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**Perdaman Industries**  
Collie Urea Project  
Level 1 Fauna Assessment  
June 2009



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# Executive Summary

Perdaman Chemicals and Fertilisers Pty Ltd (PCF) commissioned GHD Pty Ltd (GHD) to complete a Level 1 Fauna Assessment for the proposed Collie Urea project. The Collie Urea Project is located within the proposed Collie Shotts Industrial Park (about 7.5km east of Collie).

The Level 1 Fauna Assessment included both desktop and field assessments. The desktop assessment included a review of known literature and databases including WAM, DEC and DEWHA datasets.

The field assessment was conducted between the 15/06/09 and 17/06/09. The survey was opportunistic and did not involve fauna trapping. The survey involved visual and aural surveying for any fauna species utilising the survey area. The survey area was also searched for fauna signs, such as tracks, scats, bones, diggings and feeding signs.

The field investigation recorded a total of 44 species within the survey area, five of which are introduced species. They included twenty-nine bird, ten mammal, one reptile and four amphibian species.

Five significant fauna species were identified within the survey area. These species are; Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Chuditch (*Dasyurus geoffroii*), and Western Brush Wallaby (*Macropus irma*).

Three habitat types were identified within the study area, Jarrah Woodland, Pine Plantations and cleared/disturbed areas. The survey area contains large areas of native vegetation providing suitable habitat for a number of species. In addition to the recorded conservation significant fauna, potential habitat was also recorded for Quenda, Brush-tailed Phascogales and Dells Skink.

Approximately a third of the survey area has been cleared or is open paddock, these disturbed areas have little habitat value remaining.

The clearing of vegetation that is required for this project will reduce the amount of habitat available to fauna, however the impacts of clearing are minor given the history of disturbance to the survey area and its link to quality native vegetation in the surrounding area. Displaced fauna will be able to move easily into adjoining native vegetation to the east, south and west.

A number of management measures have been detailed that aim to reduce impacts upon local fauna, in particular PCF will consider offsets for loss of fauna habitat.

# 1. Introduction

Perdaman Chemicals and Fertilisers Pty Ltd (PCF) have commissioned GHD Pty Ltd (GHD) to complete a Level 1 Fauna Assessment for the proposed Collie Urea Project. The purpose of the survey is to provide an appropriate examination and description of the receiving environment to ensure that all significant aspects relating to vertebrate fauna are identified and recorded.

The Collie Urea Project is located within the proposed Collie Shotts Industrial Park (about 7.5km east of Collie). The survey area is shown in Figure 1, Appendix A.

## 1.1 Project Details

PCF propose to establish a best practice Urea Production Plant at the proposed Shotts Industrial Park. The Project involves converting mined Collie coal from the Griffin coal mine, situated north of the Shotts Industrial Park, to urea and transporting the final product by rail to the Bunbury Port for export. The project is being developed on a commercial basis using proven technology units and scale. The project consists of:

- » The proposed Urea Production Plant;
- » A coal conveyor connecting the plant and the Griffin Coal Mine;
- » Water supply pipeline to supply water from Wellington Dam and other sources to the Plant.
- » A rail spur within the project site to facilitate loading of urea connected to the existing rail network; and
- » A storage shed, railcar unloading facilities, conveyor and shiploading facilities at Bunbury Port.

## 1.2 Previous Ecological Studies

In 2007, GHD conducted a Spring Flora, Fauna and Wetlands Assessment of the Collie Shotts Industrial Area. The aim of that report was to provide advice with respect to statutory process and any issues that may affect the proposed development. The opportunistic fauna survey identified 48 species, four of which were introduced. Two species of conservation significance were observed during the survey, Baudin's Black-Cockatoo and the Western Brush Wallaby (GHD 2008).

In 2009, a targeted Cockatoo assessment was conducted over the entire Shotts Industrial Park (including the Collie Urea Project survey area). The targeted assessment recorded potential feeding and breeding areas and examined all hollows located (GHD 2009).

## 1.3 Scope of Works

The Level 1 Fauna Assessment included both desktop and field assessments. The desktop assessment included:

- » A review of the DEC's Threatened Fauna database;
- » A review of the Western Australian Museum database (NatureMap) for fauna; and
- » A review of the Department of the Environment, Water, Heritage and Arts (DEWHA) database for areas listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The field survey verified the desktop study and provided a detailed assessment of the existing environment in the survey area and its relationship to adjoining areas. The field survey included the following actions and details:

- » An inventory of the vertebrate fauna species in the survey area through targeted searches and opportunistic recording of species;
- » Review of the fauna species considered to be rare or in need of special protection;
- » Review of the presence and abundance of pest, declared or feral animals;
- » Assessment of habitat health and value; and
- » Identification of habitats of significance.

## 2. Review of the Existing Environment

This section provides a summary of the existing environmental aspects relevant to fauna within the survey area. Information used in this section has been sourced from previous studies of the survey area (GHD 2008) in addition to scientific literature and online databases.

### 2.1 Geology, Topography and Soils

The survey area is situated within the Collie Basin. The Collie Basin forms a northwesterly trending valley in the Darling Plateau (DoW, 2007) and is surrounded by Archaean granitic rocks of the Yilgarn Craton. The basin is bilobate in shape and is filled with Permian and Recent sedimentary deposits. The area is also characterised by bedrock outcrops, and a dissected topography (Department of Fisheries, 2004).

The survey area consists of a combination of gently undulating lateritic uplands and broad shallow sandy valley floors. Based on the Environmental Geology Series Muja Map (1987) there are four soil types within the survey area. The soil in the western section of the survey area is described as pale grey sand; medium to coarse and poorly sorted and the laterite soils of the uplands are classified as massive, limonite-cemented gravels. The soils of the broad shallow sandy valley floors are described as fawn to strong brown sands, fine to medium and poorly to moderately sorted, whilst a small granite outcrop occurs on the southern edge of the survey area.

### 2.2 Wetlands, Rivers and Drainage

The desktop analysis did not identify any wetlands, rivers or drainage lines within the survey area. A small ephemeral drainage line is located within 50 m south of the survey area.

### 2.3 Reserves, Conservation Areas and Environmentally Sensitive Areas

The survey area is situated within State Forest, which is managed by the DEC. State Forest is managed for recreation and nature conservation, to protect water catchments, and to provide sustainable resource use. There are no other reserves or conservation areas in close proximity to the survey area.

The DEC on-line Native Vegetation Map Viewer was searched to determine the location of any Environmentally Sensitive Areas (ESA) within the survey area, as declared by a Notice under Section 51B of the *Environmental Protection Act 1986*. The search confirmed that there are no ESAs within the survey area.

In addition, a search was undertaken of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* protected matters tool. This search provides guidance on matters of national environmental significance and other matters protected by the *EPBC Act*. According to this search there were no World Heritage

Properties, National Heritage Places, Wetlands of International Significance (Ramsar Sites), Commonwealth Marine Areas or Threatened Ecological Communities within a one-kilometre radius of the Survey area.

## 2.4 Vegetation

### 2.4.1 Pre-European Vegetation Types

Beard (1979) has mapped the vegetation of the survey area at a scale of 1:250,000. This mapping shows the survey area to occur within the Menzies botanical district of the Southwestern Botanical Province. According to Beard (1979), the vegetation within the Survey area can be described as Medium forest: jarrah-marri. The native vegetation type represented in the survey area; its regional extent and reservation status are drawn from Shepherd *et al.* (2005). This is shown in Table 1.

