56' 58" S – plus 40 km buffer.
BirdLife Australia Atlas Database (Birdlife Australia 2015)	Records of bird observations in Australia, 1998-2015.	Species list for one degree cell containing: 122.94537°S, 18.9298°E
EPBC Protected Matters (DotE 2015)	Records on matters of national environmental significance protected under the EPBC Act.	Polygon containing lease area – plus 40 km buffer

3.2.2 Previous Fauna Surveys

A short-term fauna survey was conducted by Bamford and Davies (1996) in adjacent areas; this included trapping and opportunistic surveys, and a review of a trapping survey of several locations in the Great Sandy Desert in 1981 by Parish and Treves (1981). A longer-term broad-scale survey was conducted by McKenzie and Youngson (1983), with sites across the Great Sandy Desert systematically sampled over several years. BCE has conducted several fauna surveys within EP 493, including a level 1 assessment of a well head site and associated tracks and infrastructure sites (Bamford and Chuk 2014, Bamford and Chuk 2015), and a pre-clearing survey of a ring road and access track (BCE 2015).

3.2.3 *Nomenclature and taxonomy*

As per the recommendations of EPA (2004), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's (WAM) *Checklist of the Vertebrates of Western Australia 2009*. The authorities used for each vertebrate group were: amphibians (Doughty and Maryan 2010a), reptiles (Doughty and Maryan 2010b), birds (Christidis and Boles 2008), and mammals (How, Cooper and Bannister 2009). English names of species, where available, are used throughout the text; Latin species names are presented with corresponding English names in tables in the appendices.

3.2.4 *Interpretation of species lists*

Species lists generated from the review of sources of information are generous as they include records drawn from a large region and possibly from environments not represented in the permit area. Therefore, some species that were returned by one or more of the data searches have been excluded because their ecology, or the environment within the permit area, meant that it was highly unlikely that these species would be present. Some are also known to be regionally extinct. In general, however, species returned by the desktop review process are considered to be potentially present in the survey area whether or not they were recorded during field surveys, and whether or not the permit area is likely to be important for them. This is because fauna are highly mobile, often seasonal and frequently cryptic. This is particularly important for significant species that are often rare and hard to find. Species returned from databases but excluded from species lists are presented in Appendix 6.

Interpretation of species lists generated through the desktop review included assigning an expected status within the permit area to species of conservation significance. This is particularly important for birds that may naturally be migratory or nomadic, and for some mammals that can also be mobile or irruptive. The status categories used include:

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

3.3 Key Fauna Values

This section presents the results of the desktop study in terms of the following key fauna values (described in detail in Appendix 1):

- Assemblage characteristics (uniqueness, completeness and richness) - based upon desktop assessment and information from the site inspection
- Species of conservation significance – based upon desktop assessment and site inspection
- Recognition of ecotypes or VSAs - based upon desktop assessment and site inspection
- Patterns of biodiversity across the landscape - based upon desktop assessment and site inspection
- Ecological processes upon which the fauna depend - based upon desktop assessment and site inspection.

4 Results

4.1 Vertebrate Fauna

4.1.1 Overview of fauna assemblage

The desktop study identified 266 vertebrate fauna species as potentially occurring in the permit area (see Table 2 and Appendix 5). Note that this assemblage comes from databases and includes species that may occur occasionally within the permit area, but for which it is not important (such as birds that rarely fly overhead). The vertebrate assemblage includes 33 species of conservation significance (Tables 2 & 3).

The overall fauna assemblage is relatively large, and reflects the overlap of the area across two major bioregions. Key features of the fauna assemblage expected in the permit area are:

- **Uniqueness:** It is expected that the assemblage could be separated into two groups i.e. regionally widespread species occurring over a range of local habitats and VSAs, and species locally restricted to the Great Sandy Desert. The assemblage has a level of uniqueness because of the combination of elements from adjacent bioregions.
- **Completeness:** The species assemblage from the Great Sandy Desert is missing a significant number of native mammal species. Migratory bird species may utilise the permit area occasionally.
- **Richness:** The richness of the fauna assemblage is likely to vary annually and seasonally according to climatic conditions. It can be expected to be generally rich because it spans two bioregions.

As a fauna value, the most important feature of the permit area's assemblage is the presence of two different bioregions, both of which support relatively intact native vegetation, and the presence of conservation significant species.

Table 2. Composition of vertebrate fauna assemblage expected to occur within the permit area, EP 493 (CS – levels of Conservation Significance as described in Appendix 1).

Taxon	Number of species expected	Significant fauna expected to occur		
		CS1	CS2	CS3
Frogs	6	0	0	0
Reptiles	62	2	0	0
Birds	156	18	1	3
Native Mammals	32	5	3	1
Introduced Mammals	10	-	-	-
Total	266	25	4	4

Table 3. Conservation status of significant fauna species expected to occur within the permit area, EP 493

(Species in bold have been confirmed as present in the permit area).

CS Species		Status	CS Level	Expected Status
REPTILES				
Great Desert Skink	<i>Liopholis kintorei</i>	V S1	CS1	Possible resident
Woma	<i>Aspidites ramsayi</i>	S4	CS1	Resident
BIRDS				
Fork-tailed Swift	<i>Apus pacificus</i>	M S3	CS1	Regular migrant
Cattle Egret	<i>Ardea ibis</i>	M S3	CS1	Vagrant
Eastern Great Egret	<i>Ardea modesta</i>	M S3	CS1	Vagrant
Glossy Ibis	<i>Plegadis falcinellus</i>	M S3	CS1	Vagrant
Grey Falcon	<i>Falco hypoleucos</i>	S1	CS1	Visitor
Peregrine Falcon	<i>Falco peregrinus</i>	S4	CS1	Visitor
Australian Bustard	<i>Ardeotis australis</i>	P4	CS2	Resident
Bush Stone Curlew	<i>Burhinus grallarius</i>		CS3	Resident
Oriental Plover	<i>Charadrius veredus</i>	M S3	CS1	Vagrant
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	M S3	CS1	Vagrant
Curlew Sandpiper	<i>Calidris ferruginea</i>	M S1 S3	CS1	Vagrant
Little Curlew	<i>Numenius minutus</i>	M S3	CS1	Vagrant
Marsh Sandpiper	<i>Tringa stagnatilis</i>	M S3	CS1	Vagrant
Wood Sandpiper	<i>Tringa glareola</i>	M S3	CS1	Vagrant
Oriental Pratincole	<i>Glareola maldivarum</i>	M S3	CS1	Vagrant
Major Mitchell Cockatoo	<i>Cacatua leadbeateri</i>	S4	CS1	Regular visitor
Red-tailed Black Cockatoo	<i>Calptorhynchus banksii macrorhynchus</i>		CS3	Regular visitor
Red-winged Parrot	<i>Aprosmictus erythropterus</i>		CS3	Regular visitor
Night Parrot	<i>Pezoporus occidentalis</i>	E S1	CS1	Possible resident
Princess Parrot	<i>Polytelis alexandrae</i>	V P4	CS1	Regular visitor
Rainbow Bee-eater	<i>Merops ornatus</i>	M S3	CS1	Regular migrant
Barn Swallow	<i>Hirundo rustica</i>	M S3	CS1	Regular visitor
MAMMALS				
Greater Bilby	<i>Macrotis lagotis</i>	VU S1	CS1	Resident
Northern Marsupial Mole	<i>Notoryctes caurinus</i>	EN S1	CS1	Resident
Black-flanked Rock Wallaby	<i>Petrogale lateralis</i>	VU S1	CS1	Vagrant
Northern Quoll	<i>Dasyurus hallucatus</i>	E S1	CS1	Vagrant
Crest-tailed Mulgara	<i>Dasyercus cristicauda</i>	VU S1	CS1	Possible resident
Brush-tailed Mulgara	<i>Dasyercus blythi</i>	P4	CS2	Possible resident
Little North-western Mastiff Bat	<i>Mormopterus loriae subsp. cobourgiana</i>	P1	CS2	Vagrant
Short-tailed Mouse	<i>Leggadina lakedownensis</i>	P4	CS2	Resident
Northern Brushtail Possum	<i>Trichosurus velpecula arnhemensis</i>		CS3	Resident

See Appendix 1 for descriptions of conservation significance levels. Species recorded are indicated and the predicted status of each species in the permit area is also given (as per Section 3.2.4).

