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Water Corporation

Report for Vasse Diversion
Drain Upgrade

Fauna and Flora Study

February 2010



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Executive Summary

The Water Corporation proposes to upgrade the Vasse Diversion Drain and has commissioned GHD Pty Ltd (GHD) to conduct a Level 2 Flora and Level 1 Fauna Survey. The flora and fauna assessment is required to assess the impacts of the proposed upgrading works on the native vegetation and fauna, specifically the Western Ringtail Possum.

The Vasse Diversion Drain is located within the Shire of Busselton and extends for approximately 6.3 km from Geographe Bay to the Busselton Golf Course south of the town. The flora and fauna survey area was conducted from drain outlet on the beach at Geographe Bay to the intersection of Chapman Hill Road.

The survey was conducted between the 15th and 16th October 2009 and the results of the assessment are summarised below:

Desktop Assessment

- » One quarter of the project area is classified as Multiple Use wetland.
- » A small section of the survey area, located between Bussell Highway and Busselton Bypass, is adjacent to a Conservation Category wetland.
- » No reserves or conservation areas are within, or adjacent to, the study area.
- » The Conservation Category wetland and surrounding area is classified as an Environmentally Sensitive Area (ESA).
- » The majority of the study area is within the Beard vegetation association 1000 and described as “Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree (*Melaleuca* spp.)”. This vegetation association is considered *Vulnerable*.
- » There are no Threatened Ecological Communities or Priority Ecological Communities within 2 km of the survey area.
- » Thirteen Declared Rare and 33 Priority Flora species have been recorded within 10 km of the survey area.

Field Assessment

- » Five vegetation types have been identified within the study area:
 - HD: Heavily disturbed / predominantly cleared areas but some disturbance opportunists such as grasses, including **Avena fatua*, **Cynodon dactylon* and **Eragrostis curvula*;
 - AsAf: Tall shrubland of *Acacia saligna* and *Agonis flexuosa* over weed species;
 - Esp.Af: Low open woodland of *Eucalypt* species over tall shrubland of *Agonis flexuosa* and mixed *Acacia* species over weed species;
 - AfLe: Tall shrubland of *Agonis flexuosa* and mixed *Acacia* species over sedgeland of *Lepidosperma effusum*, *Juncus kraussii* and *Ficinia nodosa* over weed species; and



- Mc*WmLc.: Tall open scrub of *Melaleuca cuticularis* and *Agonis flexuosa* over herbland of **Watsonia meriana* over sedgeland of *Lepidosperma carphoides*
- » The vegetation ranged between *Very Good* (3) to *Completely Degraded* (6). Most of the understorey within the survey area has been cleared and/or grazed in the past and aggressive weed species now dominate. Rubbish was present within the survey area and a track along most of the Diversion Drain is also present.
- » Plant species diversity within the study area is considered to represent a low degree of diversity, with a total of 77 taxa from 29 families recorded.
- » No Declared Rare Flora or Priority Flora species were recorded from the study area during the field survey.
- » Forty-six weed species were recorded during the survey. Weed invasion is present along the whole of the Vasse Diversion Drain, except along a small area adjacent to Geographe Bay, where some native vegetation structure remains.
- » A total of 39 bird, seven mammal, 11 reptile, five amphibian, two fish and one crustacean species were recorded during the reconnaissance survey within the study area.
- » Two significant fauna species were identified along the alignment. These species were the Western Ringtail Possum and the Quenda (Southern Brown Bandicoot).
- » This project will require the clearing of some native vegetation which is utilised by the Western Ringtail Possum. The guidance for determining the likelihood of a significant impact in this species is clearing of a greater area than 0.5 ha of supportive remnant habitat (EPBC Policy Statement 3:10). The size of habitat to be impacted is approximately 0.35 ha. Therefore the impact on the possum does not exceed the significant impact threshold and would not warrant further investigation or special fauna management practices.
- » The Quenda may be impacted by a reduction and/or fragmentation in habitat, however does not require further assessment. The use of a fauna clearance team will be required to move individuals.