**Table 1 Vegetation Type, Extent and Status, Beard (1978) Vegetation Associations, Calculations of Vegetation Extent (Shepherd, 2005).**

Vegetation Association	Description	Pre-European Extent	Current Extent	% Remaining	% Current Extent in Conservation Reserves
3	Medium forest: jarrah-marri	2,390,534 ha	1,661,219 ha	69.5%	23.4%

The extent of the vegetation in the survey area is considered to be Least Concern, with approximately 70% of the pre-European extent of remaining. The vegetation is well represented at a local scale, within the Collie State Forest, Wellington National Park and Harris River State Forest.

### 2.4.2 GHD (2008) Vegetation Assessment

GHD conducted a vegetation assessment of the area in 2007. The vegetation types and condition of the survey area is described in Table 2.

**Table 2 Vegetation Types and Condition Rating**

Vegetation Association	Vegetation Type	General Description	Vegetation Condition
1 Jarrah Forest / Woodland	1a. Jarrah – Marri – Sheoak Open Forest	<i>Eucalyptus marginata</i> – <i>Corymbia calophylla</i> with scattered <i>Allocasuarina fraseriana</i> and <i>Banksia grandis</i> (in dieback free areas) Open Forest over <i>Xanthorrhoea preissii</i> , <i>Hakea lissocarpa</i> , <i>Daviesia incrassata</i> , <i>Gastrolobium</i> sp., Shrubland, over mixed sedges and herbs on lateritic soils.	2-4

Vegetation Association	Vegetation Type	General Description	Vegetation Condition
	1b. Jarrah - Banksia - Xylomelum - Sheoak Woodland	<i>Eucalyptus marginata</i> – <i>Banksia attenuata</i> – <i>Xylomelum occidentale</i> – <i>Allocasuarina fraseriana</i> Woodland over <i>Kunzea glabrescens</i> Tall Shrubland over <i>Lysinema ciliatum</i> , <i>Leucopogon</i> spp., Low shrubland over mixed sedges, including <i>Lomandra</i> spp. and <i>Phlebocarya ciliata</i> over mixed herbs.	3
2 Mixed Open Woodland	2. Banksia spp. -Sheoak – Muja Open Woodland	<i>Allocasuarina fraseriana</i> – <i>Banksia attenuata</i> – <i>Banksia littoralis</i> – <i>Nuytsia floribunda</i> Open Woodland over mixed low shrubs of sedges dominated by <i>Lepidosperma</i> spp.	3
3 Wetlands / Damplands	3. <i>Melaleuca preissiana</i> – <i>Kunzea glabrescens</i> – Low Woodland	<i>Melaleuca preissiana</i> – <i>Kunzea glabrescens</i> Low Woodland with scattered <i>Banksia littoralis</i> over <i>Baeckea camphorosmae</i> , <i>Pericalymma ellipticum</i> , <i>Hypocalymma angustifolium</i> , <i>Pultenaea skinneri</i> , <i>Acacia extensa</i> , <i>Acacia semitrullata</i> , <i>Hibbertia stellaris</i> <i>Leucopogon</i> spp. Low shrubland over <i>Dasyopogon bromeliifolius</i> , over <i>Lyginia barbata</i> , <i>Caladenia flava</i> , <i>Drakaea</i> sp., <i>Paracalaena nigrita</i> , <i>Elythranthera brunonis</i> mixed sedges herbs. Upland Swamp areas. Includes SW Ag Zone Wetland	2-5
4 Cleared / Degraded Areas	4a. Cleared Paddock	Cleared Paddocks dominated by pasture grasses and weeds with occasional scattered native species.	6
	4b. Old Sand Quarry	Cleared / disturbed areas, with scattered remnant/recovering native vegetation with areas of rehabilitation of introduced planted tree species.	6

Generally, the vegetation within the Survey area is in Very Good (3) condition. A long history of disturbances and clearing has resulted in approximately a third of the area being completely degraded (6).

### 2.4.3 Dieback

The impact of Phytophthora dieback on native plant communities can result in changes to the vegetation structure and resistant plants such as sedges or grasses becoming dominant. This change in plant community composition and structure causes impacts throughout the whole ecosystem, including impacts on the local fauna. Changes in the availability of food resources and habitat, due to the impacts of Phytophthora dieback, may adversely affect associated groups of animals (Dieback.Org.Au, 2009)

The survey area is within an area susceptible to the development of the pathogen.

## 3. Desktop Fauna

### 3.1 Fauna of the Surrounding Area

The Western Australian Museum *NatureMap* online search was conducted for a 10 km buffer of the survey area. The search identifies terrestrial vertebrate fauna species recorded in the collections of the Western Australian Museum. The search identified the potential presence of 5 bird, 10 mammal, 17 reptile and 4 amphibian species. A full list of species recorded from the WA Museum database is presented in Table 8, Appendix C.

It should be noted that some of the records of the Museum are historical and some of the recorded species may now be locally extinct. Additionally these records may include species that are vagrants or present in the general area but not present within the survey area due to lack of suitable habitat.

#### 3.1.1 Significant Fauna

##### Legislation

The conservation status of fauna species is assessed under State and Commonwealth Acts: in particular the Western Australian *Wildlife Conservation Act 1950* and the Commonwealth *EPBC Act 1999*.

The significance levels for fauna used in the *EPBC Act* are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). The *Wildlife Conservation Act 1950* uses a set of Schedules but also classifies species using some of the IUCN categories. These categories and Schedules are described in Appendix B.

The *EPBC Act* also protects migratory species that are listed under the following International Agreements:

- » Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;
- » The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA);
- » The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); and
- » The Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (ROKAMBA).

Listed migratory species also include species identified in other international agreements approved by the Commonwealth Environment Minister. The Act also protects marine species on Commonwealth lands and waters.

In Western Australia, the DEC also produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the Western Australian *Wildlife Conservation Act 1950* but for which the Department feels there is a cause for concern. These species have no special legislative protection, but their presence would normally be considered. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. Levels of Priority are described in Table 6, Appendix B.

### **Significant Species Records**

The DEWHA maintains a database of matters of national environmental significance that are protected under the *EPBC Act*. An *EPBC Act* Protected Matters Report was generated (from the website of the DEWHA), for the matters of significance that may occur in, or may relate to, the survey area. A search of the DEC's Threatened Fauna database for any rare and priority species that may occur in the survey area was also undertaken.

From the DEWHA, DEC and WAM databases, a number of protected fauna species were identified as potentially occurring within the survey area, these species are detailed in Table 3.

It should be noted that some species that appear in the *EPBC Act* Protected Matters Search Tool are often not likely to occur within the specified area, as the search provides an approximate guidance to matters of national significance that require further investigation. The records from the DEC searches of threatened fauna provide more accurate information for the general area; however some records of sightings or trappings can be dated and often misrepresent the current range of threatened species.