EPBC Act listed species: V = Vulnerable, E = Endangered, C = Critically Endangered, M = Migratory.

WC Act listed species: S1 - S4 = Schedule 1 - 4, DEC Priority Species: P1 - P5 = Priority 1 - 5.

4.1.2 *Species of conservation significance*

Details on species of conservation significance returned from the database and expected (including those recorded) to occur in the permit area (even as vagrants) are presented in Table 3. This list includes two reptile species, 22 bird species and nine mammal species. Further information on species that might be present, including observations from the site inspection, is presented below. Note that species extinct in the region and that may have been present in the permit area historically on the basis of broad patterns of distribution, and species highly unlikely to be present based on their biology, have not been included (but are listed in Appendix 6).

Conservation Significance Level 1

Great Desert Skink (*Liopholis kintorei*)

The Great Desert Skink is often associated with sandplains and dunefields (Cogger *et al.*, 1993), where family groups will occupy the same burrow complex (Pearson *et al.* 2001). The species is threatened by altered fire regimes and predation/competition by feral species (McAlpin, 2001). It is considered to be possibly resident.

Woma (*Aspidites ramsayi*)

The Woma is widespread at low densities throughout sand plain VSAs of the semi-arid and arid inland of Western Australia. The southern population appears to have suffered significant declines, but the northern population is considered stable (Maryan, 2002). It is considered to be possibly resident.

Migratory Bird Species

The 13 migratory bird species are listed under one or more of the agreements/conventions relating to the protection of migratory species, that Australia is signatory to i.e. JAMBA, CAMBA, ROKAMBA and the Bonn Convention. The majority are waterbirds or associated with wetland habitats. The remaining three species, Fork-tailed Swift, Rainbow Bee-eater and Barn Swallow, are likely to occur as vagrants or seasonal visitors across the permit area. Only the Rainbow Bee-eater has been confirmed.

Grey Falcon (*Falco hypoleucos*)

The Grey Falcon is nomadic, inhabiting lightly timbered riverine plains. It appears to have a distribution centred around ephemeral or permanent drainage lines, utilising old nests of other species situated in the tallest trees along the river systems (Garnett and Crowley 2000). The Grey Falcon is unlikely to nest in the permit area, although may pass through or over the permit area to forage.

Peregrine Falcon (*Falco peregrinus*)

This species is found in a wide variety of habitats, with its distribution often linked to the abundance of prey. Blakers *et al.* (1984) consider that Australia is one of the strongholds of the species, since it has declined in many other parts of the world. It nests on cliffs or in very large trees so while unlikely to nest in the permit area, the site may be part of its foraging range.

Major Mitchell's Cockatoo (*Lophochroa leadbeateri*)

The Major Mitchell is sporadically distributed through arid and semi-arid Australia and may occur in sparsely timbered grasslands, shrublands and rocky outcrops. The species may be a regular visitor to the permit area.

Night Parrot (*Pezoporus occidentalis*)

A very rarely-encountered species that has not been confirmed in the region but is considered possibly present in the permit area.

Princess Parrot (*Polytelis alexandrae*)

The Princess Parrot is often associated with shrubland habitats in interdunal swales. The species appears to have declined, possibly due to the same factors that have impacted many of Australia's critical weight range mammals (Burbidge and McKenzie, 1989); its habitat may have been degraded, and the availability of its food reduced by the introduction of new and unsuitable fire regimes, and herbivores such as sheep, rabbits and camels (Garnett and Crowley 2000). The species was recorded regularly by Bamford and Davies (1996) from the Great Sandy Desert, and may be a regular visitor to the permit area.

Greater Bilby (*Macrotis lagotis*)

McKenzie and Youngson (1983) considered the species to be widespread in the Great Sandy Desert, while according to Bamford and Davies (1996) it was widespread but absent in the west where pastoral areas adjoined the desert. The presence of the species was confirmed during site inspections with foraging signs and disused burrows found within the permit area.

Northern Marsupial Mole (*Notoryctes caurinus*)

The Northern Marsupial Mole is associated with dunefields and sandplains through the north-western desert regions. Although a sampling technique has been developed (Benshemesh, 2005), little is known about this cryptic species, including whether it has declined. Threats to the species may include predation by the European Fox, Feral Cat and altered fire regimes (Maxwell, Burbidge and Morris 1996). The species is probably present along sandy ridges in the region, as this has been found to be the case in similar environments when time has allowed for detailed searching. Sandy ridges occur across much of the permit area.

Black-flanked Rock Wallaby (West Kimberley race) *Petrogale lateralis*

The Black-flanked Rock-Wallaby is associated with sandstone cliffs and escarpments. It is known to occur at scattered localities in the west Kimberley region including Grant and Edgar Ranges, Mt Wynne, Mt Anderson and Mt Alexander (Pearson & Kinnear 1997). This species may be a vagrant to the permit area.

Northern Quoll (*Dasyurus hallucatus*)

The Northern Quoll is listed as Schedule 1 under the WA Wildlife Conservation Act and Endangered under the Commonwealth's EPBC Act. This is due to the negative impact of Cane Toads (*Rhinella marina*) in more easterly parts of the Quoll's range, and the threat of Cane Toads in the north and west of the Quoll's range. If the Cane Toad does not penetrate into the Pilbara region, the Pilbara Northern Quoll population may be the only group of Northern Quolls that will not be greatly impacted by the Cane Toad. This species is often associated with rocky areas but also occurs along watercourses.

Crest-tailed Mulgara (*Dasyercus cristicauda*)

There is some confusion as to the taxonomy and distribution of the Mulgara, however it is possible that one of the *Dasyercus* taxa (*D. cristicauda* or *D. blythi*) could occur in the permit area. The species are generally associated with mature Spinifex hummock grasslands on sandplains and/or sand ridges, but have been recorded from other VSAs. Evidence of the two species (burrows, tracks and scats) is usually easy to find and no such evidence was found during the site inspection, however as only a small portion of the suitable habitat in the permit area has been searched, these two species are still considered to be possibly resident.

Conservation Significance Level 2

Australian Bustard (*Ardeotis australis*)

The Australian Bustard is nomadic and may range over very large areas, largely dependent on rainfall and hence food availability. This species may be a resident in the permit area.

Brush-tailed Mulgara (*Dasyercus blythi*)

See Crest-tailed Mulgara above (CS1).

Little North-western Mastiff Bat (*Mormopterus loriae cobourgiana*)

This species is unlikely to be found in the permit area due to lack of suitable habitat.

Kerakenga or Short-tailed Mouse (*Leggadina lakedownensis*)

This species is often associated with Gilgai and clay soils in the Pilbara, and has been found around the lower slopes of rocky hills in the Great Sandy Desert (Bamford and Davies, 1996). Although it does not appear to have declined, the species does show large fluctuations in population numbers (Moro and Kutt, 2008). It may be present in the permit area around the margins of claypan areas.