Management Recommendations

- » The drain creates a link between the ocean and fresh water and may be suitable and important for the survival of species that may migrate, such as the Pouched Lamprey. It is important that disturbance to the drain be kept to a minimum.
- » Due to the potentially long time frame to project commencement, it is recommended that a re-assessment of the presence and location of the Western Ringtail Possum be undertaken. Populations of possums can move to other areas of suitable habitat and further growth of plants in the project area may create new habitat opportunities.
- » It is recommended that a qualified zoologist be present during clearing or trimming of branches to assist in minimising the impacts of clearing on the Western Ringtail Possum and Quenda (Southern Brown Bandicoot).



- » For any clearing occurring on site, the clearing line should be clearly defined in order to prevent impact on native vegetation that is to be retained.
- » The project is not considered to require referral under the *Environmental Protection and Biodiversity Conservation Act 1999* or the *Environmental Protection Act 1986*.
- » The project is considered to possibly be at variance with one of the Ten Clearing Principles. Clearing Principle (f) relates to the presence of vegetation dependent on watercourses or wetlands.
- » The Water Corporation will be required to acquire a Clearing Permit as the areas to be cleared intersect a wetland/ESA and the drain reconstruction is not classified as a 'structure' under the guidelines of it's agreement with DEC.



1. Introduction

1.1 Background

The Water Corporation commissioned GHD Pty Ltd (GHD) to conduct a Level 2 Flora and Level 1 Fauna Survey within 10 m of the outside edge of the Vasse Diversion Drain (VDD). The level 1 fauna survey included a targeted survey for Western Ringtail Possums and their dreys.

The flora and fauna assessment is required to assess the impacts of the proposed upgrading works on the native vegetation and native fauna including the Western Ringtail Possum.

1.2 Study Area

The VDD is located in the Shire of Busselton approximately 220 km from Perth on the shores of Geographe Bay. The VDD extends approximately 6.3 km from the ocean outfall point at Geographe Bay in the north to the Busselton Golf Course in the south.

The location of study area is shown in Figure 1, Appendix A.

1.3 Scope of Works

This flora and fauna assessment included both desktop and field assessments. The desktop assessment included:

- » A review of the Department of Environment and Conservation's (DEC) Rare and Threatened Flora database;
- » A review of the DEC's Threatened Fauna database;
- » A review of local and regional significance of plant communities;
- » A review of the Western Australian Museum database for threatened and endangered fauna;
- » A review of the DEC's Environmentally Sensitive Areas (ESAs); 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 aimed to verify the outcomes of the desktop study and provide 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 vascular plant species in the study area, undertaken through transect survey methods;
- » A review of, and search for, significant flora species;
- » An inventory of dominant exotic plants, including declared noxious plants and environmental weed species;



- » Advice on whether weeds are likely to spread to and result in environmental harm to adjacent areas of native vegetation that are in good or better condition;
- » A description and location, including mapping, of plant communities;
- » A rating of condition of the vegetation communities or areas;
- » A review of the local and regional significance of the plant communities in terms of their intrinsic value, extent, rarity and condition;
- » Assessment of potential clearing against the Environmental Protection Act's 10 Clearing Principles (Schedule 5). Each principle has been assessed in accordance with the DEC's Guideline to Assessment – Clearing of Native Vegetation.
- » An inventory of the vertebrate fauna species in the study area through targeted searches and opportunistic recording of species;
- » Review of the presence and abundance of pest, declared or feral animals;
- » Review of the fauna species considered to be rare or in need of special protection;
- » Targeted survey for Western Ringtail Possums; and
- » Identification of any other habitats of significance.



2. Existing Environment

2.1 Climate

The Bureau of Meteorology (BOM) weather station located nearest to the study area is at Busselton. Recorded climatic data is summarised below:

- » Mean Daily Maximum Temperature: 29.2°C (Jan) – 17.1°C (July)
- » Mean Daily Minimum Temperature: 15.2°C (Feb) – 8.1°C (July)
- » Mean Annual Rainfall: 723.4mm
- » Mean Annual Rain Days: 91.8 days

(Source: BoM, 2009)

2.2 Wetlands and Watercourses

The survey area is a constructed watercourse, the Vasse River Diversion Drain which runs into the ocean.