**Table 3 Potentially occurring significant species within a 10km radius of the Collie Urea Project as recorded EPBC Act, DEC Threatened and Priority Fauna Database and WAM “Nature Map”**

Genus	Species	Common Name	DEC Rating	EPBC Act Rating	DEC Database	EPBC Matters Search	NatureMap
<b>Birds</b>							
<i>Calyptorhynchus</i>	<i>banksii naso</i>	Forest Red-tailed Black Cockatoo	Schedule 1		X		X
<i>Calyptorhynchus</i>	<i>baudinii</i>	Baudin's Black Cockatoo, Long-billed Black Cockatoo	Schedule 1	Vulnerable	X		X
<i>Calyptorhynchus</i>	<i>latirostris</i>	Carnaby's Black Cockatoo, Short-billed Black Cockatoo	Schedule 1	Endangered		X	
<i>Haliaeetus</i>	<i>leucogaster</i>	White-bellied Sea Eagle	Schedule 3	Migratory		X	
<i>Merops</i>	<i>ornatus</i>	Rainbow Bee-eater		Migratory		X	
<i>Ardea</i>	<i>alba</i>	Great Egret, White Egret		Migratory		X	
<i>Ardea</i>	<i>ibis</i>	Cattle Egret		Migratory		X	
<i>Apus</i>	<i>pacificus</i>	Fork-tailed Swift		Migratory		X	
<b>Reptiles</b>							
<i>Ctenotus</i>	<i>delli</i>	Dell's Skink	Priority 4		X		
<b>Mammals</b>							
<i>Dasyurus</i>	<i>geoffroii</i>	Chuditch, Western Quoll	Schedule 1	Vulnerable	X	X	
<i>Myrmecobius</i>	<i>fasciatus</i>	Numbat	Schedule 1	Vulnerable	X		
<i>Macropus</i>	<i>Irma</i>	Western Brush Wallaby	Priority 4		X		

Genus	Species	Common Name	DEC Rating	EPBC Act Rating	DEC Database	EPBC Matters Search	NatureMap
<i>Setonix</i>	<i>brachyurus</i>	Quokka	Schedule 1	Vulnerable			
<i>Phascogale</i>	<i>tapoatafa</i> subsp. ssp. (WAM M434)	Brush-tailed Phascogale, Wambenger	Schedule 1				
<i>Pseudocheirus</i>	<i>occidentalis</i>	Western Ringtail Possum	Schedule 1	Vulnerable			
<i>Isoodon</i>	<i>obesulus fusciventer</i>	Quenda	Priority 5		X		

## 4. Field Methodology

### 4.1 Methodology

The Level 1 fauna survey was conducted by GHD's qualified senior zoologist and ecologist. The survey included desktop investigations and field surveys, conducted with regard to the EPA's Guidance Statement No. 56, where possible.

The survey was conducted between the 15/06/09 and 17/06/09. The survey was opportunistic and did not involve fauna trapping. The survey involved visual and aural surveying for any fauna species utilising the survey area. The survey area was also searched for fauna signs, such as tracks, scats, bones, diggings and feeding signs.

The survey included systematic searching across all habitat types, which is an effective method of surveying for many reptile species. This involved searching through microhabitats where reptiles are known to frequent, including turning over logs or rocks, turning over leaf litter and examining hollow logs. Reptiles were also sighted as they basked during the day. Targeted bird surveys were conducted during the morning and evening hours. Nocturnal searching was also conducted over a total of four person hours and comprised of road spotting to focus on nocturnal species. This is to maximise the search effort and specifically focus on the listed target species.

Specific search strategies were used to identify any protected species in the area or evidence that they utilise the survey area.

#### 4.1.1 Nomenclature

Nomenclature used in this report follows that used by the Western Australian Museum *NatureMap* program as it is deemed to contain the most up-to-date species information for Western Australia.

#### 4.1.2 Limitations

The fauna survey undertaken was a reconnaissance survey only and thus only sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings etc. Many cryptic and nocturnal species would not have been identified during a reconnaissance survey. Extensive detailed fauna surveys, involving trapping surveys, are required to obtain a more comprehensive list of fauna species that may utilise the site.

This survey was aimed at identifying the terrestrial vertebrate fauna of the survey area; no sampling for invertebrates or aquatic species occurred.

## 5. Fauna Survey Results

### 5.1 Fauna Species

The field investigation recorded a total of 44 species within the survey area, five of which are introduced species. They included twenty-nine bird, ten mammal, one reptile and four amphibian species (Table 7, Appendix C). The number of species recorded during the survey was limited by the opportunistic nature of the survey and the period of survey (2 days).

### 5.2 Conservation Significant Fauna

Five significant fauna species were identified within the survey area. These species are; Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Chuditch (*Dasyurus geoffroii*), and Western Brush Wallaby (*Macropus irma*).

A targeted assessment for Cockatoo habitat has been conducted for the entire Shotts Industrial Park (including the Collie Urea Project survey area). The assessment included identifying hollows and evidence of feeding/breeding. The cockatoo habitat that was identified within the survey area during the targeted assessment has been mapped and presented in Figure 2, Appendix A.

Given that there is a large area of habitat for rare fauna, particularly the Cockatoo species, the project would need to be referred to the EPA for formal assessment under the *Wildlife Conservation Act 1950*. However, as the project is currently being assessed by EPA under the *Environmental Protection Act 1986*, a separate referral is not required.

#### 5.2.1 Likelihood of Occurrence of Significant Fauna

The desktop surveys indicated that a number of threatened fauna may occur within the project area (Table 3). An assessment of the potential habitat of these species and the likelihood of their occurrence in the site was considered during the fauna survey.

#### **Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) Schedule 1 Vulnerable**

The Forest Red-tailed Black-Cockatoo species is essentially a cockatoo of the Jarrah forest (*Eucalyptus marginata*) but also uses Marri (*Corymbia calophylla*) and woodlands for foraging, with Marri seeds (along with jarrah) being its principal food source (Johnstone and Kirkby, 1999).

The Forest Red-tailed Black Cockatoo has reduced in range on the Swan Coast Plain due to habitat loss and now persists in the Jarrah forest of the South West.

*Habitat Assessment:* This species was observed flying over the study area. Evidence of feeding was also observed. Areas of potential feeding and breeding habitat are present within the survey area.

### **Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) Vulnerable, Schedule 1**

Baudin's Black Cockatoo is found in the south-west of Western Australia in the Forest and Woodlands of Jarrah (*Eucalyptus marginata*), Karri (*E. diversicolor*) and Marri (*Corymbia calophylla*). It also occurs in Wandoo (*E. wandoo*) woodland, and in orchards, and is occasionally recorded in farmland and grasslands (DEC, 2009). This species mainly feeds on the seeds and flowers of Marri in the forested regions of the south-west, and the seeds of the Proteaceous *Banksia grandis*, *B. littoralis*, *B. ilicifolia*, *Hakea undulata*, *H. prostrata*, *H. trifurcata*, as well as *Erodium botrys*, Jarrah and insect larvae. They also feed on apple and pear seeds in orchards. Baudin's Cockatoo nests in mature trees such as Marri, Karri, Jarrah and Wandoo in the lower south-west of Western Australia (DEC, 2009).

The principal cause of the decline in range was clearing of the eastern margins of the forests for agriculture. Other threatening processes are killing by illegal shooting, feral honeybees (*Apis mellifera*), habitat loss, nest shortage and competition for available nest hollows (DEC, 2009).

*Habitat Assessment:* This species was observed flying over the study area. Evidence of feeding was also observed. Areas of potential feeding and breeding habitat are present within the survey area.

### **Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) Schedule 1, Endangered**

Carnaby's Cockatoo, also known as the Short-billed Black-Cockatoo, is distributed across the south-west of Western Australia in uncleared or remnant areas of *Eucalyptus* Woodland and Shrubland or kwongan heath. Breeding usually occurs in the Wheatbelt region of Western Australia, with flocks moving to the higher rainfall coastal areas to forage after the breeding season. These Cockatoos feed on the seeds of a variety of native plants, including *Allocasuarina*, *Banksia*, *Dryandra*, *Eucalyptus*, *Grevillea* and *Hakea*, and some introduced plants. They will also feed on the nectar from flowers of a number of species, and on insect larvae.