Conservation Significance Level 3

Bush Stone-curlew, Red-tailed Black Cockatoo, Red-winged Parrot and the Northern Brushtail Possum

These species are considered CS3 as all are Kimberley species that are rarely recorded as far south as the permit area.

4.1.3 Introduced / Feral Species

The desktop study identified ten introduced fauna species as potentially occurring in the permit area (Table 4). Not included, but considered likely to impact the area in the near future, is the Cane Toad (*Rhinella marina*). This species is advancing across northern Australia; already it is in the Kimberley and will almost certainly spread down through the Pilbara. It will impact on a range of fauna species (i.e. eating prey animals and poisoning predators) and have significant immediate impacts on the local fauna assemblage, but the long-term impacts are difficult to predict (DotE, 2014b). Domestic cattle and camels have been confirmed during site inspections.

Table 4. Introduced fauna species expected to occur in the permit area, EP 493 (based on desktop review and field investigations) (Species in bold have been confirmed as present in the permit area).

Common Name	Latin Name	Expected status in permit area
Domestic Cattle	<i>Bos taurus</i>	Resident (recorded)
Dromedary Camel	<i>Camelus dromedarius</i>	Resident (recorded)
Dingo/Dog	<i>Canis lupus</i>	Resident
Donkey	<i>Equus asinus</i>	Possibly resident
Horse	<i>Equus caballus</i>	Possibly resident
Feral Cat	<i>Felis catus</i>	Resident
House Mouse	<i>Mus musculus</i>	Resident
Rabbit	<i>Oryctolagus cuniculus</i>	Possibly resident
Pig	<i>Sus scrofa</i>	Occasional visitor
European Red Fox	<i>Vulpes vulpes</i>	Occasional visitor

4.2 Summary of species of conservation significance

Significant species expected to be present at least occasionally within the permit area include two reptiles, up to 22 birds and nine mammal species. Of greatest significance is the Greater Bilby as there was evidence of recent (within the previous six months) activity of this species in the permit area, and it may be vulnerable to some impacts associated with the proposal. Other significant species in the permit area are the Northern Marsupial Mole, Mulgara, Red-tailed Black Cockatoo, Major Mitchell Cockatoo, Princess Parrot and migratory birds.

4.3 Vegetation and Substrate Associations (VSAs)

The permit area straddles two biological subregions: Pindanland in the north and McLarty in the south. Key VSAs, based on vegetation mapping (Figure 3) and information from fauna assessments comprise:

- VSA 1 – Pindan shrublands over spinifex on sandplain (approximately equivalent to vegetation type 699 and 700). This VSA is abundant in the north-west of the permit area with smaller pockets in the north-east of the permit area.
- VSA 2 – Dune ridges of loose sand and swale plains of red sand to sandy loam (approximately equivalent to vegetation type 713). Vegetation of mixed *Acacia* and *Grevillea* shrubland over hummock grassland, with occasional groves of trees along the ridges. This VSA is widespread in the centre, south and east of the permit area, making up the majority of the permit area.
- VSA 3 – Low tree steppe over hummock grasslands (approximately equivalent to vegetation type 104, 701 and 703).
- VSA 4 – Low scattered trees and sparse shrubs over river flats (approximately equivalent to vegetation type 704).
- VSA 5 – Small ironstone hills (small fragments present in various vegetation types)

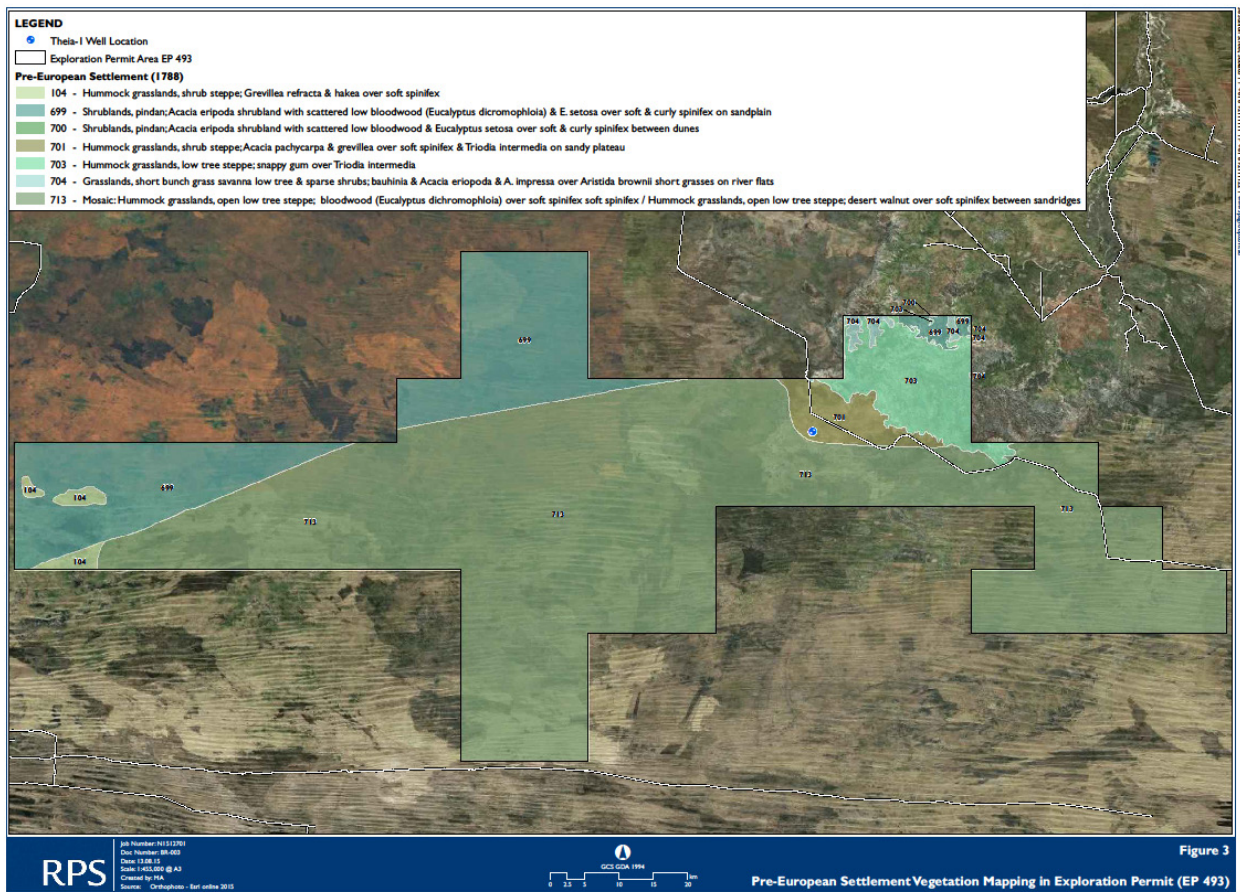


Figure 3. Pre-European Settlement Vegetation Mapping in the permit area, EP 493

4.4 Patterns of biodiversity

Investigating patterns of biodiversity can be complex and are often beyond the scope of level 2 investigations. However, some important patterns can be predicted for the region in which the permit area lies. These include:

- Fauna assemblages can be expected to vary in composition between the main VSAs.
- Sandy deserts in Australia are very rich in reptile species, with a high species richness associated with sand ridges and differences in species composition from the ridges to the interdune plains.
- The lower margins of dunes and associated shrublands/open woodlands are likely to support a concentration of bird species.
- The river flats may support migratory waterbirds on a seasonal basis.
- The fauna assemblage can alter with the seral (post-fire) stage of the vegetation.