2.2.1 Geomorphic Wetlands

Categorisation of wetlands has been undertaken by Hill *et al.* (1996), delineating the Swan Coastal Plain into levels of protection and management categories. The location of geomorphic wetlands within the vicinity of the study area is shown in Figure 2.

A small section of the survey area, located between Bussell Highway and Busselton Bypass, is designated as a Conservation Category Wetland. “Conservation Category Wetlands” are the highest priority wetlands and support a high level of ecological attributes and functions (Environmental Protection Authority [EPA], 2005). The EPA’s position is that no development or clearing should occur within these wetlands and any activity that may lead to further loss or degradation is inappropriate (EPA, 2005). Schemes and proposals that are likely to lead to a significant adverse impact on these wetlands are likely to be formally assessed by the EPA.

“Conservation Category Wetlands” are also classified Environmentally Sensitive Areas (ESAs). The EPA also requires a buffer around Conservation Category Wetlands. Buffers are designed to protect wetlands from potential deleterious impacts while helping safeguard and maintain ecological processes and functions within the wetland and, wherever possible, in the buffer.

Approximately one quarter of the project area is classified Multiple Use wetland. Multiple Use wetlands are classified as those wetlands with few attributes which still provide important wetland functions.

The EPA states management objectives for these wetlands are that “all reasonable measures should be taken to retain the wetland’s hydrological functions (including onsite water infiltration and flood detention) and, where possible, other wetland functions” (EPA, 2005).



2.3 Reserves and Conservation Areas

The VDD runs between two C Class Nature Reserves for approximately 150m of its length (see Figure 2). These reserves are part of the Vasse wetland area which is relatively degraded.

2.4 Environmentally Sensitive Areas

The DEC's online Native Vegetation Viewer was searched to determine the location of any Environmentally Sensitive Areas (ESAs) within the vicinity of the project area, as declared by a Notice under Section 51B of the *Environmental Protection Act 1986*.

The Conservation Category wetland discussed above, and a buffer area around part of it, is classified as an ESA.

2.4.1 Vegetation Descriptions

The study area is within the Perth subregion of the Swan Coastal Plain Biogeographic region of Western Australia. Broadscale mapping (Beard, 1979) indicates three vegetation associations are present within the Study Area:

1000 Mosaic: Medium forest; jarrah-marri / Low woodland; *Banksia* / Low forest; teatree (*Melaleuca* species.);

27 Low woodland; paperbark (*Melaleuca* sp.); and

949 Low woodland; *Banksia*

2.4.2 Vegetation Extent, Type 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 (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

The extent of remnant native vegetation has been assessed by Shepherd *et al.* (2002), based on vegetation association mapping undertaken by Beard (1979). The remaining extent of the vegetation associations present within the study area, for the Perth subregion, is detailed in Table 1.

The majority of vegetation in the survey areas is within association 1000 and considered *Vulnerable*. A small amount of vegetation in the southern corner of the survey area is within associations 27 and 949.

Table 1 Major Vegetation System Associations within the Study Area (Shepherd *et al.*, pers comm 2005).

Vegetation Association Number	Association Description	Pre-European Extent (ha) in Perth IBRA subregion	Current Extent (ha) in Perth IBRA subregion	% Remaining	Proportion of study area (%)
1000	Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree (<i>Melaleuca</i> spp.)	94176	22514	23.9	>90
27	Low woodland; paperbark (<i>Melaleuca</i> sp.)	5836	1439	24.7	<10
949	Low woodland; banksia	184504	107620	58.3	<1

2.4.3 Threatened Ecological Communities (TEC)

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 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 EPA's position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

Possible TECs that do not meet survey criteria are added to the Department of Environment and Conservation's (DEC) Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

The DEC's TEC database was queried for known occurrences of TECs and PECs near the study area.

There are no known TECs or PECs in the near vicinity of the study area. TECs are present on the plain further inland, focussing on shrublands on clay flats.

2.5 Significant Flora

Commonwealth

Species of significant flora are protected under both State and Commonwealth Acts. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and the *Wildlife Conservation Act 1950* can trigger referral to the DEWHA and/or the EPA.

