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## **Water Corporation**

### **Report for Mundaring Water Treatment Plant Site Selection**

#### **Preliminary Spring Flora and Fauna Assessment - DEC Land**

June 2007



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## Executive Summary

The Water Corporation is currently conducting a site selection process for the proposed Mundaring Water Treatment Plant (WTP). This process involves community-based consultation, and has included preliminary consideration of the environmental, social, technical and economic features of a number of site options. Further detailed investigations will be undertaken once a preferred site is selected.

As part of the site selection process GHD Pty Ltd (GHD) was commissioned by the Water Corporation to undertake preliminary flora and fauna investigations in spring 2006 at some of the Mundaring WTP site options. This report presents the results of the field survey at the DEC Land (previously "CALM Land").

This flora and fauna investigation is a preliminary investigation aimed at identifying any major environmental constraints on the site and to assess the environmental values of the site. A full flora and vegetation assessment and fauna assessment will be required once a final site has been determined.

The preliminary flora and fauna investigations for the 'DEC Land' included a desktop assessment and a preliminary field assessment. The results of the assessment concluded that:

- » The majority of this site has been highly altered and disturbed due to the old settlement that was located on the site and from the site's current use as the DEC depot.
- » The site is highly degraded, with the majority of the site cleared or containing introduced species. These introduced species include garden escapes and planted forests of Pines and Eucalypts (introduced species) from the old settlement. There are small patches of native vegetation in the southern section of the site but these remnants are very degraded due to weed invasion and impacts from works at the adjacent DEC depot. On the eastern boundary of the site there is Jarrah-Marri forest in good condition. The northern section of the site (where the site becomes narrow) contains a gully system with a creekline and native vegetation in good condition. There are some patches of Wandoo in the gully system. There are a number of vegetation types north of the gully system, which are in excellent condition and which have good species diversity. This northern area supports granitic herblands, shrublands and an area of Jarrah-Marri forest.
- » The site has moderate plant species diversity with a total of 109 taxa (80 native taxa) from 39 families recorded within the surveyed area.
- » No Declared Rare or Priority Species were identified during the survey.
- » This site contains a number of introduced plant species, which dominate large areas of the site. Much of the site supports Pine trees and introduced *Acacia* and Eucalypt trees. Additionally, there are a number of garden plants throughout the site, which have established from the old settlement gardens. A total of 29 weed



species were recorded within the Site, which represents about 27 % of the total species recorded.

- » A number of fauna species occur in the general Mundaring area, including a number of protected species. The site is mainly highly degraded and would not be expected to support many of the species that may occur in the area. The site would be of some value to certain bird species, and may be used by black cockatoos, which are protected under the *Wildlife Conservation Act 1950* and the *EPBC Act*. A detailed fauna assessment should be undertaken if this site is progressed further as a suitable option for the WTP.
- » The northern section of the site has high habitat value as it contains a number of different habitat types, including granite outcrops and a gully system.
- » If this site is considered further for the proposed Mundaring WTP it is recommended that the northern section of the site be preserved (including the creekline and gully) as it has high environmental value. A buffer may also be required around the creekline and gully, to prevent any direct or indirect impacts from the construction and operation of the WTP. Weed control could be conducted in this area, and to the north of the site, to improve its environmental value.

**If the northern section of the site, which has high environmental value, can be preserved and the majority of the impacts of the WTP be restricted to the degraded areas in the rest of the site (particularly the flat sections in the south of the site) then the direct impacts from the Mundaring WTP on native flora and fauna at this site will be minimal.**



# 1. Introduction

## 1.1 Background

The Water Corporation proposes to improve the quality and security of water supplies to the Eastern Hills areas of Perth and to the Goldfields and Agriculture regions. The \$55 million Mundaring Water Supply Improvement Project was announced in 2002, and involved the first stage construction over about six years of a 50 megalitre water tank and a 150 megalitres per day capacity water treatment plant at Sawyers Valley Tank site. Two more stages were planned and by 2030 it was projected that a total of three 50 megalitre water tanks would be constructed on the site and the water treatment plant capacity would be increased to 250 megalitres per day.

Strong community objections emerged against the location of the WTP at Sawyers Valley. Due to these community objections the Water Corporation decided to withdraw the application to the EPA to build the water treatment plant at Sawyers Valley and a commitment was made to undergo a more detailed site selection process, with the involvement of the community. The Water Corporation's application to the EPA to build one 50 megalitre water tank remained active.

The current site selection process commenced in mid-2005 and is a community-based consultation process, which involved reconsidering all previous site options and including any other potentially suitable options. This process has involved preliminary consideration of the environmental, social, technical and economic features of a number of options. Further detailed investigations will be required once a preferred site has been selected.

## 1.2 Scope of this Report

GHD Pty Ltd (GHD) has been commissioned by the Water Corporation to assist with the site selection process for the Mundaring WTP and to provide independent advice to the Water Corporation and the community on the environmental features of the site options, as required.

As part of the site selection process GHD was commissioned by the Water Corporation to undertake preliminary biological field surveys in spring 2006 at a number of the Mundaring WTP site options. A number of site options being considered at this time contained major areas of remnant vegetation. These included:

- » Site One;
- » Site Two;
- » Site '1km below Weir';
- » Pine Plantation Site;
- » DEC Land (formerly "CALM Land");
- » Site Five (Sawyers Hill); and
- » Site Seven.



There have been previous biological investigations conducted at Site One and Two, so further survey was not considered necessary at this time. A number of biological surveys have been conducted previously at Site Five but none were conducted in early spring so a survey of this site was considered necessary at this time. A biological survey was not undertaken at Site Seven but a brief inspection of the site was conducted to determine the environmental condition of the site.

The Water Corporation determined that preliminary biological surveys in spring 2006 were to be conducted at the following sites:

- » Site '1km below Weir';
- » Pine Plantation Site;
- » DEC Land and
- » Site Five (Sawyers Hill).

This report presents the results of the field survey at the DEC Land, (**Figure 1**).

The biological investigations were designed to highlight major flora and fauna issues and to determine the ecological value of the site. The surveys included the following aspects:

- » A broad-scale vegetation assessment, including assessment of vegetation types, vegetation condition, dominant species and potential presence of diseases such as dieback, and weeds. The vegetation type and condition was mapped;
- » A targeted search for any Declared Rare Flora (DRF) and Priority flora species that occur in the area;
- » An assessment of habitat potential, including the assessment of the significance of habitat trees; and
- » A targeted opportunistic fauna search, particularly for any significant fauna species.

### **1.3 Site Location**

DEC Land is a 20 ha site located at the current DEC depot to the east of Mundaring Weir Rd, at Mundaring Weir, WA (**Figure 1**). The site is located on State Forest and Freehold land owned by DEC.

The Site is across Allen Rd from the Hills Forest Discovery Centre (approximately 100 m) and across Mundaring Weir Rd from Fred Jacoby Park. Approximately 300 m to the west of the site is the Munda Biddi Trail and approximately 50 m to the south of the Site is the Bibbulmun Track. A number of other walking tracks pass through the site and there is a picnic table in the north of the site

The Site is approximately 550 m to the north-east of the picnic sites associated with Mundaring Weir and the start of the Site about 500 m from Mundaring Weir Hotel.



#### **1.4 Limitations of this Report**

This biological investigation is only a preliminary survey and a full flora and vegetation assessment and fauna assessment may be required once a final site has been determined. The investigation focused on the site of the WTP and detailed investigations of the access routes was not undertaken. However, the potential access routes were assessed to determine any major biological constraints.

The targeted Declared Rare and Priority Flora search is dependent on a number of factors, including flowering times for the significant species, and hence cannot be a completely comprehensive search. Further field-work may be required once the final site has been selected to determine the potential presence of any significant flora species at that site.

Desktop investigations on fauna species were conducted at the regional level, to determine species that are present in the general area and that have the potential to occur at the site. While this does not allow comparison between sites the information on fauna habitat obtained during the survey provides some indication of the likelihood of fauna species occurring at the site and of the value of the site as fauna habitat.