Over the last 50 years most of the feeding habitat of Carnaby's Black-Cockatoo has been destroyed by agricultural clearing. Any suitable habitat that remains is fragmented, and often degraded by soil salinity and weed invasion. Feeding habitat is often so far away from nests that the growth rate and survival of nestlings is significantly reduced. The original food sources for Carnaby's Black-Cockatoo have been largely replaced by urban development and introduced pine plantations.

*Habitat Assessment:* This species was observed flying over the study area. Evidence of feeding was also observed. Areas of potential feeding and breeding habitat are present within the survey area.

### **Dell's Skink (*Ctenotus delli*) Priority 4**

Dell's skink occurs in the higher rainfall zone close to the Darling Scarp. This species occurs in the Darling Range from Mundaring south nearly to Collie, mainly on laterites and clays.

*Habitat Assessment:* This species has been recorded from the survey area in the past and is considered likely to be present.

### **Chuditch (*Dasyurus geoffroi*) Schedule 1, Vulnerable**

The Chuditch or Western Quoll formerly ranged over nearly 70% of Australia but now retains only a patchy distribution through the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-western WA. This reduction in range and decline in population numbers have been caused by habitat alteration, impacts from the introduction of foxes and cats, hunting and poisoning (Orell and Morris, 1994). This species tends to now be restricted to the more open Jarrah forests and woodlands to the north of Manjimup (Orell and Morris, 1994) and northern Jarrah forest (Orell and Morris, 1994). This species is currently listed as Vulnerable on the EPBC Act.

It currently occurs in sclerophyll forests, heath and mallee shrublands of the southwest region of Western Australia, and the southern Wheatbelt. The Chuditch occurs at low densities, even in quality habitats of coastal areas.

*Habitat Assessment:* Scats of this species were identified within 50 m of the survey area. It is likely to utilize the survey area as a source for foraging and refuge.

### **Numbat (*Myrmecobius fasciatus*) Vulnerable, Schedule 1**

The numbat is a small, banded, diurnal marsupial that feeds solely on termites. This species once ranged widely in southern semi-arid and arid Australia, distributed within a number of vegetation types. However, the numbat's current distribution is limited to Dryandra and Perup/Kingston area east of Manjimup and a number of nature reserves into which it has been reintroduced. This species occupies a number of habitat types including Jarrah forest, open eucalypt woodland, *Banksia* woodland and tall closed shrubland (Van Dyck and Strahan, 2008).

The numbat has been threatened by a number of factors since European colonization of Western Australia including predation by foxes, clearing of native vegetation and changed fire regimes.

*Habitat Assessment:* This species was recorded within the survey area in the 1980s. Considering the level of disturbance of habitat and the fact that they have not been recorded since, it is considered unlikely that this species remains within the survey area.

### **Western Brush Wallaby (*Macropus irma*) Priority 4**

The Western Brush Wallaby is a medium sized macropod and is a grazer, found primarily in open forest and woodland. This species was once very common in the south-west of Western Australia but has undergone a reduction in range and a significant decline in abundance in its current habitat. The decline in populations of this species has resulted from extensive clearing within its original distribution and from predation of juvenile Western Brush Wallabies by foxes (DEC, 2009).

*Habitat Assessment:* This species is adaptable to both disturbed and native bush. It is known to be within the survey area and was sighted during both the current and 2007 surveys.

### **Mainland Quokka (*Setonix brachyurus*) Vulnerable, Schedule 1**

The current distribution of the Quokka includes Rottnest and Bald Islands, and at least 25 sites on the mainland, including Two Peoples Bay Nature Reserve, Torndirrup National Park, Mt Manypeaks National Park, Walpole-Nornalup National Park, and swamp areas through the south-west forests from Jarrahdale to Walpole (DEC 2009).

The Quokka tend to inhabit areas that provide refuge such as low dense heath, low forest (*Acacia rostellifera*) and the salt marsh and lakeside communities. The mainland Quokka lives in the Darling Range and south-west regions of Western Australia, mostly inhabiting densely vegetated swamps and sometimes tea-tree thickets on sandy soils along creek systems and dense heath on slopes.

Much of the decline of the Quokka coincided with the arrival of the fox in the south-west of Western Australia in the late 1920s. Clearing and burning of remnant swamp habitat has also contributed to their decline through increased exposure to fox predation.

*Habitat Assessment:* This species has not been recorded from the vicinity of the survey area in the past. It is considered unlikely to be present within the survey area.

**Brush-tailed Phascogale, Wambenger (*Phascogale tapoatafa subsp. ssp* (WAM M434) Schedule 1, Vulnerable**

This subspecies of the Brush-tailed Phascogale (BTP) is observed in dry sclerophyll forests and open woodlands with a generally spare understorey. This species' habitat requirements also include hollow-bearing trees, rotted stumps or tree cavities which they use as nest sites (Van Dyck and Strahan, 2008). Tree hollows that have a small and secure entrance with a large internal cavity are highly favoured by breeding BTPs. Brush-tailed Phascogale will also use existing bird's nests as their small size and weight allows them to use such existing nests successfully (Van Dyck and Strahan, 2008).

Habitat clearing and fragmentation as a result of agriculture and land development; and habitat alteration from logging and mining have reduced the availability of trees with hollows required for this species to nest and breed. Another cause for decline of this species is predation by foxes and cats. What suitable habitat remains is often fragmented, isolating populations and impeding genetic exchange.

*Habitat Assessment:* Likely to be present. There are a number of hollow bearing trees within the survey area that could be utilized by this species.

**Western Ring-tail Possum (*Pseudocheirus occidentalis*) Schedule 1, Vulnerable**

Western Ring-tail Possums occur only in the south west region of Western Australia where they feed upon Peppermint (*Agonis flexuosa*) and *Eucalyptus* trees (Menkhorst 2004). The species is now restricted to wetter coastal areas of the south west; with smaller populations occurring inland in Jarrah, Wandoo and Marri forests (Menkhorst 2004).

*Habitat Assessment* This species is unlikely to be present within the survey area. There was little peppermint present and the survey area was too open to provide good habitat.

### **Quenda (*Isoodon obesulus fusciventer*) Priority 5**

The Quenda or Southern Brown Bandicoot, is an omnivorous marsupial that occurs in the southwest of Western Australia. This species prefers areas with dense understorey vegetation, particularly around swamps and along watercourses. However, it also occurs in woodlands, and may use less ideal habitat where this habitat occurs adjacent to the thicker, more desirable vegetation.

The Quenda is a Priority 5 species, which means that it is not considered threatened but is subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years. Quenda populations on the Swan Coastal Plain are threatened by development in this region, which has resulted in loss of habitat. This species is relatively common in parts of the greater Perth and south west region.

*Habitat Assessment:* Likely to be present. Areas of dense scrubby vegetation are present which would provide good habitat for Quenda. This species has been recorded from within the vicinity of the survey area in the recent past. No diggings were observed during the fauna survey.

### **Migratory Bird Species**

A number of the species included in the list of significant fauna species that could potentially occur in the project area were migratory terrestrial, marine and wetland species. There is the potential for terrestrial and marine migratory bird species, such as the White-bellied Sea-Eagle, to occur occasionally within the survey areas.

Many of these bird species have extended home ranges and vagrants of the study areas with use being opportunistic. The study area is not considered to contain significant habitat for marine and migratory species. Potential impacts on these species are considered to be negligible.