A description of Conservation Categories delineated under the EPBC Act is detailed in Appendix B. These are applicable to threatened flora and fauna species. A search of the EPBC Act Protected Matters Search Tool identified 11 Commonwealth protected flora species within the vicinity of the survey area.

State

In addition to the EPBC Act, significant flora in Western Australia is protected by the *Wildlife Conservation Act 1950*. This Act, which is administered by the DEC, protects Declared Rare Flora (DRF) species. The DEC also maintains a list of Priority Flora species. Conservation codes for flora species are assigned by the DEC to define the level of conservation significance. Priority Flora are not currently protected under the *Wildlife Conservation Act 1950*. Priority Flora may be rare or threatened, but cannot be considered for declaration as rare flora until adequate surveys have been undertaken of known sites and the degree of threat to these populations clarified. Special consideration is often given to sites that contain Priority Flora, despite them not having formal legislation protection. A description of the DEC's Conservation Codes that relate to flora species is provided in Appendix B.

A search of the DEC's Rare Flora Databases, Western Australian Herbarium (WAHERB) and Western Australian Museum (*NatureMap*) records was undertaken. Records identified 13 Declared Rare flora species occurring within 10 km of the study area. In addition, 33 Priority Flora species have been recorded within the search area. These species are listed in Table 2.



Table 2 Significant flora species previously recorded within 10 km of the study area (DEC, WAHERB and WA Museum)

Family	Species	Status (State)	Status (EPBC Act)
Asparagaceae	<i>Thysanotus glaucus</i>	P4	-
Brassicaceae	<i>Cardamine paucijuga</i>	P2	-
Cyperaceae	<i>Schoenus benthamii</i>	P3	-
	<i>Tetaria australiensis</i>	DRF	V
Epacridaceae	<i>Andersonia barbata</i>	P2	-
Euphorbiaceae	<i>Amperea micrantha</i>	P2	-
Hemerocallidaceae	<i>Johnsonia inconspicua</i>	P3	-
Menyanthaceae	<i>Villarsia submersa</i>	P4	-
Mimosaceae	<i>Acacia flagelliformis</i>	P4	-
	<i>Acacia lateriticola</i> glabrous variant (B.R. Maslin 6765)	P3	-
	<i>Acacia semitrullata</i>	P4	-
Myrtaceae	<i>Calothamnus</i> sp. Whicher (B.J. Keighery & N. Gibson 230)	P4	-
	<i>Chamelaucium erythrochlorum</i>	P4	-
	<i>Chamelaucium roycei</i>	DRF	-
	<i>Verticordia densiflora</i> var. <i>pedunculata</i>	DRF	E
	<i>Verticordia lehmannii</i>	P4	-
	<i>Verticordia plumosa</i> var. <i>ananeotes</i>	DRF	E
	<i>Verticordia plumosa</i> var. <i>vassensis</i>	DRF	E
Orchidaceae	<i>Caladenia arrecta</i>	P4	-
	<i>Caladenia huegelii</i>	DRF	E
	<i>Caladenia plicata</i>	P4	-
	<i>Caladenia procera</i>	DRF	CE
	<i>Drakaea elastica</i>	DRF	E
Papilionaceae	<i>Chorizema carinatum</i>	P3	-
	<i>Chorizema reticulatum</i>	P3	-
	<i>Gastrolobium</i> sp. Yoongarillup (S.Dilkes s.n. 1/9/1969)	P1	-