## 2. Desktop Assessment

### 2.1 Vegetation

Beard (1979) has mapped the vegetation of the general area at a scale of 1:250,000. The site vegetation is within the Darling Botanical District: Dale Subdistrict of the South Western Botanical Province as recognised by Beard (1979). According to Beard the vegetation of the sub-district is primarily Jarrah – Marri forest.

Mapping by Heddle *et al.* (1980) shows the site to be within the **Pindalup and Yarragil complex in Low to Medium Rainfall**. Open forest of *Eucalyptus. marginata* – *E. calophylla* now *Corymbia calophylla*) on slopes and open woodland of *E. wandoo* with some *E. patens* in the lower gullies.

Mundaring Weir and the study site occur on the Darling Plateau region, which has the following general vegetation complexes as defined in the Regional Forest Agreement Vegetation Complexes mapping of Matiske and Havel (1998):

- » **Dwellingup 2 (D2) (uplands)** Open forest of *Eucalyptus marginata subsp. marginata* – *Corymbia calophylla* on lateritic uplands in the arid zone.
- » **Helena 2 (He2) (in valleys)** Mosaic of open forest of *Eucalyptus marginata subsp. thalassica-Corymbia calophylla* and woodland of *Eucalyptus wandoo* with some *Eucalyptus accedens* and *Eucalyptus rudis* on the deeper soils ranging to closed heaths and lithic complex on shallow soils associated with granite on steep slopes of valleys in semiarid and arid zones.
- » **Murray 2 (My2) (in valleys)** Open forest of *Eucalyptus marginata subsp. thalassica-Corymbia calophylla- Eucalyptus patens* and woodlands of *Eucalyptus wandoo* with some *Eucalyptus accedens* on valley slopes to woodlands of *Eucalyptus rudis-Melaleuca raphiophylla* on the valley floor in semiarid and arid zones.
- » **Yarragil 1 (in valleys)** Open forest of *Eucalyptus marginata subsp. marginata-Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones.
- » **Pindalup (in valleys)** Open forest of *Eucalyptus marginata subsp. thalassica-Corymbia calophylla* on slopes and open woodlands of *Eucalyptus wandoo* with some *Eucalyptus patens* on the lower slopes in semiarid and arid zones.

The Matiske and Havel mapping (1998) indicates that the Site 'DEC Land' occurs mainly in the vegetation complex **Dwellingup 2 (D2) (uplands)**.

### 2.2 Vegetation Extent and Status

A vegetation type is considered underrepresented if there is less than 30 percent of its original distribution remaining. From a purely biodiversity perspective, and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation in States where clearing is still occurring (EPA, 2000)

- » The “threshold level” below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European/ pre-1750 extent of the vegetation type;
  - » A level of 10% of the original extent is regarded as being a level representing *Endangered*; and
  - » Clearing which would put the threat level into the class below should be avoided.
- Such status can be delineated into five (5) classes, where:
- » *Presumed Extinct*: Probably no longer present in the bioregion
  - » *Endangered\**: <10% of pre-European extent remains
  - » *Vulnerable\**: 10-30% of pre-European extent exists
  - » *Depleted\**: >30% and up to 50% of pre-European extent exists
  - » *Least Concern*: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

\* or a combination of depletion, loss of quality, current threats and rarity gives a comparable status

Native vegetation types represented in the survey area, their regional extent and reservation status are generally drawn from Shepherd, *et al.* (2002), and Shepherd pers. comm., which are in turn based on broadscale mapping undertaken by Beard (1979). These are shown in **Table 1**.

**Table 1 Vegetation extent and status for Beard (1979) Vegetation Associations in the Mundaring areas (after Shepherd, *et al.* (2002), Shepherd, pers. comm.)**

Vegetation Association	Vegetation Description	Pre-European Extent (ha)	Current Extent (ha)	% Remaining
3	Medium Forest: Jarrah – Marri	908, 040	747, 888	82.4

Generally the extent of the vegetation remaining on the Darling Scarp is above the threshold level and it can be seen from the table above the Jarrah – Marri Medium Forest is relatively well preserved.

### 2.3 Threatened Ecological Communities

Ecological communities are defined as ‘naturally occurring biological assemblages that occur in a particular type of habitat’ (English and Blythe, 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered, and Vulnerable. Some TECs are protected under the Commonwealth *Environment Protection and Biodiversity Act 1999 (EPBC Act)*. Although TECs are not formally protected under the State *Wildlife Conservation Act 1950*, the loss of, or disturbance to, some TECs triggers the EPBC Act. The Environmental Protection Authority’s (EPA’s) position on



TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

A search of the DEC's TEC database was undertaken for the Mundaring area. This search recorded that there were no known occurrences of TECs for the general area of Mundaring Weir. Occurrences of the 'Critically Endangered' communities known as 'Shrublands and woodlands of the eastern side of the Swan Coastal Plain' and '*Eucalyptus calophylla* – *Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain' and an occurrence of the 'Endangered' threatened ecological community known as '*Banksia attenuata* woodland over species rich dense shrublands' occur nearby to the general Mundaring area, and the potential for these communities to occur in the study site was taken into consideration during the field surveys.

## 2.4 Flora

Flora species that are considered to be significant are listed under the Western Australian *Wildlife Conservation Act 1950* and the Commonwealth *EPBC Act*. A description of the DEC's conservation codes is provided in **Table 6, Appendix B**.

A search of the DEC's Rare Flora Databases and the Western Australian Herbarium indicates that a number of significant species are known to occur in the general Mundaring area. There are no records of significant species at or near to the site, but this may simply reflect the lack of flora surveys conducted in the area. The recorded significant species in the general vicinity of the site are presented in **Table 2** and **Figure 1, Appendix A**. Please note that a large search area was requested due to the large study area for all the Mundaring WTP site options, and this large search area has resulted in a number of recorded significant flora species.

**Table 2 Significant Flora Species Previously Recorded within the Mundaring Area (Source: DEC and the WA Herbarium)**

Species	Conservation Code
<i>Adenanthos cygnorum</i> subsp. <i>chamaephyton</i>	P3
<i>Adenanthos filifolius</i>	P3
<i>Acacia anomala</i>	DRF
<i>Acacia aphylla</i>	DRF
<i>Acacia horridula</i>	P3
<i>Acacia oncinophylla</i> subsp. <i>oncinophylla</i>	P3
<i>Anthocercis gracilis</i>	DRF
<i>Aotus cordifolia</i>	P3
<i>Boronia tenuis</i>	P4
<i>Bossiaea modesta</i>	P2



<i>Caladenia arrecta</i>	P4
<i>Cyanicula ixiooides</i> subsp. <i>ixiooides</i>	P4
<i>Darwinia apiculata</i>	DRF
<i>Darwinia pimelioides</i>	P4
<i>Daviesia oxylobium</i>	P4
<i>Diplolaena andrewsii</i>	P2
<i>Grevillea drummondii</i>	
<i>Grevillea flexuosa</i>	DRF
<i>Grevillea pimeleoides</i>	P4
<i>Halgania corymbosa</i>	P3
<i>Hemigenia rigida</i>	P1
<i>Isopogon drummondii</i>	P3
<i>Lasiopetalum bracteatum</i>	P4
<i>Lepyrodia heleocharoides</i>	P3
<i>Persoonia sulcata</i>	P4
<i>Pimelea rara</i>	P4
<i>Pithocarpa corymbulosa</i>	P2
<i>Scholtzia</i> sp. Bickley	P1
<i>Senecio gilbertii</i>	P1
<i>Senecio leucoglossus</i>	P4
<i>Stylidium</i> sp. Boulder Rock	
<i>Stylidium striatum</i>	P4
<i>Templetonia drummondii</i>	P4
<i>Tetralthea pilifera</i>	P3
<i>Tetralthea</i> sp. Granite	P3
<i>Thelymitra manginiorum</i>	DRF
<i>Thysanotus anceps</i>	P3
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	P4
<i>Verticordia serrata</i> var. <i>linearis</i>	P3



## 2.5 Fauna

A search of the Western Australian Museum records was undertaken which determined that 19 amphibian species, 46 bird species, 26 mammal species, 3 fish species and 56 reptile species have been recorded within the general Mundaring area. These results are included in **Table 11, Appendix D**. Please note that a large area was searched for fauna records, due to the large study area for all the Mundaring WTP site options, and this large search area has resulted in a substantial number of recorded fauna species.