4.5 Ecological processes

The nature of the landscape and the faunal assemblage indicate that the ecological processes that are important for ecosystem function (see Appendix 4 for descriptions and other ecological processes) include:

Local hydrology. The local hydrology is dominated by Geegully Creek in the north-east and riverflats and claypans.

Fire. There is evidence of fire scars across the permit area. Traditional fire regimes, creating a patchwork of different seral stages of vegetation across the landscape, should be encouraged. There is ample evidence that such fire regimes are beneficial to a range of native fauna species; inappropriate regimes can lead to a loss of biodiversity.

Feral species and interactions with over-abundant native species. The faunal assemblage of the permit area has already been impacted by feral species (loss of a major component of the mammal fauna), and both feral and domestic herbivores are likely leading to degradation of native vegetation. Human activity has the potential to alter the abundance of feral species.

Habitat degradation due to weed invasion. The permit area is relatively weed-free, human activity can spread weeds which could impact the local ecology.

4.6 Summary of fauna values

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

Fauna assemblage. Largely intact, although missing several medium-sized mammals. Notable for the overlap between the two bioregions.

Species of conservation significance. A large number of significant species may be present in the region, but many of these are migratory waterbirds for which there is little suitable habitat (VSA 4). Significant species of note that are likely to occur in the permit area include the Greater Bilby, Northern Marsupial

Mole, Mulgara, Red-tailed Black Cockatoo, Major Mitchell Cockatoo, Princess Parrot and migratory birds. Bilby burrows and foraging signs were found during site inspections.

Vegetation and Substrate Associations (VSAs). The permit area mostly contains Pindan shrublands over *Spinifex* on sandplain and dune ridges of loose sand and swale plains of red sand to sandy loam. Five VSAs were identified that differ in soil and vegetation type.

Patterns of biodiversity. Investigating patterns of biodiversity can be complex and are beyond the scope of level 2 investigations. Fauna assemblages can be expected to vary in composition between the main VSAs. Sandy deserts in Australia are very rich in reptile species. Dunes and shrublands/open woodlands support various bird species. River flats likely support migratory waterbirds, seasonally. The fauna assemblage may alter with the seral (post-fire) stage of the vegetation.

Key ecological processes. Main processes currently affecting the fauna assemblage in the permit area include local hydrology, fire, feral species and their interactions with each other and/or native species.

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6 Appendices

Appendix 1. Explanation of fauna values.

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

Assemblage characteristics

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

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

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

Vegetation/substrate associations (VSAs)

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

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relictual or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna.

The disturbance of even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

Patterns of biodiversity across the landscape

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

Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Western Australian Wildlife Conservation Act 1950* (Wildlife Conservation Act). In addition, the Western Australian Department of Parks and Wildlife (DPaW) formerly Department of Environment and Conservation (DEC) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, as outlined below. A full description of the conservation significance categories, schedules and priority levels defined by the IUCN, under the EPBC Act and under Wildlife Conservation Act, are provided in Appendix 3.

Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The Wildlife Conservation Act uses a series of Schedules to classify the status of "Specially Protected" fauna, but also recognizes the IUCN categories and ranks species within the Schedules using the categories of Mace and Stuart (1994).

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

In Western Australia, the DPaW has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the Wildlife Conservation Act but for which the DPaW feels there is cause for concern. Some Priority species are also assigned to the Conservation Dependent category of the IUCN.

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

This level of significance has no legislative or published recognition and is based on interpretation of species distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds.

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

Introduced species

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

Ecological processes upon which the fauna depend

These are the complex natural processes that affect fauna populations. Populations persist if the dynamics of mortality and recruitment are more or less in balance, and these are affected by myriad factors. The dynamics of fauna populations may be affected by processes such as fire regime, landscape patterns (such as fragmentation and/or linkage), the presence of feral species and hydrology. Impacts may be significant if processes are altered such that fauna populations are adversely affected, resulting in declines and even localised loss of species. Threatening processes, as outlined below, are effectively the ecological processes that can be altered to result in impacts upon fauna.

Appendix 2. Explanation of threatening processes.

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

Loss of habitat affecting population survival

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

Loss of habitat leading to population fragmentation

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

Degradation of habitat due to weed invasion leading to population decline

Weed invasion can occur as a result of development and, if this alters habitat quality, can lead to effects similar to habitat loss.

Increased direct mortality

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

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

Species interactions, including predation and competition

Changes in species interactions often occur with development. Introduced species, including the Cat, Red Fox and Rabbit may benefit from the creation of fresh water sources and food wastes and may have adverse impacts upon native species. In particular, some mammal species are very sensitive to introduced predators and the decline of many mammals in Australia has been linked to predation by the Red Fox, and to a lesser extent the Cat (Burbidge and McKenzie 1989).

Introduced grazing species, such as the Rabbit, Goat, Camel and domestic livestock, can also degrade habitats and deplete vegetation that may be a food source for native species.

Changes in the abundance of some native species at the expense of others, due to the provision of fresh watering points, can also be a concern. Harrington (2002) found the presence of artificial fresh waterpoints in the semi-arid mallee rangelands influenced the abundance and distribution of certain bird species. Common, water-dependent birds were found to out-compete some less common, water-independent species. Over-abundant native herbivores, such as kangaroos, can benefit from habitat modification and can adversely affect less abundant native species through competition and displacement.

Hydroecology

Interruption of hydroecological processes can have major effects on faunal populations. Fauna may be impacted by potential changes to groundwater level and chemistry and altered flow regime. These changes may alter vegetation across large areas and may lead to extensive habitat degradation or loss.

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

Fire

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

Dust, light, noise and vibration

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

The death of large numbers of insects has been observed around some remote mine sites and this attracts other fauna, notably native and introduced predators (M.Bamford pers. obs). The abundance of some insects can decline due to mortality around lights, although this has

previously been recorded in fragmented landscapes where populations are already under stress (Rich and Longcore 2006). Artificial night lighting may also lead to disorientation of migratory birds. Aquatic habitats and open habitats such as grasslands and dunes are likely to be more vulnerable to light spill.

Appendix 3. Categories used in the assessment of conservation status.

IUCN categories (based on review by Mace and Stuart 1994) as used for the *Environment Protection and Biodiversity Conservation Act 1999* and the *Western Australian Wildlife Conservation Act 1950*.

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 high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not Threatened.

Schedules used in the *WA Wildlife Conservation Act 1950*

Schedule 1	Rare or Likely to become Extinct.
Schedule 2	Presumed extinct.
Schedule 3	Migratory bird species listed under international treaties.
Schedule 4	Other Specially Protected Fauna

WA Department of Environment and Conservation Priority species (species not listed under the *Wildlife Conservation Act 1950*, but for which there is some concern).

Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3	Taxa with several, poorly known populations, some on conservation lands.
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.
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 (IUCN Conservation Dependent).

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

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

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

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

Threatening processes (EPBC Act)

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

- Competition and land degradation by Rabbits.
- Competition and land degradation by unmanaged Goats.
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*).
- Incidental catch (bycatch) of Sea Turtle during coastal otter-trawling operations within Australian waters north of 28 degrees South.
- Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations.
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis.
- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.
- Invasion of northern Australia by Gamba Grass and other introduced grasses.
- Land clearance.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean.
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.
- Novel biota and their impact on biodiversity.
- Predation by European Red Fox.
- Predation by exotic rats on Australian offshore islands of less than 1,000 km² (100,000 ha).
- Predation by Cats.
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.

- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species.
- The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Rhinella marina*).
- The reduction in the biodiversity of Australian native fauna and flora due to the Red Imported Fire Ant, *Solenopsis invicta*.

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

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

In addition to the above processes, the DotE has produced Significant Impact Guidelines (DotE 2013) that provide criteria for the assessment of the significance of impacts. These criteria provide a framework for the assessment of significant impacts for each matter of national environmental significance (MNES) and are intended to assist in determining whether impacts from a proposed action on any MNES are likely to be significant.

Appendix 5. Fauna expected to occur in the permit area, EP 493.

The lists in Table 5 to 8 lists are derived from the results of database and literature searches and from previous field surveys conducted in the local area. Results do not include returned marine species.

- CS = Conservation Significant
- N = Naturemap Database, searched May 2014
- BA = Birdlife Australia's Birdata database, searched May 2014
- EPBC = EPBC Protected Matters Search, searched May 2014
- D = Discovery project, undertaken in 1996
- GSD = Great Sandy Desert survey, undertaken between 1979-1983
- FS = Previous field investigation, May 2014.

Table 5. Frog species expected to occur in the permit area, EP 493.

FROGS	CS	N	EPBC	D	GSD	FS
HYLIDAE						
Giant Frog <i>Cyclorana australis</i>				X	X	
Sheep Frog <i>Cyclorana maini</i>					X	
Green Tree Frog <i>Litoria caerulea</i>		X				
Desert Tree Frog <i>Litoria rubella</i>		X			X	
LIMNODYNASTIDAE						
Desert Spadefoot <i>Notaden nichollsi</i>				X	X	
MYOBATRACHIDAE						
Mole Toadlet <i>Uperoleia talpa</i>		X			X	
Total Number of Species Expected:	6	0	3	0	2	5

Table 6. Reptile species expected to occur in the permit area, EP 493.

REPTILES		CS	N	EPBC	D	GSD	FS
AGAMIDAE							
Long-nosed Dragon	<i>Amphibolurus longirostris</i>				X	X	
Ring-tailed Dragon	<i>Ctenophorus caudicinctus</i>		X			X	X
	<i>Ctenophorus clayi</i>				X	X	
Military Dragon	<i>Ctenophorus isolepis</i>		X		X	X	
Central Netted Dragon	<i>Ctenophorus nuchalis</i>		X		X	X	
	<i>Diporiphora pindan</i>		X		X	X	
Blue-lined Dragon	<i>Diporiphora winneckeii</i>					X	
Thorny Devil	<i>Moloch horridus</i>					X	
Dwarf Bearded Dragon	<i>Pogona minor mitchelli</i>		X		X	X	
DIPLODACTYLIDAE							
Fat-tailed Gecko	<i>Diplodactylus conspicillatus</i>		X			X	
	<i>Lucasium stenodactylum</i>				X	X	
Beaked Gecko	<i>Rhynchoedura ornata</i>		X			X	
Gecko	<i>Strophurus ciliaris</i>		X		X	X	
Jewelled Gecko	<i>Strophurus elderi</i>		X			X	
Gecko	<i>Strophurus jeanae</i>		X				
CARPHODACTYLIDAE							
Pale Knob-tailed Gecko	<i>Nephrurus laevis</i>		X		X	X	
Barking Gecko	<i>Nephrurus levis</i>		X			X	
GEKKONIDAE							
Pilbara Dtella	<i>Gehyra pilbara</i>		X		X	X	
Purplish Dtella	<i>Gehyra purpurascens</i>					X	
Tree Dtella	<i>Gehyra variegata</i>				X	X	
Bynoe's Gecko	<i>Heteronotia binoei</i>		X		X	X	
PYGOPODIDAE							
	<i>Delma borea</i>		X		X		
Burton's Legless-Lizard	<i>Lialis burtonis</i>				X	X	
Western Hooded Scaly-foot	<i>Pygopus nigriceps</i>					X	
SCINCIDAE							
Desert Rainbow Skink	<i>Carlia tricantha</i>		X		X	X	
	<i>Cryptoblepharus plagiocephalus</i>					X?	
	<i>Ctenotus brooksi</i>				X	X	
	<i>Ctenotus calurus</i>					X	
	<i>Ctenotus grandis</i>		X			X	
	<i>Ctenotus helena</i>		X		X	X	X
	<i>Ctenotus nasutus</i>				X	X	
Leopard Ctenotus	<i>Ctenotus pantherinus</i>		X		X	X	X
Pianka's Ctenotus	<i>Ctenotus piankai</i>		X			X	

REPTILES		CS	N	EPBC	D	GSD	FS
	<i>Ctenotus quattuordecimlineatus</i>		X		X	X	
Rock Ctenotus	<i>Ctenotus saxatilis</i>		X			X	
	<i>Eremiascincus isolepis</i>					X	
Mosaic Desert Skink	<i>Eremiascincus musivus</i>		X			X?	
Broad-banded Sandswimmer	<i>Eremiascincus richardsonii</i>		X			X	
	<i>Lerista bipes</i>		X		X	X	
	<i>Lerista ips</i>				X	X	
	<i>Lerista vermicularis</i>				X	X	
Great Desert Skink	<i>Liopholis kintorei</i>	V S1		X		X	
Night Skink	<i>Liopholis striata</i>					X	
	<i>Menetia greyii</i>					X	
	<i>Morethia ruficauda</i>		X		X	X	X
	<i>Notoscincus ornatus</i>				X	X	
	<i>Proablepharus reginae</i>		X			X	
Central Blue-tongue	<i>Tiliqua multifasciata</i>				X	X	
VARANIDAE							
Spiny-tailed Monitor	<i>Varanus acanthaurus</i>				X	X	
Short-tailed Pygmy Monitor	<i>Varanus brevicauda</i>				X	X	
Pygmy Desert Monitor	<i>Varanus eremius</i>		X		X	X	
Pygmy Mulga Monitor	<i>Varanus gilleni</i>		X		X	X	
Bungarra	<i>Varanus gouldii</i>				X	X	
Argus Monitor	<i>Varanus panoptes</i>		X				*
Black-headed Monitor	<i>Varanus tristis</i>		X			X	
TYPHLOPIDAE							
Blind Snake	<i>Ramphotyphlops grypus</i>					X	
BOIDAE							
Stimson's Python	<i>Antaresia stimsoni</i>		X		X	X	
Woma	<i>Aspidites ramsayi</i>	S4			X	X	
ELAPIDAE							
Moon Snake	<i>Furina ornata</i>				X	X	
Mulga Snake	<i>Pseudechis australis</i>				X	X	
Ringed Brown Snake	<i>Pseudonaja modesta</i>				X	X	
Desert Banded Snake	<i>Simoselaps anomalus</i>				X	X	
Total Number of Species Expected:	62	2	32	1	37	59	5

*Reported by personnel.

Table 7. Bird species expected to occur in the permit area, EP 493.