Family	Species	Status (State)	Status (EPBC Act)
	<i>Jacksonia gracillima</i>	P3	-
	<i>Kennedia lateritia</i>	DRF	E
	<i>Pultenaea pinifolia</i>	P3	-
Poaceae	<i>Puccinellia vassica</i>	P1	-
Proteaceae	<i>Banksia nivea</i> subsp. <i>uliginosa</i>	DRF	E
	<i>Conospermum paniculatum</i>	P3	-
	<i>Franklandia triaristata</i>	P4	-
	<i>Grevillea brachystylis</i> subsp. <i>brachystylis</i>	P3	-
	<i>Grevillea bronwenae</i>	P2	-
	<i>Grevillea elongata</i>	DRF	V
	<i>Hakea oldfieldii</i>	P3	-
	<i>Isopogon formosus</i> subsp. <i>dasylepis</i>	P3	-
	<i>Lambertia echinata</i> subsp. <i>occidentalis</i>	DRF	E
	<i>Lambertia orbifolia</i> subsp. Scott River Plains (L.W. Sage 684)	DRF	R
	<i>Synaphea hians</i>	P3	-
	<i>Synaphea petiolaris</i> subsp. <i>simplex</i>	P2	-
Rutaceae	<i>Boronia tetragona</i>	P3	-
Santalaceae	<i>Leptomeria furtiva</i>	P2	-
Sterculiaceae	<i>Thomasia laxiflora</i>	P3	-
Thymelaeaceae	<i>Pimelea ciliata</i> subsp. <i>longituba</i>	P3	-

P: Priority

DRF: Declared Rare Flora

V: Vulnerable

R: Rare

E: Endangered

CE: Critically Endangered



2.6 Fauna

2.6.1 Fauna within the general area

The Western Australian Museum *NatureMap* online search was conducted for a 10 km buffer of the study area. The search identifies terrestrial vertebrate species recorded in the collections of the Western Australian Museum and records from the DEC. The search identified the potential presence of 54 bird, 21 reptile, four amphibians and 16 mammal species.

A full list of species recorded from the *NatureMap* database is presented in Table 3, Appendix D.

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 (particularly bird species) that are vagrants or present in the general area but not present within the study area due to lack of suitable habitat.

2.6.2 Significant Fauna

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

Commonwealth legislation

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). A description of Conservation Categories delineated under the EPBC Act is detailed in Appendix D. These are applicable to threatened flora and fauna species. The WA *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 D.

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); and
- » 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).



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.

State Legislation

In Western Australia, the DEC also produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the *Wildlife Conservation Act 1950* but for which the DEC feels there is a cause for concern. These species have no special legislation 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 Appendix D.

Database searches

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 (administered by the DEWHA), for the matters of national environmental significance that may occur in, or may relate to, the study area.

From the *NatureMap* and DEWHA databases, a number of protected fauna species were identified as potentially occurring within the study area. These are shown in Table 4 below.

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 WA Museum 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 4 Listing of Potentially Occurring Significant, Rare and Priority Fauna Species within 10 km of the Study Area, with Information Source

Genus	Species	Common Name	Listing under Wildlife Conservation Act 1950 or DEC Priority List	Listing under EPBC Act	Source of Information	
					DEWHA	NatureMap
Birds						
<i>Anous</i>	<i>tenuirostris melanops</i>	Australian Lesser Noddy	Schedule 1	Vulnerable	+	+
<i>Calyptorhynchus</i>	<i>banksii naso</i>	Forest Red-tailed Black-Cockatoo	Schedule 1	Vulnerable	+	
<i>Calyptorhynchus</i>	<i>baudinii</i>	Baudin's Black-Cockatoo, Long-billed Black-Cockatoo	Schedule 1	Vulnerable	+	
<i>Calyptorhynchus</i>	<i>latirostris</i>	Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo	Schedule 1	Endangered	+	
<i>Diomedea</i>	<i>exulans (sensu lato)</i>	Wandering Albatross	Schedule 1	Vulnerable	+	
<i>Diomedea</i>	<i>exulans amsterdamensis</i>	Amsterdam Albatross	Schedule 1	Endangered	+	
<i>Diomedea</i>	<i>cauta</i>	Shy Albatross	Schedule 1	Vulnerable		+
<i>Diomedea</i>	<i>chrysostoma</i>	Grey-headed Albatross	Schedule 1	Vulnerable		+
<i>Diomedea</i>	<i>exulans</i>	Tristan Albatross	Schedule 1	Endangered	+	+
<i>Diomedea</i>	<i>gibsoni</i>	Gibson's Albatross	Schedule 1	Vulnerable	+	
<i>Halobaena</i>	<i>caerulea</i>	Blue Petrel	Schedule 1	Vulnerable	+	
<i>Macronectes</i>	<i>giganteus</i>	Southern Giant-Petrel	Schedule 1	Endangered	+	+