## **5.3 Introduced/Pest fauna**

Five introduced or domestic species were observed within the site, the Pig (*Sus scrofa*), Rabbit (*Oryctolagus cuniculus*), Domestic Dog (*Canis domesticus*), Fox (*Vulpes vulpes*) and the Laughing Kookaburra (*Dacelo novaeguineae*).

## **5.4 Fauna Habitat**

### **5.4.1 Habitat Types**

Three habitat types were identified within the study area. The location of these habitats is presented in Figure 1, Appendix C.

#### **Habitat 1: Jarrah Woodland**

Jarrah woodland has a high fauna habitat value. The vegetation within the woodland can be split into three broad vegetation types: Jarrah-Marri-Sheoak Open Forest, Jarrah-Banksia-Xylomelum-Sheoak Woodland and Banksia-Sheoak-Muja Open

Woodland. The Jarrah woodland has an intact understorey and would provide good habitat for reptiles and small ground mammals e.g quenda.

#### **Habitat 2: Pine Plantation**

A lack of species diversity within a plantation means the fauna value of this habitat type is diminished. Bird species, including the cockatoo, may feed upon the pines.

#### **Habitat 3: Cleared/Disturbed Areas**

The cleared/disturbed areas constitute approximately one third of the survey area and provide very poor fauna habitat value. A small number of isolated large trees remain and may be utilised by cockatoos for feeding or breeding.

### **5.4.2 Habitat Value**

Within the vicinity of survey area, the extent of vegetation has had a high degree of historical disturbance whilst access tracks, roads and existing infrastructure have dissected the vegetation into a series of relatively narrow blocks. However, the vegetation types are considered to be relatively unaltered, and good fauna habitat remains. The Survey area is adjacent to native vegetation, pine plantations and a coal mine to the north.

The Survey area contains large areas of native vegetation providing suitable habitat for a number of species, including conservation significant fauna. Five conservation significant fauna were recorded and potential habitat for Quenda, Brush-tailed Phascogales and Dells Skink is present. Approximately a third of the survey area has been cleared or is open paddock, these disturbed areas have little habitat value remaining.

The habitat value to each of the recorded significant fauna species is discussed below:

#### **Western Brush Wallaby**

The Western Brush Wallaby is known to occur within the survey area, being observed on two occasions (2007 and 2009). Whilst good vegetation for this species occurs within the survey area native vegetation of similar or better quality is available in the bushland adjacent to the Survey area.

#### **Cockatoos**

Carnaby's Black Cockatoo, Baudin's Black Cockatoo, Forest Red-tailed Black Cockatoo are all recorded as using the site as foraging with evidence found of feeding in *Banksia sp.*, Marri, Jarrah and *Allocasuarina sp.* To date no breeding has been recorded on the site however a number of suitable trees have been identified as bearing suitable sized hollows.

Potential feeding and breeding habitat is present within the survey area. The location of feeding and breeding areas is presented in Figure 2, Appendix C.

#### **Chuditch**

Chuditch were identified at the site through the presence of scats. Scats were found on logs in areas of good vegetation cover. Chuditch are known (particularly males) to

use faecal matter on logs or rocky areas too presumably mark territory (Brent Johnson pers comm.). Chuditch are known to be in the region and are well documented from the Collie area including Wellington Dam and Honeymoon Pool areas.

The clearing of vegetation that is required for this project will reduce the amount of habitat available to each of the above fauna, however the impact of clearing is minor given the history of disturbance to the survey area and its link to quality native vegetation in the surrounding area. Displaced fauna will be able to move easily to areas of adjoining native vegetation.

#### **5.4.3 Habitat Linkages**

Fauna corridors and habitat linkage are important to allow animals to move between areas of resource availability. Such corridors are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction.

Habitat corridors are important in areas where extensive clearing has occurred to help overcome the effects of habitat fragmentation. These corridors assist in maintaining genetic diversity through connection of gene pools, enabling recolonisation of disturbed areas and the provision of habitat. Where contiguous bushland areas can not be maintained a connection can still be maintained through “stepping stones”, which are isolated patches of vegetation close enough together to allow very mobile e.g bird species to move between them. Stepping stones can provide shelter from predators and rest sites.

The proposed works will cause further fragmentation to an already fragmented area.

The area between the Griffin and Premier Coal mines, of which the urea plant site takes up the western section, offers value as a habitat linkage and fauna corridor between the south and north sides of Coalfields and Shotts Road.

## 6. Assessment of Fauna Issues

### 6.1 Potential Fauna Impacts

The main impacts on fauna are:

- » *Habitat fragmentation due to vegetation clearing:* The vegetation within and surrounding the survey area has had a high degree of historical disturbance whilst access tracks, roads and existing infrastructure have dissected the vegetation into a series of relatively narrow blocks. The proposed works will cause further fragmentation to the area.
- » *Habitat loss and damage:* The proposed development will cause a loss of fauna habitat. Of particular concern is the loss of habitat utilised by significant fauna. The survey area contains potential feeding and breeding habitat for Cockatoo species. In addition to habitat for the Chuditch and Western Brush Wallaby.
- » *Death or harm to fauna species:* Any construction works have the potential to cause death or harm to fauna species. Vegetation clearing and vehicle movements are likely to result in an increased incidence of animal death or injury. Slower moving land animals (including mammals, reptiles and amphibians) are most at risk, as they are often unable to vacate disturbed areas of vegetation quickly enough to avoid harm. Animals may become disorientated following destruction of their current habitat ranges. Therefore, clearing in disturbed areas first and working into habitat not to be cleared may steer fauna in a safe direction. The use of a fauna clearance team will also assist in the safe removal of fauna such as the Brushtail Possum, from the disturbance area.
- » *Weed introduction and invasion:* Approximately a third of the survey area has had a high degree of disturbance and contains weeds that are relatively widespread. Disturbance from the proposed activities has the potential to introduce and/or spread weeds to the area directly impacted by, and adjacent to, the clearing. Introduced weeds may alter the availability of suitable habitat for some ground dwelling species.

### 6.2 Management of Potential Impacts

Impacts on fauna can be minimised and managed by a number of measures which are outlined below:

- » Management measures will be implemented to ensure clearing does not cause appreciable land degradation, including preventing erosion from the cleared areas.
- » Management measures will be implemented to minimize the introduction and spread of weeds, such as avoiding movement of soils containing weedy species.
- » Management measures will be implemented to prevent impacts on adjacent fauna from pollution, such as litter and oil spills.
- » Measures will be implemented to reduce the risk of fire starting from activities at site.

- » Destruction of fauna habitat (outside of the proposed area) will be minimised during clearing. Dead, standing or fallen timber will be retained as habitat, wherever possible and used if any rehabilitation of areas is undertaken.
- » When required, the use of a fauna clearance team will be used to remove and relocate disturbed fauna and venomous animals.
- » Management measures can minimise the impact upon significant fauna species, these measures will include;
- » Where possible large stags with hollows will be left.
- » If large trees with hollows are removed then the hollows will be salvaged and donated to the Cockatoo care groups to support captive breeding efforts.
- » To assist in successful breeding events, areas not in use, buffers and areas to be rehabilitated will be planted with desirable feeding species for Cockatoos.
- » The loss of suitable habitat will be offset by regeneration of degraded vegetation or protection of existing habitat, in other areas.

## 7. Conclusions

A Level 1 Fauna survey was undertaken by GHD Pty Ltd for the proposed Collie Urea Project, located approximately 7.5 km east of Collie Townsite.