### 2.5.1 Fauna of Conservation Significance

The conservation status of fauna species is assessed under State and Commonwealth Acts; in particular the Western Australian *Wildlife Conservation Act 1950*; *Wildlife Conservation (Specially Protected Fauna) Notice 2006*, and the Commonwealth *EPBC Act*.

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). These levels are described in **Table 8, Appendix D**.

The *EPBC Act* also lists migratory species that are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA) and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals).

Listed migratory species also include any native species identified in an international agreement approved by the Commonwealth Environment Minister. The Minister may approve an international agreement for this purpose if satisfied that it is an agreement relevant to the conservation of migratory species.

In Western Australia, the *Wildlife Conservation (Specially Protected Fauna) Notice 2006* has significant levels for fauna classified in a series of Schedules (**Table 9, Appendix C**). The DEC also produces a supplementary list of Priority Fauna, 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 protection, but their presence would normally be considered and they 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 10, Appendix C**.

A listing of Significant Fauna from the *EPBC Act* Protected Matters Search Tool and Rare and Priority species from the Department of Environment and Conservation (DEC) rare fauna database for the general Mundaring area are presented in **Table 3**.

It should be noted that the results of the searches are only an indication of the threatened fauna that may be present in the general area and detailed fauna surveys, including trapping programs are required to verify these results.



**Table 3 Listing of Potentially Occurring Rare and Priority Fauna Species – Mundaring Weir area (Source: EPBC Act Protected Matters Search, DEC Threatened and Priority Fauna Database search results and WA Museum Faunabase search for the general Mundaring Weir area)**

Genus	Species	Common Name	DEC/ Wildlife Conservation Act 1950 Rating	EPBC Act Rating	DEC Database	EPBC Act Protected Matters search
<i>Dasyurus</i>	<i>geoffroi</i>	Chuditch	Vulnerable / Schedule 1	Vulnerable	x	
<i>Myrmecobius</i>	<i>fasciatus</i>	Numbat	Vulnerable / Schedule 1	Vulnerable	x	
<i>Calyptorhynchus</i>	<i>latirostris</i>	Carnaby's Cockatoo	Endangered / Schedule 1	Endangered	x	
<i>Calyptorhynchus</i>	<i>baudinii</i>	Baudin's Cockatoo	Endangered / Schedule 1	Vulnerable		x
<i>Pseudocheirus</i>	<i>occidentalis</i>	Western Ringtail Possum	Vulnerable / Schedule 1	Vulnerable		X
<i>Phascogale</i>	<i>tapoatafa tapoatafa</i>	Southern Brush-tailed Phascogale	Priority 3		x	
<i>Macropus</i>	<i>irma</i>	Western Brush Wallaby	Priority 4		x	
<i>Hydromys</i>	<i>chrysogaster</i>	Water-rat (Rakali)	Priority 4		x	
<i>Isoodon</i>	<i>obesulus fusciventer</i>	Quenda	Priority 5		x	
<i>Haliaeetus</i>	<i>leucogaster</i>	White-bellied Sea-eagle		Migratory		X
<i>Apus</i>	<i>pacificus</i>	Fork-tailed Swift		Marine		X



<b>Genus</b>	<b>Species</b>	<b>Common Name</b>	<b>DEC/ Wildlife Conservation Act 1950 Rating</b>	<b>EPBC Act Rating</b>	<b>DEC Database</b>	<b>EPBC Act Protected Matters search</b>
<i>Ardea</i>	<i>alba</i>	Great Egret, White Egret		Marine		X
<i>Ardea</i>	<i>ibis</i>	Cattle Egret		Marine		X
<i>Merops</i>	<i>ornatus</i>	Rainbow Bee-eater		Marine		X



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.

The habitat requirements of the protected species listed under the *EPBC Act*, the *Wildlife Conservation Act 1950* and listed as priority species by the DEC, and the likelihood of their occurrence in the site is considered below.

#### ***Dasyurus geoffroii* Chuditch**

The Chuditch is the largest carnivorous marsupial in Western Australia. This species occupies a wide range of habitats including woodlands, riparian vegetation, beaches and deserts. The Chuditch 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. This species is currently listed as Vulnerable on the *EPBC Act* (CALM, 2005a).

This species may occur in the native vegetation to the east of the study site, but is unlikely to occur in the disturbed areas of the site.

#### ***Myrmecobius fasciatus* Numbat**

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 (CALM, 2005b).

This species only occurs in isolated populations in Western Australia, in a number of small reserves, and it is unlikely that it would be found at this site.

#### ***Calyptorhynchus latirostris* Carnaby's Cockatoo**

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 eucalypt 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 black cockatoos feed on the seeds of a variety of native plants, including *Allocasuarina*, *Banksia*, *Dryandra*, *Eucalyptus*, *Grevillea* and *Hakea*, and some introduced plants, including *Pinus*. They will also feed on the nectar from flowers of a number of species, and on insect larvae. Carnaby's Cockatoo has been listed as Endangered under the Federal *EPBC Act*.



This species is known to occur in the study area and could use a number of the plant species on this site for foraging. This site also contains some Wandoo trees, a species which Carnaby's Cockatoo can use for nesting. While Carnaby's Cockatoo generally breeds in the Wheatbelt, this species has been previously recorded as nesting in the Mundaring area.

#### ***Calyptorhynchus baudinii* Baudin's Cockatoo**

Baudin's Cockatoo, also known as the Long-billed 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*). The primary food source of this cockatoo is the seeds of the Marri (Garnett and Crowley, 2000). This species has been impacted by the removal of large Marri throughout its range. Baudin's Cockatoo has been listed as Vulnerable under the Commonwealth *EPBC Act*.

Baudin's Cockatoo are known to occur in the Mundaring area and the site contains habitat that is suitable for this species. This species may utilise the site for foraging, and the site also contains Marri and Wandoo, both tree species that are used by this cockatoo for breeding.

#### ***Pseudocheirus occidentalis* Western Ringtail Possum**

The Western Ringtail Possum (*Pseudocheirus occidentalis*) is found in the south-west of Western Australia, with a patchy occurrence from the Collie River to Two Peoples Bay (Jones, *et al.*, 1994). Urban populations of this species are located in Busselton, as well as East Augusta and Albany.

This species was recorded in the *EPBC Act* Protected Matters Search but this species is not known from the Mundaring area and this record is likely to be inaccurate.

#### ***Phascogale tapoatafa tapoatafa* Southern Brush-tailed Phascogale**

This arboreal marsupial occurs in forest and woodland with suitable tree hollows. Populations fluctuate dramatically in response to invertebrate prey abundance. This subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. Records are less common from wetter forests (CALM, 2005c).

The Southern Brush-tailed Phascogale is known to occur in low densities in the northern Jarrah forests. This species is known to occur in the Mundaring area and may occur in the native vegetation to the east of the study site, but is unlikely to occur in the disturbed areas of the site.

#### ***Macropus irma* Western Brush Wallaby**

The Western Brush Wallaby, a medium sized macropod, 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 (CALM, 2005d).



This species is not protected under legislation but is listed as a Priority 4 species by DEC, which means it is a species in need of monitoring. This species is known to occur in the general area and may occur in the native vegetation to the east of the study site, but is unlikely to occur in the disturbed areas of the site.