Genus	Species	Common Name	Listing under Wildlife Conservation Act 1950 or DEC Priority List	Listing under EPBC Act	Source of Information	
					DEWHA	NatureMap
<i>Macronectes</i>	<i>halli</i>	Northern Giant-Petrel	-	Vulnerable	+	
<i>Pterodroma</i>	<i>mollis</i>	Soft-plumaged Petrel	-	Vulnerable	+	
<i>Thalassarche</i>	<i>carteri</i>	Indian Yellow-nosed Albatross	Schedule 1	Vulnerable	+	
<i>Thalassarche</i>	<i>cauta cauta</i>	Shy Albatross, Tasmanian Shy Albatross	Schedule 1	Vulnerable	+	
<i>Thalassarche</i>	<i>melanophys</i>	Black-browed Albatross	Schedule 1	Vulnerable	+	
<i>Phoebetria</i>	<i>fusca</i>	Sooty Albatross	Schedule 1	Vulnerable		+
<i>Phoebetria</i>	<i>palpebrata</i>	Light-mantled Sooty Albatross	Schedule 1	Migratory/ Marine		
Mammals						
<i>Dasyurus</i>	<i>geoffroii</i>	Chuditch, Western Quoll	Schedule 1	Vulnerable	+	+
<i>Pseudocheirus</i>	<i>occidentalis</i>	Western Ringtail Possum	Schedule 1	Vulnerable	+	+
<i>Hydromys</i>	<i>chrysogaster</i>	Water-rat	Priority 4	-		
<i>Isodon</i>	<i>obesulus subsp. fusciventer</i>	Southern Brown Bandicoot, Quenda	Priority 5			



Genus	Species	Common Name	Listing under Wildlife Conservation Act 1950 or DEC Priority List	Listing under EPBC Act	Source of Information	
					DEWHA	NatureMap
Migratory/Marine Birds						
<i>Haliaeetus</i>	<i>leucogaster</i>	White-bellied Sea-Eagle	-	Migratory	+	
<i>Merops</i>	<i>ornatus</i>	Rainbow Bee-eater	-	Migratory	+	
<i>Ardea</i>	<i>alba</i>	Great Egret, White Egret	-	Migratory	+	
<i>Ardea</i>	<i>ibis</i>	Cattle Egret	-	Migratory	+	
<i>Calidris</i>	<i>acuminata</i>	Sharp-tailed Sandpiper	-	Migratory	+	
<i>Calidris</i>	<i>ferruginea</i>	Curlew Sandpiper	-	Migratory	+	
<i>Calidris</i>	<i>ruficollis</i>	Red-necked Stint	-	Migratory	+	
<i>Charadrius</i>	<i>bicinctus</i>	Double-banded Plover	-	Migratory	+	
<i>Charadrius</i>	<i>mongolus</i>	Lesser Sand Plover, Mongolian Plover	-	Migratory	+	
<i>Pluvialis</i>	<i>squatarola</i>	Grey Plover	-	Migratory	+	
<i>Tringa</i>	<i>glareola</i>	Wood Sandpiper	-	Migratory	+	
<i>Tringa</i>	<i>nebularia</i>	Common Greenshank, Greenshank	-	Migratory	+	
<i>Tringa</i>	<i>stagnatilis</i>	Marsh Sandpiper, Little Greenshank	-	Migratory	+	



3. Field Survey Methodology

3.1 Vegetation and Flora Assessment

GHD's qualified ecologists conducted the field flora survey between the 15th and 16th October, 2009. The survey was undertaken with regards to the EPA's Guidance Statement No. 51, where possible.

The flora and vegetation survey was conducted using relevés (unbounded search areas) across the project area. Relevés were used instead of quadrats due to the narrow and linear nature of the survey area and the fact that much more information could be recorded using this method. The relevés included recording a list of flora species visible at the time and mapping of vegetation types and conditions (including weed status). Aerial photography was used to assist in the delineation of vegetation types present in the study area.

A list of flora species collated from the relevés was generated for the study area. Where identification of flora species was uncertain, confirmation was made at the Western Australian State Herbarium.