BIRDS	CS	N	BA	EPBC	D	GSD	FS
CASUARIIDAE							
Emu <i>Dromaius novaehollandiae</i>		X			X	X	
PHASIANIDAE							
Brown Quail <i>Coturnix ypsilophora</i>			X		X	X	
ANATIDAE							
Grey Teal <i>Anas gracilis</i>			X			X	
Pacific Black Duck <i>Anas superciliosa</i>			X			X	
Hardhead <i>Aythya australis</i>			X			X	
Australian Wood Duck <i>Chenonetta jubata</i>						X	
Black Swan <i>Cygnus atratus</i>						X	
Wandering Whistling Duck <i>Dendrocygna arcuata</i>			X				
Plumed Whistling Duck <i>Dendrocygna eytoni</i>			X				
Pink-eared Duck <i>Malacorhynchus membranaceus</i>			X			X	
PODICIPEDIDAE							
Hoary-headed Grebe <i>Poliiocephalus poliocephalus</i>						X	
Australasian Grebe <i>Tachybaptus novaehollandiae</i>			X			X	
COLUMBIDAE							
Diamond Dove <i>Geopelia cuneata</i>		X	X		X	X	
Bar-shouldered Dove <i>Geopelia humeralis</i>			X				
Peaceful Dove <i>Geopelia striata</i>			X			X	
Spinifex Pigeon <i>Geophaps plumifera</i>		X					
Crested Pigeon <i>Ocyphaps lophotes</i>		X	X		X	X	
Common Bronzewing <i>Phaps chalcoptera</i>							
Flock Bronzewing <i>Phaps histrionica</i>							
PODARGIDAE							
Tawny Frogmouth <i>Podargus strigoides</i>					X		
CAPRIMULGIDAE							
Spotted Nightjar <i>Eurostopodus argus</i>		X				X	
AEGOTHELIDAE							
Australian Owlet-nightjar <i>Aegotheles cristatus</i>		X	X		X	X	
APODIDAE							
Fork-tailed Swift <i>Apus pacificus</i>	M S3		X	X			
ANHINGIDAE							

BIRDS		CS	N	BA	EPBC	D	GSD	FS
Darter	<i>Anhinga melanogaster</i>			X			X	
PHALACROCORACIDAE								
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>			X		X		
Great Cormorant	<i>Phalacrocorax carbo</i>			X				
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>			X				
Pied Cormorant	<i>Phalacrocorax varius</i>			X				
CICONIIDAE								
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>			X				
ARDEIDAE								
Cattle Egret	<i>Ardea ibis</i>	M S3			X			
Intermediate Egret	<i>Ardea intermedia</i>			X				
Eastern Great Egret	<i>Ardea modesta</i>	M S3		X	X		X	
White-necked Heron	<i>Ardea pacifica</i>		X	X			X	
Little Egret	<i>Egretta garzetta</i>			X				
White-faced Heron	<i>Egretta novaehollandiae</i>			X		X	X	
Nankeen Night Heron	<i>Nycticorax caledonicus</i>		X				X	
PLATALEIDAE								
Glossy Ibis	<i>Plegadis falcinellus</i>	M S3		X				
Australian White Ibis	<i>Threskiornis molucca</i>			X				
Straw-necked Ibis	<i>Threskiornis spinicollis</i>			X		X	X	
Royal Spoonbill	<i>Platalea regia</i>			X			X	
ACCIPITRIDAE								
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>		X	X		X	X	
Brown Goshawk	<i>Accipiter fasciatus</i>		X	X		X	X	
Wedge-tailed Eagle	<i>Aquila audax</i>		X	X		X	X	
Spotted Harrier	<i>Circus assimilis</i>		X	X		X	X	
Black-shouldered Kite	<i>Elanus axillaris</i>			X		X	X	
Whistling Kite	<i>Haliastur sphenurus</i>			X		X	X	
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>		X	X		X	X	
Little Eagle	<i>Hieraetus morphnoides</i>			X		X	X	
Black Kite	<i>Milvus migrans</i>			X		X	X	
FALCONIDAE								
Brown Falcon	<i>Falco berigora</i>		X	X		X	X	
Nankeen Kestrel	<i>Falco cenchroides</i>		X	X		X	X	

BIRDS		CS	N	BA	EPBC	D	GSD	FS
Grey Falcon	<i>Falco hypoleucos</i>	S1		X				
Australian Hobby	<i>Falco longipennis</i>			X		X	X	
Peregrine Falcon	<i>Falco peregrinus</i>	S4	X	X		X	X	
Black Falcon	<i>Falco subniger</i>						X	
GRUIDAE								
Brolga	<i>Grus rubicunda</i>			X		X	X	
RALLIDAE								
Black-tailed Native-hen	<i>Tribonyx ventralis</i>			X			X	
RECURVIROSTRIDAE								
Black-winged Stilt	<i>Himantopus leucocephalus</i>			X			X	
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>						X	
OTIDIDAE								
Australian Bustard	<i>Ardeotis australis</i>	P4	X	X		X	X	
BURHINIDAE								
Bush Stone-curlew	<i>Burhinus grallarius</i>	CS3	X	X		X		
CHARADRIIDAE								
Red-capped Plover	<i>Charadrius ruficapillus</i>			X			X	
Oriental Plover	<i>Charadrius veredus</i>	M S3		X	X			
Black-fronted Dotterel	<i>Euseyonis melanops</i>			X			X	
Red-kneed Dotterel	<i>Erythrogonys cinctus</i>			X		X	X	
Masked Lapwing	<i>Vanellus miles</i>			X				
SCOLOPACIDAE								
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	M S3		X				
Curlew Sandpiper	<i>Calidris ferruginea</i>	M S1 S3		X				
Little Curlew	<i>Numenius minutus</i>	M S3		X				
Marsh Sandpiper	<i>Tringa stagnatilis</i>	M S3		X				
Wood Sandpiper	<i>Tringa glareola</i>	M S3		X				
GLAREOLIDAE								
Oriental Pratincole	<i>Glareola maldivarum</i>	M S3		X	X			
Australian Pratincole	<i>Stiltia isabella</i>			X			X	
TURNICIDAE								
Little Button-quail	<i>Turnix velox</i>		X	X		X	X	
CACATUIDAE								
Major Mitchell Cockatoo	<i>Cacatua leadbeateri</i>	S4				X	X	
Little Corella	<i>Cacatua sanguinea</i>		X	X		X	X	

BIRDS		CS	N	BA	EPBC	D	GSD	FS
Red-tailed Black Cockatoo	<i>Calptorhynchus banksii macrorhynchus</i>	CS3						
Galah	<i>Eolophus roseicapillus</i>			X		X	X	
Cockatiel	<i>Nymphicus hollandicus</i>		X	X		X	X	
PSITTACIDAE								
Red-winged Parrot	<i>Aprosmictus erythropterus</i>	CS3	X	X				
Budgerigar	<i>Melopsittacus undulatus</i>		X	X		X	X	
Night Parrot	<i>Pezoporus occidentalis</i>	E S1						
Princess Parrot	<i>Polytelis alexandrae</i>	V P4				X	X	
CUCULIDAE								
Pallid Cuckoo	<i>Cacomantis pallidus</i>		X	X		X	X	X
Horsfield's Bronze Cuckoo	<i>Chalcites basalus</i>		X	X			X	X
Little Bronze Cuckoo	<i>Chalcites minutillus</i>			X				
Black-eared Cuckoo	<i>Chalcites osculans</i>			X		X		
CENTROPODIDAE								
Pheasant Coucal	<i>Centropus phasianinus</i>		X	X		X		
STRIGIDAE								
Southern Boobook	<i>Ninox novaeseelandiae</i>		X	X		X	X	
HALCYONIDAE								
Blue-winged Kookaburra	<i>Dacelo leachii</i>			X				
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>		X	X		X	X	
Sacred Kingfisher	<i>Todiramphus sanctus</i>			X			X	
MEROPIIDAE								
Rainbow Bee-eater	<i>Merops ornatus</i>	M S3	X	X	X	X	X	X
CORACIIDAE								
Dollarbird	<i>Eurystomus orientalis</i>			X				
PTILONORHYNCHIDAE								
Great Bowerbird	<i>Ptilonorhynchus nuchalis</i>			X				
MALURIDAE								
Variegated Fairy-wren	<i>Malurus lamberti</i>		X	X		X	X	
White-winged Fairy-wren	<i>Malurus leucopterus</i>					X	X	
Red-backed Fairy-wren	<i>Malurus melanocephalus</i>			X				
Rufous-crowned Emu-wren	<i>Stipiturus ruficeps</i>						X	