***Hydromys chrysogaster* Water-rat (Rakali)**

The water rat occupies habitat in the vicinity of permanent water and nests are constructed in logs or at the end of tunnels dug into banks. Unlike many other Australian rodents, the water rat is not entirely nocturnal, with activity usually high at sunset, though animals have been seen foraging during the day. The water rat is an opportunistic predator, feeding upon large aquatic insects, fish, crustaceans and mussels. They are also known to feed on frogs, lizards, small mammals, fresh carrion, and birds (CALM, 2005e).

This species is not protected under legislation but is listed as a Priority 4 species by DEC, which means it is a species in need of monitoring. This species may occur in the general Mundaring area but there is no suitable habitat for this species at the study site and it would be unlikely to occur here.

***Isodon obesulus fusciventer* Quenda**

The Quenda is an omnivorous marsupial that occurs in the south-west of Western Australia. It 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. On the Swan Coastal Plain Quenda are often associated with wetlands (CALM, 2005c).

Quenda are known to occur in the Mundaring region and would be likely to occur in the forested areas to the east of the site but would be unlikely to occur on the majority of the site as the disturbed areas do not contain the understorey vegetation required by this species.



## 3. Field Survey

### 3.1 Survey Methods

The field survey was conducted on the 28<sup>th</sup> September, 2006, by a qualified botanist and a field ecologist.

The survey recorded vegetation types and dominant species in each vegetation type. A full list of species was generated for the site and where identification was uncertain, confirmation was made at the Western Australian State Herbarium. The presence of DRF or Priority flora species was assessed. The condition and weed status of the vegetation were also noted. Vegetation was also assessed to determine the presence of TECs within the project area. Aerial photography was used to assist in the delineation of vegetation types present in the study area.

A reconnaissance survey was conducted for the presence of fauna. A consideration of fauna habitat was undertaken within the study area.

Nomenclature of the species follows that of *Florabase* (2006) for flora species and the *Faunabase* (2006) for fauna species.

### 3.2 Vegetation Types

The site contains a number of different vegetation types, ranging from remnant Marri-Jarrah forest to granitic herblands. However, the native vegetation is restricted to small patches, mainly at the edges of the site, and the majority of the site is disturbed and degraded. A full description of the vegetation types, photographs and inventory of vascular plants is provided in **Appendix B** and **Appendix C**. The broad vegetation types at the site have been mapped in **Figure 2, Appendix A**.

Most of the site is located in an old settlement area and thus has been subject to a long period of disturbance. Much of the vegetation that occurs on this site is introduced. The disturbed areas include planted Pine and introduced *Acacia* and *Eucalyptus* forests. Even the patches of remnant vegetation, which are located mainly at the edges of the site have been impacted by disturbances from the old settlement and from the site's current use as the DEC depot.

In the south of the site there are patches of remnant open forest of Jarrah-Marri. However, these remnants are scattered and have been disturbed by earthworks and subject to weed invasion. To the east of the site there is an open forest of Jarrah-Marri that is in relatively good condition.

In the north of the site there is a gully containing a creekline and remnant native vegetation. The north side of the gully supports predominantly Wandoo and the south side supports predominantly Marri-Jarrah forest with occasional Wandoo. Much of the gully system has been disturbed and it contains a number of weed species, including substantial infestations of *Watsonia*, an invasive environmental weed species.

North of this creekline there is a small area of granitic rock outcrops that support open vegetation types. This includes a mosaic of herblands over outcropping granites and



shrublands on the deeper soils. The granitic herblands are dominated by Variegated Featherflower (*Verticordia huegeli*) and *Styloidium* and *Drosera* species. The granitic areas also contain ferns and non-vascular species (that were not recorded in this survey), as well as a number of weed species. Adjacent to the granite outcrops is an area of Jarrah-Marri forest in excellent condition.

### 3.3 Vegetation Condition

The vegetation in the study area was given a condition rating based on the Bush Forever (Government of Western Australia, 2000) vegetation condition ratings scale. This scale recognises a level of intactness of vegetation, which is defined by the following:

- » Completeness of structural levels;
- » Extent of weed invasion;
- » Historical disturbance from tracks and other clearing or dumping;
- » The potential for natural or assisted regeneration.

The ratings in this scale are described as follows:

**Table 4 Government of Western Australia (2000) Vegetation Condition Scale**

Assigned Number	Classification	Description
1	<i>Pristine or nearly so</i>	No obvious signs of disturbance
2	<i>Excellent</i>	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species
3	<i>Very Good</i>	Vegetation structure altered, obvious signs of disturbance
4	<i>Good</i>	Vegetation structure significantly altered by very obvious signs of multiple disturbance, retains basic vegetation structure or ability to regenerate it
5	<i>Degraded</i>	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
6	<i>Completely degraded</i>	The structure of the vegetation is no longer intact and the area is completely or almost without native species

The vegetation condition of the site was very variable, ranging from Condition 1/2 (*Pristine/Excellent*) in the remnant vegetation in the north of the study site, to Condition 6 (*Completely Degraded*) in the old settlement area. In general, the vegetation of the



site has been highly disturbed and degraded. The eastern and northern edges of the site contain the vegetation of the highest condition. The vegetation condition of the site is recorded at **Figure 3**.

### 3.3.1 Plant Pests and Diseases

There was no indication of the occurrence of *Phytophthora cinnamomi* (commonly known as dieback) within the site, based on patterns of death of susceptible plants. However, as the site contained predominately introduced species there were few indicator plants and the presence of dieback could not be adequately determined. Determination of the presence of dieback should be assessed formally by a DEC interpreter or equivalent, should this site be progressed further as an option for the WTP.

## 3.4 Threatened Ecological Communities

No Threatened Ecological Communities were identified during the field survey.

## 3.5 Flora

The site has moderate species diversity with a total of 109 taxa (80 native taxa) from 39 families recorded within the surveyed area.

The dominant families recorded from the area were:

- » Myrtaceae 13 taxa
- » Mimosaceae 10 taxa
- » Papilionaceae 10 taxa
- » Proteaceae 9 taxa
- » Asteraceae 9 taxa

Additionally, the dominant genus recorded was:

- » *Acacia* 10 taxa

Eight species were identified to genus only, due to lack of distinctive features, such as flowers. Additionally two species were identifiable to family only, as the majority of the plant had died. Field surveys at different times of year would allow the identification of a greater number of plant species. A number of plants were not identified as they were known to be weeds or garden escapes and were not significant for the survey.

See **Appendix B** for a full list of flora species recorded in the project area.

### 3.5.1 Significant Species

No DRF or Priority flora species were identified during the survey.



### 3.5.2 Weeds

This site contains a number of introduced species, which dominate large areas of the site. The site has a long history as an old settlement area and a number of introduced tree species were planted around the settlement, particularly Pines and introduced Eucalypts. Additionally, there are a number of garden plants located throughout the site, which have established from the old settlement gardens.

A total of 29 weed species were recorded within the site, which represents about 27 % of the total species recorded. These were mainly pasture grasses (Poaceae) and Acacias (Mimosaceae) from the eastern states. One species, *Asparagus asparagoides* (Bridal Creeper), which was found in the area near the Kookaburra Outdoor Cinema, is a Weed of National Significance (WONS). Bridal Creeper is also a Declared Plants under the Agriculture and Related Resource Protection Act. Weeds that are declared plants under the *Act* are assigned to control class codes, as defined in **Table 5**. Bridal Creeper is P1 for the whole of state.

**Table 5 Department of Agriculture and Food Declared Plant Control Classes.**

Control Class Code	Description
P1	Prohibits movement of plants or their seeds within the State. This prohibits the movement of contaminated machinery and produce including livestock and fodder.
P2	Eradicate infestation to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.
P3	Control infestation in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants.
P4	Prevent the spread of infestation from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set on all plants.
P5	Infestations on public lands must be controlled.

## 3.6 Fauna

### 3.6.1 Fauna Species

An opportunistic fauna survey was completed in association with the spring flora survey. The results from this survey are included in **Table 11, Appendix D**.

The number of species determined during the opportunistic species was limited by the short period of the survey and the fact that it was purely opportunistic and did not provide the opportunity to survey those species that are cryptic or not active during the day. Further detailed fauna surveys would be required once the final site of the Mundaring WTP has been selected.