The presence of Declared Rare or Priority Flora was assessed with suitable habitat for significant species searched. Vegetation was also assessed to determine the presence of TECs within the study area.

3.2 Fauna

GHD's qualified ecologists conducted the fauna investigation in conjunction with the flora investigation. The fauna survey included desktop investigations and field surveys, conducted with regard to the EPA's Guidance Statement No. 56, where possible.

The fauna survey was an opportunistic survey and did not involve any fauna trapping. The survey involved visual and aural surveys for any fauna species utilising the study area. The study area was also searched for any fauna signs, such as tracks, scats, bones, diggings and feeding signs.

Surveys also 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.

Species – specific search strategies were used to identify any protected species in the area or evidence that they utilise the study area. The zoologist and ecologists walked the VDD alignment looking for possums, dreys and scats as a sign of presence.



3.3 Nomenclature

Nomenclature used in this report follows that used by the DEC's *FloraBase* program and Western Australian Museum *NatureMap* program as they are deemed to contain the most up-to-date species information for Western Australia.

3.4 Limitations

Complete flora and vegetation assessments can require multiple surveys, at different times of year, and over a period of a number of years, to enable observation of all species present.

Some flora species, such as annuals, are only available for collection at certain times of the year, and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to above factors. Therefore, while this flora survey was relatively exhaustive, it is possible that some species with low abundance or with a very restricted range in the project area may have been overlooked.

The flora surveys were also restricted to predominantly flowering plants, with consideration of some other vascular plants such as cycads. Non-vascular plants were not systematically searched for, as the information available on these plants is generally limited.

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 study area; no sampling for invertebrates or aquatic species occurred.

4. Vegetation and Flora

4.1 Vegetation Description

The vegetation of the VDD was classified into five vegetation types. Generally the vegetation was homogenous across the study area, with all vegetation types having a dominant weed understorey and being heavily disturbed/previously cleared. However survey areas north of Bussell Highway and along Queen Elizabeth Avenue were different to vegetation recorded for the rest of the survey in having more native species recorded and a dominant understorey of sedge species. *Agonis flexuosa* and *Acacia saligna* were present in all vegetation types besides the heavily disturbed areas.

These vegetation types have been mapped at Figure 3, Appendix A and are summarised below:

- » **HD:** Heavily disturbed / predominantly cleared areas but some disturbance opportunists such as grasses, including **Avena fatua*, **Cynodon dactylon* and **Eragrostis curvula*
- » **AsAf:** Tall shrubland of *Acacia saligna* and *Agonis flexuosa* over weed species
- » **EspP.Af:** Low open woodland of *Eucalypt* species over tall shrubland of *Agonis flexuosa* and mixed *Acacia* species over weed species
- » **AfLe:** Tall shrubland of *Agonis flexuosa* and mixed *Acacia* species over sedgeland of *Lepidosperma effusum*, *Juncus kraussii* and *Ficinia nodosa* over weed species
- » **Mc*WmLc.:** Tall open scrub of *Melaleuca cuticularis* and *Agonis flexuosa* over herbland of **Watsonia meriana* over sedgeland of *Lepidosperma carphoides*

Photographs and descriptions of the of each of the vegetation types are shown in Appendix C.

4.1.1 Threatened Ecological Communities

No TECs or PECs were found to be within the VDD survey area, as a result of identification of the vegetation types present.

4.2 Vegetation Condition

The vegetation condition of the study area was rated during the field survey using the Vegetation Condition Rating Scale.

Developed for Bush Forever, the vegetation Condition Rating is a scale that recognises the intactness of vegetation, which is defined by the following (Government of Western Australia, 2000):

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



The Vegetation Condition Rating Scale is outlined in Table 5.

Table 5 Bush Forever (Government of WA, 2000) Vegetation Condition Rating Scale

Vegetation Condition Rating	Vegetation Condition	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 disturbances 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 in 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 condition of the native vegetation of the VDD ranged between *Very Good* (3) to *Completely Degraded* (6). The highest vegetation condition rating (*Very Good*) was located north of Bussell Highway adjacent to the coast. This area maintained some basic vegetation structure and contained the least amount of weeds compared to the rest of the survey area. However areas to the south have been previously cleared and planted tree species exist. Native vegetation to the north east of Bussell Highway rated between *Degraded* (5) and *Completely Degraded* (6). The area had been cleared in the past and was dominated by weed species.