BIRDS		CS	N	BA	EPBC	D	GSD	FS
ACANTHIZIDAE								
Western Gerygone	<i>Gerygone fusca</i>		X					
White-throated Gerygone	<i>Gerygone olivacea</i>			X				
Weebill	<i>Smicrornis brevirostris</i>		X					
PARDALOTIDAE								
Red-browed Pardalote	<i>Pardalotus rubricatus</i>		X	X				X
Striated Pardalote	<i>Pardalotus striatus</i>			X				
MELIPHAGIDAE								
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>		X			X	X	X
Pied Honeyeater	<i>Certhionyx variegatus</i>		X			X	X	
Orange Chat	<i>Epthianura aurifrons</i>						X	
Yellow Chat	<i>Epthianura crocea</i>			X				
Crimson Chat	<i>Epthianura tricolor</i>		X			X	X	
Grey-headed Honeyeater	<i>Lichenostomus keartlandi</i>		X	X		X	X	X
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>		X	X		X	X	
Singing Honeyeater	<i>Lichenostomus virescens</i>		X	X		X	X	X
Brown Honeyeater	<i>Lichmera indistincta</i>		X	X		X	X	X
Yellow-throated Miner	<i>Manorina flavigula</i>		X	X		X	X	X
Black-chinned Honeyeater	<i>Melithreptus gularis</i>		X	X		X	X	
White-fronted Honeyeater	<i>Purnella albifrons</i>		X			X	X	
Black Honeyeater	<i>Sugomel niger</i>		X	X		X	X	X
POMATOSTOMIDAE								
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>		X	X		X	X	
NEOSITTIDAE								
Varied Sittella	<i>Daphoenositta chrysoptera</i>							
CINCLOSOMATIDAE								
Chiming Wedgebill	<i>Psophodes occidentalis</i>					X	X	
CAMPEPHAGIDAE								
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>		X	X		X	X	X
White-winged Triller	<i>Lalage sueurii</i>		X	X		X	X	X
PACHYCEPHALIDAE								
Grey Shrike-thrush	<i>Colluricincla harmonica</i>		X	X		X	X	

BIRDS		CS	N	BA	EPBC	D	GSD	FS
Crested Bellbird	<i>Oreoica gutturalis</i>		X	X		X	X	
Rufous Whistler	<i>Pachycephala rufiventris</i>		X	X		X	X	
ARTAMIDAE								
Black-faced Woodswallow	<i>Artamus cinereus</i>		X	X		X	X	X
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>			X				
Little Woodswallow	<i>Artamus minor</i>		X					
Masked Woodswallow	<i>Artamus personatus</i>		X	X		X	X	X
White-browed Woodswallow	<i>Artamus superciliosus</i>		X					
Pied Butcherbird	<i>Cracticus nigrogularis</i>		X	X		X	X	X
Australian Magpie	<i>Cracticus tibicen</i>			X				
RHIPIDURIDAE								
Grey Fantail	<i>Rhipidura albiscapa</i>					X		
Willie Wagtail	<i>Rhipidura leucophrys</i>		X	X		X	X	
CORVIDAE								
Little Crow	<i>Corvus bennetti</i>			X		X		
Torresian Crow	<i>Corvus orru</i>		X	X		X	X	
MONARCHIDAE								
Magpie-lark	<i>Grallina cyanoleuca</i>		X	X		X	X	
Restless Flycatcher	<i>Myiagra inquieta</i>		X	X				
PETROICIDAE								
Red-capped Robin	<i>Petroica goodenovii</i>					X	X	
Hooded Robin	<i>Melanodryas cucullata</i>			X				
Jacky Winter	<i>Microeca fascinans</i>			X				
ALAUDIDAE								
Singing Bushlark	<i>Mirafrja javanica</i>			X		X	X	
MEGALURIDAE								
Rufous Songlark	<i>Cincloramphus mathewsi</i>		X	X		X		
Brown Songlark	<i>Cincloramphus cruralis</i>			X		X	X	
HIRUNDINIDAE								
White-backed Swallow	<i>Cheramoeca leucosterna</i>					X	X	
Barn Swallow	<i>Hirundo rustica</i>	M S3		X	X			
Welcome Swallow	<i>Hirundo neoxena</i>			X				
Fairy Martin	<i>Petrochelidon ariel</i>			X		X	X	
Tree Martin	<i>Petrochelidon nigricans</i>			X		X	X	
NECTARINIIDAE								
Mistletoebird	<i>Dicaeum hirundinaceum</i>		X	X		X	X	

BIRDS	CS	N	BA	EPBC	D	GSD	FS
ESTRILDIDAE							
Painted Finch <i>Emblema pictum</i>		X	X			X	
Pictorella Mannikin <i>Heteromunia pectoralis</i>		X					
Long-tailed Finch <i>Poephila acuticauda</i>			X				
Double-barred Finch <i>Taeniopygia bichenovii</i>		X	X				
Zebra Finch <i>Taeniopygia guttata</i>		X	X		X	X	X
MOTACILLIDAE							
Australasian Pipit <i>Anthus novaeseelandiae</i>		X	X		X	X	
Total Number of Species Expected:	156	22	66	122	7	77	16

Table 8. Mammal species expected to occur in the permit area, EP 493.

MAMMALS		CS	N	EPBC	D	GSD	FS
TACHYGLOSSIDAE							
Echidna	<i>Tachyglossus aculeatus</i>		X				*
DASYURIDAE							
Brush-tailed Mulgara	<i>Dasycercus blythi</i>	P4					
Crest-tailed Mulgara	<i>Dasycercus cristicauda</i>	V S1					
Northern Quoll	<i>Dasyurus hallucatus</i>	E S1		X			
Long-tailed Dunnart	<i>Planigale ingrami</i>				X	X	
Ningbing Pseudantechinus	<i>Pseudantechinus ningbing</i>		X				
Stripe-faced Dunnart	<i>Sminthopsis macroura</i>					X	
Lesser Hairy-footed Dunnart	<i>Sminthopsis youngsoni</i>		X		X	X	
THYLACOMYIDAE							
Greater Bilby	<i>Macrotis lagotis</i>	V S1	X	X		X	*
NOTORYCTIDAE							
Northern Marsupial Mole	<i>Notoryctes caurinus</i>	E S1		X	X	X	
MACROPODIDAE							
Euro	<i>Macropus robustus</i>				X	X	
Red Kangaroo	<i>Macropus rufus</i>					X	
Black-flanked Rock Wallaby	<i>Petrogale lateralis</i>	V S1	X	X			
PHALANGERIDAE							
Northern Brushtail Possum	<i>Trichosurus velpecula arnhemensis</i>	CS3			X		
PTEROPIIDAE							
Little Red Flying-fox	<i>Pteropus scapulatus</i>				X	X	
EMBALLONURIDAE							
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>		X			X	
MOLOSSIDAE							
White-striped Freetail Bat	<i>Tadarida australis</i>					X	
Northern Freetail Bat	<i>Chaerephon jobensis</i>		X			X	
Beccari's Freetail Bat	<i>Mormopterus beccari</i>		X			X	
Little North-western Mastiff Bat	<i>Mormopterus loriae subsp. cobourgiana</i>	P1	X				
VESPERTILIONIDAE							
Gould's Wattle-tail Bat	<i>Chalinolobus gouldii</i>					X	
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>					X	
Northern Pipistrelle	<i>Pipistrellus westralis</i>		X				
Little Broad-nosed Bat	<i>Scotorepens greyii</i>		X			X	