The following is a summary of the investigation:

- » The field investigation recorded a total of 44 species within the survey area, five of which are introduced species. They included twenty-nine bird, ten mammal, one reptile and four amphibian species
- » Five significant fauna species were identified within the survey area. These species are; Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Chuditch (*Dasyurus geoffroii*), and Western Brush Wallaby (*Macropus irma*).
- » The Western Brush Wallaby (P4) was observed in both the current and 2007 fauna surveys. The species is known to be able to adapt to degraded vegetation. Given the immediate proximity to surrounding bushland, this species is unlikely to be dependent on the project area for its survival.
- » An assessment of potential breeding and feeding habitat for Cockatoo species has been presented in Figure 1, Appendix A.
- » Chuditch scats were observed within 50 m of the study area. Avoidance of clearing of habitat and severing of habitat linkages should be the first priority for managing impacts on Chuditch.
- » The Survey area contains large areas of native vegetation providing suitable habitat for a number of species. Three habitat types were identified within the study area, Jarrah Woodland, Pine Plantations and cleared/disturbed areas. In addition to the recorded conservation significant fauna, potential habitat was also recorded for Quenda, Brush-tailed Phascogales and Dells Skink.
- » PCF will consider offsets for loss of fauna habitat in addition to other management measures, as part of best practice environmental management actions.

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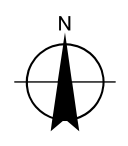
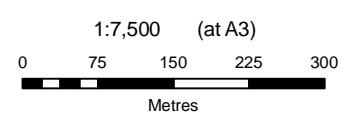
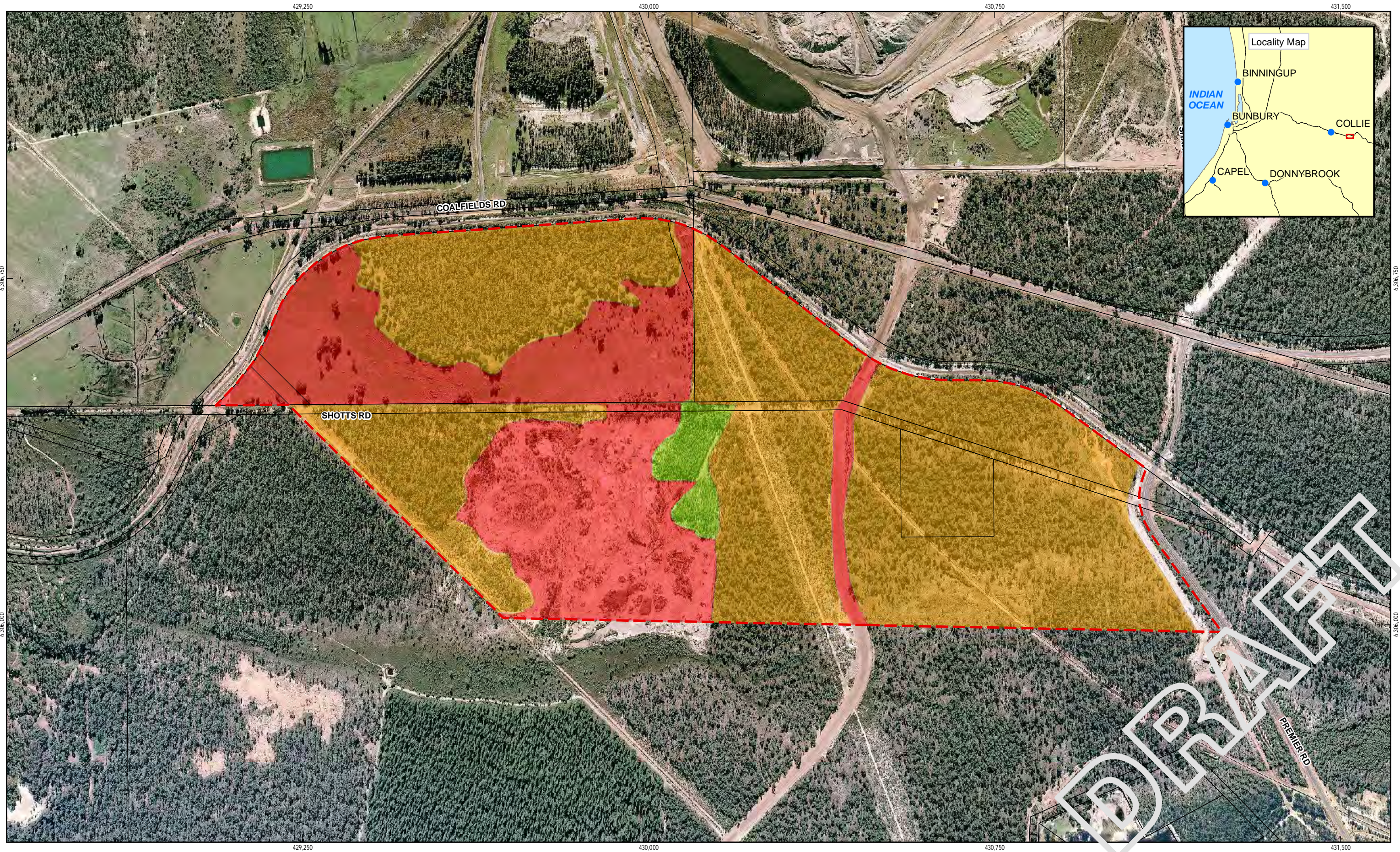
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## Appendix A

# Figures

**Figure 1 Fauna Habitat**

**Figure 2 Potential Cockatoo Breeding and Feeding Areas**



LEGEND	
	Survey Area
	Jarrah Woodland
	Pine Plantation
	Cleared/Disturbed
	Cadastre

Map Projection: Transverse Mercator  
 Horizontal Datum: Geocentric Datum of Australia (GDA)  
 Grid: Map Grid of Australia 1994, Zone 50