### **3.6.2 Habitat Value**

The habitat value of the site was assessed during the survey. The majority of the site has been significantly altered due to the old settlement that was located on it and would provide little value as habitat to native fauna species. Some species, particularly bird species such as honeyeaters, could utilise the introduced garden plants for foraging, but in general the disturbances on the site have reduced its value for fauna. This site contains some plant species that are used by black cockatoos for foraging. These species are protected under the *Wildlife Conservation Act 1950* and the *EPBC Act*.

The northern section of the site has high habitat value as it contains a number of different habitat types, including granite outcrops and a gully system.

### **3.6.3 Habitat Linkages**

Fauna corridors and habitat linkages 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.

Areas of this site may facilitate fauna movement, but the majority of the site has been highly disturbed and is of less importance to fauna movement than the large areas of remaining native vegetation that surround this site.



## 4. Conclusions and Recommendations

The preliminary flora and fauna investigations for the DEC Land included a desktop assessment and a preliminary field assessment. The results of the assessment concluded that:

- » The majority of this site has been highly altered and disturbed due to the old settlement that was located on the site and from the site's current use as the DEC depot.
- » The site is highly degraded, with the majority of the site cleared or containing introduced species. These introduced species include garden escapes and planted forests of Pines and Eucalypts (introduced species) from the old settlement. There are small patches of native vegetation in the southern section of the site but these remnants are very degraded due to weed invasion and impacts from works at the adjacent DEC depot. On the eastern boundary of the site there is Jarrah-Marri forest in good condition. The northern section of the site (where the site becomes narrow) contains a gully system with a creekline and native vegetation in good condition. There are some patches of Wandoo in the gully system. There are a number of vegetation types north of the gully system, which are in excellent condition and which have good species diversity. This northern area supports granitic herblands, shrublands and an area of Jarrah-Marri forest.
- » The site has moderate plant species diversity with a total of 109 taxa (80 native taxa) from 39 families recorded within the surveyed area.
- » No DRF or Priority flora species were identified during the survey.
- » This site contains a number of introduced plant species, which dominate large areas of the site. Much of the site supports Pine trees and introduced Acacia and Eucalypt trees. Additionally, there are a number of garden plants throughout the site, which have established from the old settlement gardens. A total of 29 weed species were recorded within the Site, which represents about 27 % of the total species recorded.
- » A number of fauna species occur in the general Mundaring area, including a number of protected species. The site is mainly highly degraded and would not be expected to support many of the species that may occur in the area. The site would be of some value to certain bird species, and may be used by black cockatoos, which are protected under the *Wildlife Conservation Act 1950* and the *EPBC Act*. A detailed fauna assessment should be undertaken if this site is progressed further as a suitable option for the WTP.
- » The northern section of the site has high habitat value as it contains a number of different habitat types, including granite outcrops and a gully system.
- » If this site is considered further for the proposed Mundaring WTP it is recommended that the northern section of the site be preserved (including the creekline and gully) as it has high environmental value. A buffer may also be required around the creekline and gully, to prevent any direct or indirect impacts from the construction



and operation of the WTP. Weed control could be conducted in this area, and to the north of the site, to improve its environmental value.

**If the northern section of the site, which has high environmental value, can be preserved and the majority of the impacts of the WTP be restricted to the degraded areas in the rest of the site (particularly the flat sections in the south of the site) then the direct impacts from the Mundaring WTP on native flora and fauna at this site will be minimal.**



## 5. Limitations

This report presents the results of a Preliminary Flora and Fauna Assessment prepared for the purpose of this commission. The data and advice provided herein relate only to the project described herein and must be reviewed by a competent scientist before being used for any other purpose. GHD accepts no responsibility for other use of the data.

Where reports, searches, any third party information and similar work have been performed and recorded by others the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

For these investigations GHD has conducted desktop data searches and field surveys. The conclusions of this report were based on the information gathered during these investigations and thus reflect the environment of the site at the time of survey. GHD accepts no responsibility for any variation in the flora and fauna present at the site due to natural and seasonal variability.



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## Appendix A

# Figures

- Figure 1**    **Location Plan and Environmental Constraints**
- Figure 2**    **Vegetation Types at the 'DEC Land'**
- Figure 3**    **Vegetation Condition at the 'DEC Land'**



## Appendix B

# Flora

Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species.

Flora List for the Site 'DEC (CALM) Land'



**Table 6 Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species.**

<b>Conservation Code</b>	<b>Description</b>
R: Declared Rare Flora – Extant Taxa	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
P1: Priority One – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2: Priority Two – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3: Priority Three – Poorly Known Taxa	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.
P4: Priority Four – Taxa in need of monitoring	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.



**Table 7 Flora List for the Site 'DEC Land' (surveyed 28/09/06)**

Family	Genus	Species	Common Name	Status
Adiantaceae	<i>?Cheilanthes</i>	<i>?austrotenuifolia</i>	Rock Fern	
Anthericaceae	<i>Corynotheca</i>	<i>micrantha</i>		
Anthericaceae	<i>Laxmannia</i>	<i>squarrosa</i>		
Anthericaceae				
Apiaceae	<i>Platysace</i>	<i>compressa</i>	Tapeworm Plant	
Apocynaceae	<i>Nerium</i>	<i>oleander</i>	Oleander	*
Apocynaceae	<i>Vinca</i>	<i>major</i>	Blue Periwinkle	*
Asparagaceae	<i>Asparagus</i>	<i>asparagoides</i>	Bridal Creeper	* DP / WONS
Asteraceae	<i>Arctotheca</i>	<i>calendula</i>	Cape Weed	*
Asteraceae	<i>Conyza</i>	<i>sp</i>	Fleabane	*
Asteraceae	<i>Hyalosperma</i>	<i>cotula</i>		
Asteraceae	<i>Hypochaeris</i>	<i>glabra</i>	Smooth Catsear	*
Asteraceae	<i>Hypochaeris</i>	<i>radicata</i>	Flat Weed	*
Asteraceae	<i>Lagenophora</i>	<i>huegelii</i>		
Asteraceae	<i>Senecio</i>	<i>hispidulus</i>	Hispid Fireweed	
Asteraceae	<i>Sonchus</i>	<i>oleraceus</i>	Common Sowthistle	*
Asteraceae	<i>Ursinia</i>	<i>anthemoides</i>		*
Caryophyllaceae	<i>Petrohragia</i>	<i>dubia</i>		*
Casuarinaceae	<i>Allocasuarina</i>	<i>fraseriana</i>	Sheoak	
Colchicaceae	<i>Burchardia</i>	<i>congesta</i>	Milkmaids	
Cupressaceae	<i>Callitris</i>	<i>preissii</i>	Rottneest Island Pine	planted
Cyperaceae	<i>Lepidosperma</i>	<i>leptostachyum</i>		
Cyperaceae	<i>Lepidosperma</i>	<i>?gladiatum</i>	?Coast Sword-sedge	
Dennstaedtiaceae	<i>Pteridium</i>	<i>esculentum</i>	Bracken	
Dilleniaceae	<i>Hibbertia</i>	<i>amplexicaulis</i>		
Dilleniaceae	<i>Hibbertia</i>	<i>hypericoides</i>	Yellow Buttercups	
Dilleniaceae	<i>Hibbertia</i>	<i>pilosa</i>	Hairy Guinea Flower	
Droseraceae	<i>Drosera</i>	<i>erythrorhiza</i>	Red Ink Sundew	
Droseraceae	<i>Drosera</i>	<i>pallida</i>	Pale Rainbow	
Droseraceae	<i>Drosera</i>	<i>stolonifera</i>	Leafy Sundew	