MAMMALS		CS	N	EPBC	D	GSD	FS
Western Cave Bat	<i>Vespadelus caurinus</i>		X				
Inland Cave Bat	<i>Vespadelus finlaysoni</i>					X	
MURIDAE							
Spinifex Hopping Mouse	<i>Notomys alexis</i>				X	X	
Delicate Mouse	<i>Pseudomys delicatulus</i>		X		X	X	
Desert Mouse	<i>Pseudomys desertor</i>					X	
Sandy Inland Mouse	<i>Pseudomys hermannsburgensis</i>		X		X	X	
Western Chestnut Mouse	<i>Pseudomys nanus</i>					X	
Short-tailed Mouse	<i>Leggadina lakedownensis</i>	P4				X	
INTRODUCED MAMMALS							
Cattle	<i>Bos taurus</i>	Int	X				*
Dromedary Camel	<i>Camelus dromedarius</i>	Int	X	X	X	X	*
Dingo	<i>Canis lupus dingo</i>	Int			X	X	
Donkey	<i>Equus asinus</i>	Int		X			
Horse	<i>Equus caballus</i>	Int		X			
Feral Cat	<i>Felis catus</i>	Int	X	X	X	X	
House Mouse	<i>Mus musculus</i>	Int		X	X	X	
Rabbit	<i>Oryctolagus cuniculus</i>	Int		X		X	
Pig	<i>Sus scrofa</i>	Int		X			
European Red Fox	<i>Vulpes vulpes</i>	Int		X	X		
Total Number of Native Species Expected:	42	CS:8 Int:10	17	12	14	27	4

* Presence inferred from scats, tracks or foraging signs.

Appendix 6. Vertebrate species returned in database searches that are unlikely to be found in the permit area, EP 493.

Database searches often return species that may have been recorded historically but are now extinct in a region. In addition, databases can include species found nearby but that are unlikely to be present in the survey area due to lack of suitable habitat (e.g. aquatic species) or ecological barriers preventing them from reaching the area (e.g. island species). There are also some errors, out-of-date Latin names, zoo specimens and subtleties of distribution that are not recognised in databases. All of the species listed below are considered unlikely to be found in the exploration permit area.

Table 9. Species returned in database searches that are unlikely to occur in the permit area, EP 493.

Unlikely	
FISH	
Freshwater Sawfish	<i>Pristis pristis</i>
REPTILES	
Freshwater Crocodile	<i>Crocodylus johnstoni</i>
Salt-water Crocodile	<i>Crocodylus porosus</i>
White-bellied Mangrove Snake	<i>Fordonia leucobalia</i>
BIRDS	
Australian Shelduck	<i>Tadorna tadornoides</i>
Wedge-tailed Shearwater	<i>Ardenna pacifica</i>
Lesser Frigatebird	<i>Fregata ariel</i>
Abbott's Booby	<i>Papasula abbotti</i>
Masked Booby	<i>Sula dactylatra</i>
Brown Booby	<i>Sula leucogaster</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>
Striated Heron	<i>Butorides striata</i>
Eastern Reef Egret	<i>Egretta sacra</i>
Swamp Harrier	<i>Circus approximans</i>
Red Goshawk	<i>Erythrotriorchis radiatus</i>
White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>
Brahminy Kite	<i>Haliastur indus</i>
Eastern Osprey	<i>Pandion cristatus</i>
Eurasian Coot	<i>Fulica atra</i>
Buff-banded Rail	<i>Gallirallus philippensis</i>
Australian Crake	<i>Porzana fluminea</i>
Beach Stone-curlew	<i>Esacus magnirostris</i>
Australian Pied Oystercatcher	<i>Haematopus longirostris</i>
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>

Unlikely	
Pacific Golden Plover	<i>Pluvialis fulva</i>
Grey Plover	<i>Pluvialis squatarola</i>
Lesser Sand Plover	<i>Charadrius mongolus</i>
Greater Sand Plover	<i>Charadrius leschenaultii</i>
Common Sandpiper	<i>Actitis hypoleucos</i>
Ruddy Turnstone	<i>Arenaria interpres</i>
Sanderling	<i>Calidris alba</i>
Red Knot	<i>Calidris canutus</i>
Red-necked Stint	<i>Calidris ruficollis</i>
Great Knot	<i>Calidris tenuirostris</i>
Broad-billed Sandpiper	<i>Limicola falcinellus</i>
Asian Dowitcher	<i>Limnodromus semipalmatus</i>
Black-tailed Godwit	<i>Limosa limosa</i>
Bar-tailed Godwit	<i>Limosa lapponica</i>
Whimbrel	<i>Numenius phaeopus</i>
Eastern Curlew	<i>Numenius madagascariensis</i>
Grey-tailed Tattler	<i>Tringa brevipes</i>
Common Greenshank	<i>Tringa nebularia</i>
Common Redshank	<i>Tringa totanus</i>
Terek Sandpiper	<i>Xenus cinereus</i>
Australian Painted Snipe	<i>Rostratula australis</i>
Common Noddy	<i>Anous stolidus</i>
Whiskered Tern	<i>Chlidonias hybridus</i>
White-winged Black Tern	<i>Chlidonias leucopterus</i>
Silver Gull	<i>Chroicocephalus novaehollandiae</i>
Caspian Tern	<i>Hydroprogne caspia</i>
Bridled Tern	<i>Onychoprion anaethetus</i>
Sooty Tern	<i>Onychoprion fuscata</i>
Little Tern	<i>Sternula albifrons</i>
Roseate Tern	<i>Sterna dougallii</i>
Common Tern	<i>Sterna hirundo</i>
Fairy Tern	<i>Sternula nereis</i>
Gull-billed Tern	<i>Sterna nilotica</i>
Lesser Crested Tern	<i>Thalasseus bengalensis</i>
Crested Tern	<i>Thalasseus bergii</i>

Unlikely	
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>
Dusky Gerygone	<i>Gerygone tenebrosa</i>
Banded Honeyeater	<i>Cissomela pectoralis</i>
Rufous-throated Honeyeater	<i>Conopohila rufogularis</i>
White-gaped Honeyeater	<i>Lichenostomus unicolor</i>
Red-headed Honeyeater	<i>Myzomela erythrocephala</i>
Little Friarbird	<i>Philemon citreogularis</i>
Olive-backed Oriole	<i>Oriolus sagittatus</i>
White-breasted Whistler	<i>Pachycephala lanioides</i>
Grey Butcherbird	<i>Cracticus torquatus</i>
Broad-billed Flycatcher	<i>Myiagra ruficollis</i>
Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>
Golden-headed Cisticola	<i>Cisticola exilis</i>
Spinifexbird	<i>Eremiornis carteri</i>
Gouldian Finch	<i>Erythrura gouldiae</i>
Yellow White-eye	<i>Zosterops luteus</i>
Total Number of Species:	75