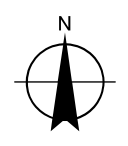
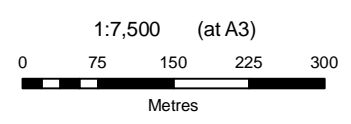
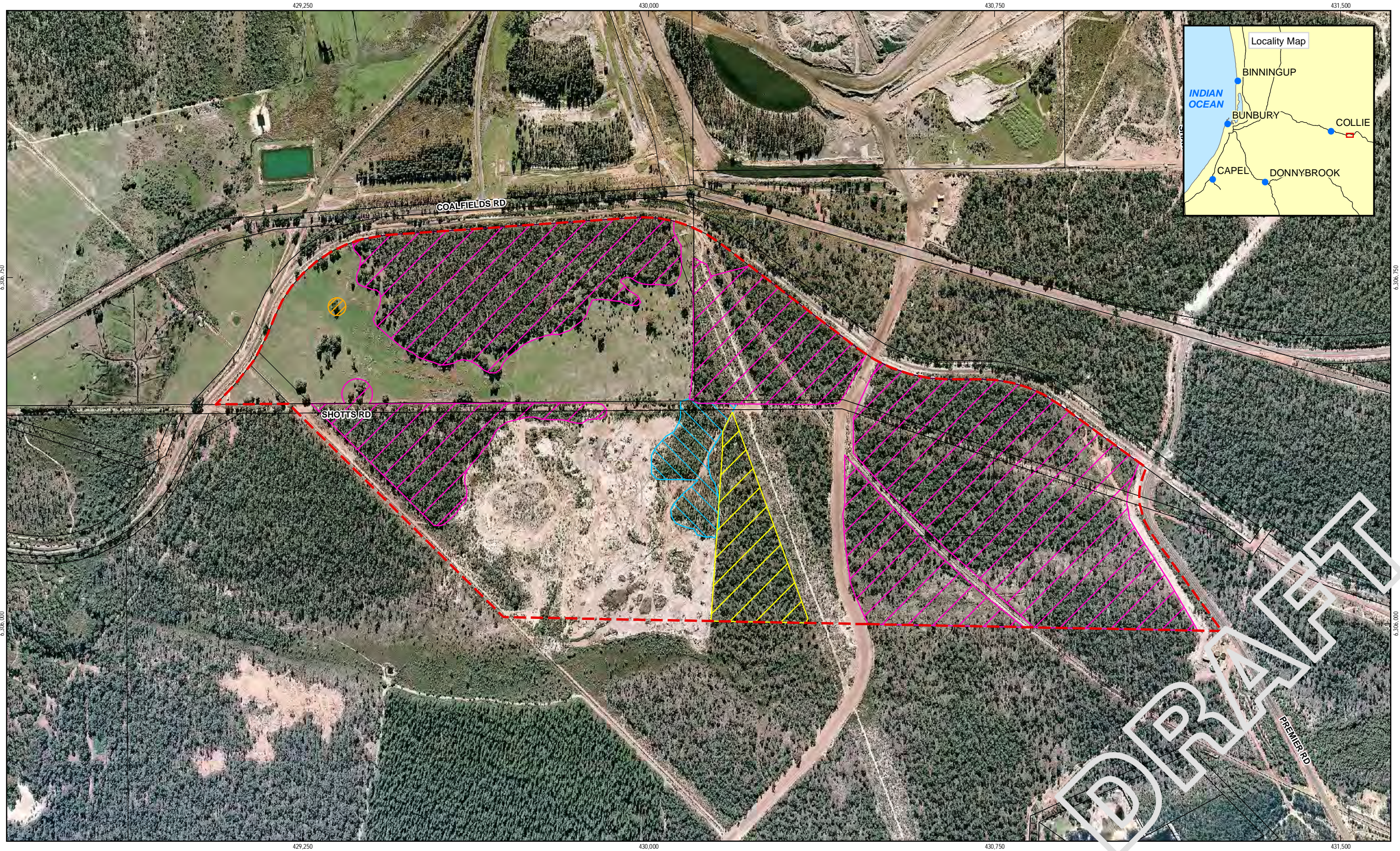


Perdaman Industries  
 PCF Ecological Assessments (1930)

### Collie Urea Project Habitat Types

Job Number	61-23685-05
Revision	A
Date	23 JUL 2009

Figure 1



LEGEND	
	Survey Area
	Cadastre
	Cockatoo Feeding Area
	Potential Cockatoo Breeding Area
	Cockatoo Feeding & Potential Breeding Area
	Exotic Pinus sp. Feeding Area

Map Projection: Transverse Mercator  
 Horizontal Datum: Geocentric Datum of Australia (GDA)  
 Grid: Map Grid of Australia 1994, Zone 50



Perdaman Industries  
 PCF Ecological Assessments (1930)  
**Collie Urea Project**  
**Cockatoo Feeding & Potential Breeding Area**

Job Number	61-23685-05
Revision	A
Date	21 JUL 2009

**Figure 2**

Appendix B

## Fauna Conservation Categories

EPBC Act Fauna Conservation Categories

Conservation Categories and Definitions for *EPBC Act* Listed  
Flora and Fauna Species

Western Australian Wildlife Conservation Act 1950  
Conservation Codes

DEC Priority Fauna Codes

## **EPBC Act Fauna Conservation Categories**

### ***Listed threatened species and ecological communities***

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- » extinct in the wild,
- » critically endangered,
- » endangered, or
- » vulnerable.

### ***Critically endangered and endangered species***

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- » lead to a long-term decrease in the size of a population, or
- » reduce the area of occupancy of the species, or
- » fragment an existing population into two or more populations, or
- » adversely affect habitat critical to the survival of a species, or
- » disrupt the breeding cycle of a population, or
- » modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- » result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat\*, or
- » interfere with the recovery of the species.

*\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

### ***Vulnerable species***

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- » lead to a long-term decrease in the size of an important population of a species, or
- » reduce the area of occupancy of an important population, or
- » fragment an existing important population into two or more populations, or
- » adversely affect habitat critical to the survival of a species, or
- » disrupt the breeding cycle of an important population, or
- » modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- » result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat\*, or

- » interferes substantially with the recovery of the species.
- » An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:
  - » key source populations either for breeding or dispersal,
  - » populations that are necessary for maintaining genetic diversity, and/or
  - » populations that are near the limit of the species range.

\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.

### ***Listed migratory species***

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species. The criteria below are relevant to migratory species that are not threatened.

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- » substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- » result in invasive species that is harmful to the migratory species becoming established\* in an area of important habitat of the migratory species, or
- » seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

1. habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
2. habitat utilised by a migratory species which is at the limit of the species range, or
3. habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an ecologically significant proportion of the population varies with the species (each circumstance will need to be evaluated).

\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.

### ***The Commonwealth marine environment***

An action will require approval from the Environment Minister if:

- » the action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment, or

- » the action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment in a Commonwealth marine area.

An action has, will have or is likely to have a significant impact on the environment in a Commonwealth marine area if it does, will, or is likely to:

- » result in a known or potential pest species becoming established in the Commonwealth marine area\*, or
- » modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area results, or
- » have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (eg breeding, feeding, migration behaviour, and life expectancy) and spatial distribution, or
- » result in a substantial change in air quality\*\* or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- » result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.

\*Translocating or introducing a pest species may result in that species becoming established.

\*\*The Commonwealth marine area includes any airspace over Commonwealth waters.

**Table 4 Conservation Categories and Definitions for EPBC Act Listed Flora and Fauna Species**

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

**Table 5 Western Australian Wildlife Conservation Act 1950 Conservation Codes**

<b>Conservation Code</b>	<b>Description</b>
Schedule 1	"...fauna that is rare or likely to become extinct, are declared to be fauna that is in need of special protection."
Schedule 2	"...fauna that is presumed to be extinct, are declared to be fauna that is in need of special protection."
Schedule 3	"...birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection."
Schedule 4	"...fauna that is in need of special protection, otherwise than for the reasons mentioned [in Schedule 1 – 3]"

**Table 6 DEC Priority Fauna Codes**

<b>Conservation Code</b>	<b>Description</b>
Priority 1	Taxa with few, poorly known populations on threatened lands.
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.
Priority 3	Taxa which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation.
Priority 4	Rare taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.
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 C

## Fauna Lists

Observed Fauna Species (15/06/09 - 17/06/09)

Fauna Species Potentially Utilising the Survey Area  
(WA Museum database)