Family	Genus	Species	Common Name	Status
Epacridaceae	<i>Leucopogon</i>	<i>sp.</i>		
Epacridaceae	<i>Leucopogon</i>	<i>verticillatus</i>	Tassel Flower	
Euphorbiaceae	<i>Phyllanthus</i>	<i>calycinus</i>		
Goodeniaceae	<i>Dampiera</i>	<i>alata</i>	Winged-stem Dampiera	
Goodeniaceae	<i>Dampiera</i>	<i>linearis</i>	Common Dampiera	
Goodeniaceae	<i>Lechenaultia</i>	<i>biloba</i>	Blue Leschenaultia	
Haemodaraaceae	<i>Anigozanthos</i>	<i>manglesii</i>	Mangles Kangaroo Paw	
Haemodaraaceae	<i>Conostylis</i>	<i>setigera</i>		
Iridaceae	<i>Freesia</i>	<i>alba x leichtlinii</i>	Freesia	*
Iridaceae	<i>Orthrosanthus</i>	<i>laxus</i>	Morning Iris	
Iridaceae	<i>Romulea</i>	<i>rosea</i>	Guildford Grass	*
Lamiaceae	<i>Hemigenia</i>	<i>incana</i>	Silky Hemigenia	
Lamiaceae	<i>Lavandula</i>	<i>stoechas</i>	Italian Lavender	*
Lamiaceae	<i>Stachys</i>	<i>arvensis</i>	Staggerweed	*
Mimosaceae	<i>Acacia</i>	<i>acuminata</i>	Jam	
Mimosaceae	<i>Acacia</i>	<i>baileyana</i>		*
Mimosaceae	<i>Acacia</i>	<i>dentifera</i>		
Mimosaceae	<i>Acacia</i>	<i>drummondii</i>	Drummond's Wattle	
Mimosaceae	<i>Acacia</i>	<i>extensa</i>	Wiry Wattle	
Mimosaceae	<i>Acacia</i>	<i>nervosa</i>	Rib Wattle	
Mimosaceae	<i>Acacia</i>	<i>pulchella</i>	Prickly Moses	
Mimosaceae	<i>Acacia</i>	<i>pycnantha</i>	Golden Wattle	*
Mimosaceae	<i>Acacia</i>	<i>podalyriifolia</i>		*
Mimosaceae	<i>Acacia</i>	<i>sp.</i>		NF
Myrtaceae	<i>Astartea</i>	<i>fascicularis</i>		
Myrtaceae	<i>Beaufortia</i>	<i>sp</i>		NF
Myrtaceae	<i>Calothamnus</i>	<i>quadrifidus</i>	One-sided Bottlebrush	
Myrtaceae	<i>Corymbia</i>	<i>calophylla</i>	Marri	
Myrtaceae	<i>Darwinia</i>	<i>citriodora</i>	Lemon-scented Darwinia	
Myrtaceae	<i>Eucalyptus</i>	<i>marginata</i>	Jarrah	
Myrtaceae	<i>Eucalyptus</i>	<i>macrocarpa</i>	Mottlecah	
Myrtaceae	<i>Eucalyptus</i>	<i>sp.</i>	planted	*planted



Family	Genus	Species	Common Name	Status
Myrtaceae	<i>Hypocalymma</i>	<i>angustifolium</i>	White Myrtle	
Myrtaceae	<i>Kunzea</i>	<i>glabrescens</i>	Spearwood	
Myrtaceae	<i>Melaleuca</i>	<i>scabra</i>	Rough Honeymyrtle	
Myrtaceae	<i>Pericalymma</i>	<i>ellipticum</i>	Swamp Teatree	
Myrtaceae	<i>Verticordia</i>	<i>huegelii</i>	Variegated Featherflower	
Orchidaceae	<i>Caladenia</i>	<i>flava</i>	Cowslip Orchid	
Orchidaceae	<i>Thelymitra</i>	<i>antennifera</i>		
Oxalidaceae	<i>Oxalis</i>	<i>glabra</i>		*
Oxalidaceae	<i>Oxalis</i>	<i>pes-caprae</i>	Soursob	*
Papilionaceae	<i>Bossiaea</i>	<i>pulchella</i>		
Papilionaceae	<i>Chamaecytisus</i>	<i>palmensis</i>	Tagasaste	*
Papilionaceae	<i>Daviesia</i>	<i>homida</i>		
Papilionaceae	<i>Daviesia</i>	<i>sp.</i>		NF
Papilionaceae	<i>Gastrolobium</i>	<i>oxylobioides</i>	Champion Bay Poison	
Papilionaceae	<i>Gompholobium</i>	<i>marginatum</i>		
Papilionaceae	<i>Hovea</i>	<i>trisperma</i>	Common Hovea	
Papilionaceae	<i>Kennedia</i>	<i>coccinea</i>	Coral Vine	
Papilionaceae	<i>Mirbelia</i>	<i>dilatata</i>	Holly-leaved Mirbelia	
Papilionaceae	<i>Podalyria</i>	<i>sericea</i>		*
Pinaceae	<i>Pinus</i>	<i>radiata</i>		*
Poaceae				
Poaceae	<i>Neurachne</i>	<i>alopeкуроidea</i>	Foxtail Mulga Grass	
Polygalaceae	<i>Comesperma</i>	<i>ciliatum</i>		
Polygalaceae	<i>Polygala</i>	<i>myrtifolia</i>	Myrtleleaf Milkwort	*
Primulaceae	<i>Anagallis</i>	<i>arvensis</i>	Pimpernel	*
Proteaceae	<i>Dryandra</i>	<i>lindleyana</i>	Couch Honeypot	
Proteaceae	<i>Dryandra</i>	<i>sessilis</i>	Parrot Bush	
Proteaceae	<i>Grevillea</i>	<i>endlicheriana</i>	Spindly Grevillea	
Proteaceae	<i>Grevillea</i>	<i>synapheae</i>		
Proteaceae	<i>Grevillea</i>	<i>sp.</i>		NF
Proteaceae	<i>Hakea</i>	<i>lissocarpha</i>	Honey Bush	
Proteaceae	<i>Hakea</i>	<i>trifurcata</i>	Two-leaf Hakea	



Family	Genus	Species	Common Name	Status
Proteaceae	<i>Hakea</i>	<i>undulata</i>	Wavy-leaved Hakea	
Proteaceae	<i>Petrophile</i>	<i>striata</i>		
Rhamnaceae	<i>Trymalium</i>	<i>ledifolium</i> var. <i>rosmarinifolium</i>		
Rubiaceae	<i>Opercularia</i>	<i>hispidula</i>	Hispid Stinkweed	
Scrophulariaceae	<i>Parentucellia</i>	<i>latifolia</i>	Common Bartsia	*
Scrophulariaceae	<i>Verbascum</i>	<i>virgatum</i>		*
Solanaceae	<i>Solanum</i>	<i>nigrum</i>	Black Berry Nightshade	*
Sterculiaceae	<i>Brachychiton</i>	<i>gregorii</i>	Desert Kurragong	*planted
Stylidiaceae	<i>Stylidium</i>	<i>amoenum</i>	Lovely Triggerplant	
Stylidiaceae	<i>Stylidium</i>	<i>calcaratum</i>	Book Triggerplant	
Stylidiaceae	<i>Stylidium</i>	<i>sp.</i>		NF
Thymelaeaceae	<i>Pimelea</i>	<i>ciliata</i> subsp. <i>ciliata</i>		
Xanthorrhoea	<i>Xanthorrhoea</i>	<i>gracilis</i>	Graceful Grass Tree	
Xanthorrhoea	<i>Xanthorrhoea</i>	<i>preissii</i>	Grasstree	
Zamiaceae	<i>Macrozamia</i>	<i>riedlei</i>	Zamia	

\* Introduced species

**NF** No flowers (so identification to species was not possible)

**WONS** "Weed of National Significance"

**DP** Declared Plant (a weed declared under the *Agriculture and Related Resources Protection Act 1976*)



Appendix C  
Vegetation



Appendix D

## Fauna

*Environment Protection And Biodiversity Conservation Act*  
1999 Fauna Conservation Categories

Western Australian *Wildlife Conservation Act 1950* Fauna  
Conservation Codes

DEC Priority Fauna Conservation Codes.

Fauna Species that may occur in the 'DEC (CALM) Land' Site



**Table 8 Environment Protection And Biodiversity Conservation Act 1999 Fauna Conservation Categories**

<b>Conservation Category</b>	<b>Definition</b>
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
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 classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Know)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened

**EPBC Act Categories**

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.*

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.*

**Table 9 Western Australian Wildlife Conservation Act 1950 Fauna 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 10 DEC Priority Fauna Conservation Codes.** (Species not listed under the Wildlife Conservation Act 1950, but for which there is some concern).

<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.



**Table 11 Fauna Species that may occur in the 'DEC (CALM) Land' Site (Source: Western Australian Museum Faunabase Search of the Mundaring area); and those recorded during the opportunistic fauna surveys.**

Family	Genus	Species	Common Name	Status	Recorded During Field Survey
<b>Birds</b>					
Accipitridae	<i>Accipiter</i>	<i>fasciatus fasciatus</i>	Brown Goshawk		
Accipitridae	<i>Aquila</i>	<i>audax</i>	Wedge-tailed Eagle		
Aegothelidae	<i>Aegotheles</i>	<i>cristatus cristatus</i>	Australian Owlet Nightjar		
Anatidae	<i>Chenonetta</i>	<i>jubata</i>	Australian Wood Duck		
Ardeidae	<i>Ixobrychus</i>	<i>minutus dubius</i>	Little Bittern	P2	
Campephagidae	<i>Coracina</i>	<i>maxima</i>	Ground Cuckoo-shrike		
Corvidae	<i>Corvus</i>	<i>bennetti</i>	Little Crow		
Cractidae	<i>Strepera</i>	<i>versicolor</i>	Grey Currawong		+
Cuculidae	<i>Chrysococcyx</i>	<i>lucidus plagosus</i>	Shining Bronze-cuckoo		
Cuculidae	<i>Cuculus</i>	<i>pallidus</i>	Pallid Cuckoo		
Dicruridae	<i>Rhipidura</i>	<i>fuliginosa preissi</i>	Grey Fantail		+
Falconidae	<i>Falco</i>	<i>berigora berigora</i>	Brown Falcon		
Falconidae	<i>Falco</i>	<i>longipennis longipennis</i>	Australian Hobby		
Halcyonidae	<i>Dacelo</i>	<i>novaeguineae</i>	Laughing Kookaburra	*	+
Hirundinidae	<i>Hirundo</i>	<i>nigricans</i>	Tree Martin		
Maluridae	<i>Malurus</i>	<i>elegans</i>	Red-winged Fairy-wren		
Meliphagidae	<i>Acanthorhynchus</i>	<i>superciliosus</i>	Western Spinebill		
Motacillidae	<i>Anthus</i>	<i>australis australis</i>	Richard's Pipit		
Pachycephalidae	<i>Pachycephala</i>	<i>pectoralis fuliginosa</i>	Golden Whistler		



Family	Genus	Species	Common Name	Status	Recorded During Field Survey
Pardalotidae	<i>Pardalotus</i>	<i>punctatus punctatus</i>	Spotted Pardalote		
Pardalotidae	<i>Pardalotus</i>	<i>punctatus xanthopyge</i>	Yellow-rumped Pardalote		
Pardalotidae	<i>Pardalotus</i>	<i>striatus</i>	Striated Pardalote		
Passeridae	<i>Neochmia</i>	<i>temporalis temporalis</i>	Red-browed Finch		
Passeridae	<i>Stagonopleura</i>	<i>oculata</i>	Red-eared Firetail		
Petroicidae	<i>Petroica</i>	<i>multicolor campbelli</i>	Scarlet Robin		
Phasianidae	<i>Pavo</i>	<i>cristatus</i>	Common Peafowl (Indian Peafowl)	*	
Podargidae	<i>Podargus</i>	<i>strigoides brachypterus</i>	Tawny Frogmouth		
Psittacidae	<i>Calyptorhynchus</i>	<i>banksii</i>	Red-tailed Black Cockatoo		
Psittacidae	<i>Calyptorhynchus</i>	<i>banksii naso</i>	Forest Red-tailed Black Cockatoo	Schedule 1 / Vulnerable (CALM)	
Psittacidae	<i>Calyptorhynchus</i>	<i>baudinii</i>	Baudin's Cockatoo	Schedule 1 / Endangered (CALM) (EPBC - Vulnerable)	
Psittacidae	<i>Calyptorhynchus</i>	<i>latirostris</i>	Carnaby's Cockatoo	Schedule 1 / Endangered	
Psittacidae	<i>Calyptorhynchus</i>	<i>sp</i>			
Psittacidae	<i>Melopsittacus</i>	<i>undulatus</i>	Budgerigar		
Psittacidae	<i>Neophema</i>	<i>elegans</i>	Elegant Parrot		
Psittacidae	<i>Platycercus</i>	<i>icterotis</i>	Western Rosella		
Psittacidae	<i>Platycercus</i>	<i>spurius</i>	Red-capped Parrot		
Psittacidae	<i>Platycercus</i>	<i>zonarius</i>	Australian Ringneck (Ring-necked Parrot)		+
Psittacidae	<i>Polytelis</i>	<i>anthopeplus anthopeplus</i>	Regent Parrot		



Family	Genus	Species	Common Name	Status	Recorded During Field Survey
Rallidae	<i>Porzana</i>	<i>pusilla palustris</i>	Baillon's Crake		
Rallidae	<i>Porzana</i>	<i>tabuensis</i>	Spotless Crake		
Strigidae	<i>Ninox</i>	<i>connivens</i>	Barking Owl	P2 ( <i>N. connivens connivens</i> )	
Strigidae	<i>Ninox</i>	<i>novaeseelandiae</i>	Boobook Owl		
Strigidae	<i>Ninox</i>	<i>novaeseelandiae boobook</i>	Boobook Owl		
Turnicidae	<i>Turnix</i>	<i>varia varia</i>	Painted Bustard-Quail		
<b>Mammals</b>					
Burramyidae	<i>Cercartetus</i>	<i>concinnus</i>	Western Pygmy-possum / Mundarda		
Dasyuridae	<i>Antechinus</i>	<i>flavipes</i>	Yellow-footed Antechinus		
Dasyuridae	<i>Antechinus</i>	<i>flavipes leucogaster</i>	Mardo		
Dasyuridae	<i>Dasyurus</i>	<i>geoffroi</i>	Western Quoll / Chuditch	Schedule 1 / Vulnerable	
Dasyuridae	<i>Phascogale</i>	<i>tapoatafa tapoatafa</i>	Brush-tailed Phascogale / Wambenger	P3	
Dasyuridae	<i>Sminthopsis</i>	<i>gilberti</i>	Gilbert's Dunnart		
Felidae	<i>Felis</i>	<i>catus</i>	Cat	*	
Macropodidae	<i>Macropus</i>	<i>eugenii derbianus</i>	Tammar Wallaby	P5	
Macropodidae	<i>Macropus</i>	<i>fuliginosus</i>	Western Grey Kangaroo		+
Macropodidae	<i>Macropus</i>	<i>irma</i>	Western Brush Wallaby	P4	
Macropodidae	<i>Setonix</i>	<i>brachyurus</i>	Quokka	Schedule 1 / Vulnerable	
Muridae	<i>Hydromys</i>	<i>chrysogaster</i>	Water Rat	P4	
Muridae	<i>Mus</i>	<i>musculus</i>	House Mouse	*	