**Table 7 Collie Urea Project Survey Area – Observed Fauna**

**(15/06/09 - 17/06/09)**

<b>Family</b>	<b>Genus</b>	<b>Species</b>	<b>Common Name</b>	<b>Conservation listing</b>	<b>Introduced Fauna</b>
Birds					
Acanthizinae	<i>Acanthiza</i>	<i>apicalis apicalis</i>	Inland Thornbill		
Acanthizinae	<i>Gerygone</i>	<i>fusca</i>	Western Gerygone		
Acanthizinae	<i>Smicrornis</i>	<i>brevirostris occidentalis</i>	Weebill		
Alcedinidae	<i>Dacelo</i>	<i>novaeguineae</i>	Laughing Kookaburra		X
Anatidae	<i>Anus</i>	<i>superciliosa</i>	Pacific Black Duck		
Campephagidae	<i>Coracina</i>	<i>novaehollandiae</i>	Black-faced Cuckoo-shrike	Ma	
Columbidae	<i>Phaps</i>	<i>chalconotus</i>	Common Bronzewing		
Corvidae	<i>Corvus</i>	<i>coronoides perplexus</i>	Australian Raven		
Cracticidae	<i>Cracticus</i>	<i>tiibicen dorsalis</i>	Australian Magpie		
Dricuridae	<i>Grallina</i>	<i>cyanoleuca</i>	Magpie-lark		
Dricuridae	<i>Rhipidura</i>	<i>fuliginosa keasti</i>	Grey Fantail		
Dricuridae	<i>Rhipidura</i>	<i>leucophrys</i>	Willie Wagtail		
Estrildidae	<i>Stagonopleura</i>	<i>oculata</i>	Red-eared Firetail		
Hirundinidae	<i>Hirundo</i>	<i>neoxena</i>	Welcome Swallow		
Malurinae	<i>Malurus</i>	<i>splendens</i>	Splendid Fairy-wren		
Meliphagidae	<i>Anthochaera</i>	<i>carunculata</i>	Red Wattlebird		
Meliphagidae	<i>Lichmera</i>	<i>indistincta indistincta</i>	Brown Honeyeater		
Pachycephalidae	<i>Colluricincla</i>	<i>harmonica rufiventris</i>	Grey Shrike-thrush		

Family	Genus	Species	Common Name	Conservation listing	Introduced Fauna
Pachycephalidae	<i>Pachycephala</i>	<i>pectoralis fuliginosa</i>	Goldern Whistler		
Petroicidae	<i>Eopsaltria</i>	<i>griseogularis griseogularis</i>	Western Yellow Robin		
Petroicidae	<i>Petroica</i>	<i>multicolor</i>	Scarlet Robin		
Petroicidae	<i>Microeca</i>	<i>fascinans assimilis</i>	Jacky Winter		
Cacatuidae	<i>Calyptorhynchus</i>	<i>latirostris</i>	Carnaby's black Cockatoo	En, S1	
Cacatuidae	<i>Calyptorhynchus</i>	<i>baudinii</i>	Baudins Black Cockatoo	En, S1	
Cacatuidae	<i>Calyptorhynchus</i>	<i>banksii naso</i>	Red-tailed Black Cockatoo	Vu, S1	
Psittacidae	<i>Platycercus</i>	<i>zonarius semitorquatus</i>	Twenty-eight Parrot		
Psittacidae	<i>Platycercus</i>	<i>icterotis icterotis</i>	Western Rosella		
Psittacidae	<i>Purpureicephalus</i>	<i>spurius</i>	Red -capped Parrot		
Zosteropidae	<i>Zosterops</i>	<i>lateralis gouldi</i>	Silvereye		
<b>Reptiles</b>					
Elapidae	<i>Parasuta</i>	<i>gouldii</i>	Goulds Snake **		
<b>Amphibia</b>					
Myobatrachidae	<i>Crinia</i>	<i>glauerti</i>	Clicking Frog***		
Myobatrachidae	<i>Crinia</i>	<i>pseudinsignifera</i>	Bleating Froglet		
Myobatrachidae	<i>Geocrinia</i>	<i>leai</i>	Ticking Frog***		
Myobatrachidae	<i>Heleioporus</i>	<i>psammophilus</i>	Sand Frog		
<b>Mammals</b>					
Canidae	<i>Vulpes</i>	<i>vulpes</i>	Fox		X

Family	Genus	Species	Common Name	Conservation listing	Introduced Fauna
Canidae	<i>Canus</i>	<i>domesticus</i>	Dogs		X
Dasyuridae	<i>Dasyurus</i>	<i>geoffroii</i>	Chuditch *	Vu, S1	
Dasyuridae	<i>Antechinus</i>	<i>flavipes ?</i>	Yellow-footed Antechinus *		
Leporidae	<i>Oryctolagus</i>	<i>cuniculus</i>	European Rabbit		X
Macropodidae	<i>Macropus</i>	<i>fuliginosus</i>	Western Grey Kangaroo		
Macropodidae	<i>Macropus</i>	<i>irma</i>	Brush Wallaby	P4	
Phalangeridae	<i>Trichosurus</i>	<i>vulpecula vulpecula</i>	Common Brushtail Possum *		
Suidae	<i>Sus</i>	<i>scrofa</i>	Pig		X
Tachyglossidae	<i>Tachyglossus</i>	<i>aculeatus</i>	Echidna		

\* Identified via scats

\*\* Identified via slough skin

\*\*\* Identified by calls

**Table 8 WA Museum Fauna Records (*NatureMap*) within 10 km of the Survey Area**

Species	Common Name	Status
<b>Amphibian</b>		
<i>Crinia georgiana</i>	Quacking Frog	
<i>Crinia glauerti</i>	Clicking Frog	
<i>Heleioporus inornatus</i>	Whooping Frog	
<i>Neobatrachus pelobatoides</i>	Humming Frog	
<b>Birds</b>		
<i>Calyptorhynchus banksii</i> subsp. <i>naso</i>	Forest Red-tailed Black-Cockatoo	Schedule 1
<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	Schedule 1 Vulnerable
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet	
<i>Merops ornatus</i>	Rainbow Bee-eater	
<i>Platycercus icterotis</i> subsp. <i>icterotis</i>		
<b>Mammals</b>		
<i>Antechinus flavipes</i> subsp. <i>leucogaster</i>	Yellow-footed Antechinus, Mardo	
<i>Cercartetus concinnus</i>	Western Pygmy-possum, Mundarda	
<i>Dasyurus geoffroii</i>	Western Quoll, Chuditch	Schedule 1 Vulnerable
<i>Isoodon obesulus</i> subsp. <i>fusciventer</i>	Southern Brown Bandicoot, Quenda	P5
<i>Macropus irma</i>	Western Brush Wallaby	P4
<i>Myrmecobius fasciatus</i>	Numbat, Walpurti	Schedule 1 Vulnerable
<i>Phascogale tapoatafa</i> subsp. ssp. (WAM M434)	Brush-tailed Phascogale, Wambenger	Schedule 1
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	Schedule 1 Vulnerable
<i>Setonix brachyurus</i>	Quokka	Schedule 1 Vulnerable
<i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i>	Common Brushtail Possum	
<b>Reptiles</b>		
<i>Acritoscincus trilineatum</i>		
<i>Aprasia pulchella</i>		
<i>Aprasia repens</i>		
<i>Cryptoblepharus buchananii</i>		
<i>Ctenotus delli</i>		P4

Species	Common Name	Status
<i>Ctenotus impar</i>		
<i>Diplodactylus polyophthalmus</i>		
<i>Egernia napoleonis</i>		
<i>Hemiergis gracilipes</i>		
<i>Hemiergis peronii</i> subsp. <i>tridactyla</i>		
<i>Lerista distinguenda</i>		
<i>Menetia greyii</i>		
<i>Morethia obscura</i>		
<i>Notechis scutatus</i>	Tiger Snake	
<i>Pseudonaja affinis</i> subsp. <i>affinis</i>	Dugite	
<i>Ramphotyphlops australis</i>		
<i>Ramphotyphlops pinguis</i>		

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