Family	Genus	Species	Common Name	Status	Recorded During Field Survey
Muridae	<i>Rattus</i>	<i>rattus</i>	Black Rat	*	
Mustelidae	<i>Mustela</i>	<i>putorius</i>	European Polecat / Ferret	*	
Myrmecobiidae	<i>Myrmecobius</i>	<i>fasciatus</i>	Numbat / Walpurti	Schedule 1 / Vulnerable	
Peramelidae	<i>Isoodon</i>	<i>obesulus fusciventer</i>	Quenda / Southern Brown Bandicoot	P5	
Phalangeridae	<i>Trichosurus</i>	<i>vulpecula vulpecula</i>	Common Brushtail Possum		
Tachyglossidae	<i>Tachyglossus</i>	<i>aculeatus</i>	Short-beaked Echidna		
Tarsipedidae	<i>Tarsipes</i>	<i>rostratus</i>	Honey Possum / Noolbenger		
Thylacomyidae	<i>Macrotis</i>	<i>lagotis</i>	Bilby	Schedule 1 / Vulnerable	
Vespertilionidae	<i>Chalinolobus</i>	<i>gouldii</i>	Gould's Wattled Bat		
Vespertilionidae	<i>Nyctophilus</i>	<i>geoffroyi</i>	Lesser Long-eared Bat		
Vespertilionidae	<i>Nyctophilus</i>	<i>timoriensis timoriensis</i>	Greater Long-eared Bat		
Vespertilionidae	<i>Vespadelus</i>	<i>regulus</i>	Southern Forest Bat		
<b>Reptiles</b>					
Agamidae	<i>Ctenophorus</i>	<i>ornatus</i>	Ornate Rock Dragon		
Agamidae	<i>Pogona</i>	<i>minor minor</i>	Western Bearded Dragon		
Agamidae	<i>Rankinia</i>	<i>adelaidensis</i>	Western Heath Dragon		
Boidae	<i>Antaresia</i>	<i>stimsoni stimsoni</i>	Western Stimson's Python		
Boidae	<i>Morelia</i>	<i>spilota imbricata</i>	Southern Carpet Python	Schedule 4	
Cheluidae	<i>Chelodina</i>	<i>oblonga</i>	Oblong Turtle		
Elapidae	<i>Acanthophis</i>	<i>antarcticus</i>	Southern Death Adder	P3	



Family	Genus	Species	Common Name	Status	Recorded During Field Survey
Elapidae	<i>Brachyuropsis</i>	<i>semifasciata</i>	Southern Shovel-nosed Snake		
Elapidae	<i>Notechis</i>	<i>scutatus</i>	Tiger Snake		
Elapidae	<i>Parasuta</i>	<i>gouldii</i>	Gould's Snake		
Elapidae	<i>Parasuta</i>	<i>nigriceps</i>	Black-backed Snake		
Elapidae	<i>Pseudechis</i>	<i>australis</i>	Mulga Snake		
Elapidae	<i>Pseudonaja</i>	<i>affinis affinis</i>	Dugite		
Elapidae	<i>Pseudonaja</i>	<i>modesta</i>	Ringed Brown Snake		
Elapidae	<i>Pseudonaja</i>	<i>nuchalis</i>	Gwardar		
Gekkonidae	<i>Christinus</i>	<i>marmoratus</i>	Marbled Gecko		
Gekkonidae	<i>Diplodactylus</i>	<i>granariensis granariensis</i>	Wheatbelt Stone Gecko		
Gekkonidae	<i>Diplodactylus</i>	<i>polyophthalmus</i>	Speckled Stone Gecko		
Gekkonidae	<i>Gehyra</i>	<i>variegata</i>	Variiegated Tree Dtella		
Gekkonidae	<i>Strophurus</i>	<i>spinigerus</i>	Western Spiny-tailed Gecko		
Gekkonidae	<i>Strophurus</i>	<i>spinigerus inornatus</i>	Western Spiny-tailed Gecko		
Gekkonidae	<i>Underwoodisaurus</i>	<i>milii</i>	Barking Gecko		
Pygopodidae	<i>Aprasia</i>	<i>pulchella</i>	Granite Worm Lizard		
Pygopodidae	<i>Aprasia</i>	<i>repens</i>	Sandplain Worm Lizard		
Pygopodidae	<i>Lialis</i>	<i>burtonis</i>	Burton's Legless Lizard		
Pygopodidae	<i>Pygopus</i>	<i>lepidopodus</i>	Common Scaly-foot		
Scincidae	<i>Acritoscincus</i>	<i>trilineatum</i>	Southwestern Cool Skink		
Scincidae	<i>Cryptoblepharus</i>	<i>plagiocephalus</i>	Fence or Wall Skink		



Family	Genus	Species	Common Name	Status	Recorded During Field Survey
Scincidae	<i>Ctenotus</i>	<i>delli</i>	Dell's Skink	P4	
Scincidae	<i>Ctenotus</i>	<i>fallens</i>	-		
Scincidae	<i>Ctenotus</i>	<i>labillardieri</i>	Red-legged Skink		
Scincidae	<i>Egernia</i>	<i>kingii</i>	King's Skink		
Scincidae	<i>Egernia</i>	<i>napoleonis</i>	Southwestern Crevice Skink		
Scincidae	<i>Eremiascincus</i>	<i>richardsonii</i>	Banded Skink		
Scincidae	<i>Hemiergis</i>	<i>initialis</i>	Five-toed Earless Skink		
Scincidae	<i>Hemiergis</i>	<i>initialis initialis</i>	Five-toed Earless Skink		
Scincidae	<i>Lerista</i>	<i>distinguenda</i>	-		
Scincidae	<i>Lerista</i>	<i>elegans</i>	-		
Scincidae	<i>Lerista</i>	<i>microtis</i>	-		
Scincidae	<i>Menetia</i>	<i>greyii</i>	Common Dwarf Skink		
Scincidae	<i>Morethia</i>	<i>lineocellata</i>	-		
Scincidae	<i>Morethia</i>	<i>obscura</i>	Woodland Flecked Skink		
Scincidae	<i>Tiliqua</i>	<i>rugosa rugosa</i>	Southwestern Bobtail		+
Typhlopidae	<i>Ramphotyphlops</i>	<i>australis</i>	-		
Typhlopidae	<i>Ramphotyphlops</i>	<i>pinguis</i>	-		
Typhlopidae	<i>Ramphotyphlops</i>	<i>waitii</i>	-		
Varanidae	<i>Varanus</i>	<i>gouldii</i>	Gould's Sand Monitor		
Varanidae	<i>Varanus</i>	<i>tristis tristis</i>	Black-headed Monitor		
<b>Amphibia</b>					



Family	Genus	Species	Common Name	Status	Recorded During Field Survey
Hylidae	<i>Litoria</i>	<i>adelaidensis</i>	Slender Tree Frog		
Hylidae	<i>Litoria</i>	<i>moorei</i>	Motorbike Frog or Bell Frog		
Myobatrachidae	<i>Crinia</i>	<i>georgiana</i>	Quacking Frog		+
Myobatrachidae	<i>Crinia</i>	<i>glauerti</i>	Glauerts' Froglet		
Myobatrachidae	<i>Crinia</i>	<i>pseudinsignifera</i>	Bleating Froglet		
Myobatrachidae	<i>Geocrinia</i>	<i>leai</i>	Lea's Frog		
Myobatrachidae	<i>Heleioporus</i>	<i>albopunctatus</i>	Western Spotted Frog		
Myobatrachidae	<i>Heleioporus</i>	<i>barycragus</i>	Western Marsh Frog		
Myobatrachidae	<i>Heleioporus</i>	<i>eyrei</i>	Moaning Frog		
Myobatrachidae	<i>Heleioporus</i>	<i>inornatus</i>	Whooping Frog		
Myobatrachidae	<i>Heleioporus</i>	<i>psammophilus</i>	Sand Frog		
Myobatrachidae	<i>Limnodynastes</i>	<i>dorsalis</i>	Bullfrog or Banjo Frog		
Myobatrachidae	<i>Myobatrachus</i>	<i>gouldii</i>	Turtle Frog		
Myobatrachidae	<i>Pseudophryne</i>	<i>guentheri</i>	Crawling Frog or Gunther's Toadlet		
<b>Fish</b>					
Poeciliidae	<i>Gambusia</i>	<i>affinis</i>	Mosquito Fish / Plague Minnow	*	



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