Native vegetation south of Bussell Highway rated between *Good* (4) and *Degraded* (5). Native species were present in the understorey, however aggressive weed species still dominated.

Native vegetation present along College Ave running south east along the VDD is rated as *Degraded* (5) to *Completely Degraded* (6). This section of the survey area understorey has been cleared in the past and aggressive weed species now dominate. Rubbish was present within this section of the survey area and a track along the VDD is also present.

The entire survey area has not been burnt for at least 5 years. There is evidence of multiple and long term disturbances across the site.

Vegetation condition has been mapped in Figure 4, Appendix A.



4.3 Flora Species

Vegetation within the study areas is considered to represent a low degree of species diversity. A total of 77 taxa from 29 families were recorded from the study areas. This list includes subspecies (subsp.), variations (var.), and hybrids (x). One collection could only be tentatively identified to family level, 3 to genera level and 1 to species level due to lack of flowering parts or fruiting bodies.

Dominant families recorded included:

- » Poaceae: 11 taxa;
- » Papilionaceae: 10 taxa; and
- » Myrtaceae : seven taxa.

Dominant genera recorded from the study area included:

- » *Acacia* five taxa;
- » *Lepidosperma* four taxa; and
- » *Melaleuca* three taxa.

A full list of flora species present in the study area is provided in Table 6, Appendix C.

This survey provides a description of the flora present in the site at the time of survey, and therefore the species inventory is influenced by factors such as climate (season) and the subsequent presence/absence of ephemeral species and the variety of habitats surveyed.

4.3.1 Significant Flora Species

No DRF or Priority Flora species were recorded from the study area during this survey.

4.3.2 Weeds

Forty-six weed species were recorded during the survey of the VDD. Weed species make up 60% of the taxa recorded in the survey area. Weed species recorded can be found in the full flora list Table 6, Appendix C.

Dominant weed families include Poaceae (11 taxa), Papilionaceae (seven taxa) Iridaceae (five taxa) and Asteraceae (5 taxa). Weed invasion is present along the whole of the VDD, except along a small area located adjacent to Geographe Bay, where some native vegetation structure remains.

Acacia saligna is a native disturbance response species and was found all along the VDD survey area revegetating areas that had been cleared in the past.



5. Fauna Results

5.1 Fauna Species

A total of 39 bird, seven mammal, 11 reptile, five amphibians, two fish and one crustacean were recorded during the reconnaissance survey within the study area. These species are listed in Table 7, Appendix E.

This survey only provides a brief snapshot of those species present at the time of sampling (daytime), in one season, in one year. Not all potentially occurring species would be recorded during a single survey due to spatial and temporal variations in fauna population numbers.

5.1.1 Observed Significant Fauna Species

During the field investigation two significant fauna species were identified along the alignment. These species were the Western Ringtail Possum and the Quenda.

A brief description of the species ecology and observations within the survey area is below.

Western Ringtail Possum, *Pseudocheirus occidentalis*

The Western Ringtail Possum is listed as Vulnerable under EPBC Act and Schedule 1 under WC Act.

Western Ring-tail Possums occur only in the south west region of Western Australia where they feed upon Peppermint (*Agonis flexuosa*) and *Eucalyptus* trees. 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).

During the field survey four individuals were observed active during the day. A number of dreys (resting platforms in trees) were recorded and their locations are presented in Figure 3 and Figure 5. Most dreys were present in *Acacia saligna* although a small number were recorded in *Agonis flexuosa* (Peppermint) and *Melaleuca* species.



Photo of active Western Ringtail Possum observed within the survey area

Quenda, *Isodon obesulus fusciventer*

The Quenda (or Southern Brown Bandicoot) is an omnivorous marsupial that occurs in the south-west 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. On the Swan Coastal Plain Quenda are often associated with wetlands. (DEC, 2005)

The Quenda is listed by the DEC as a Priority 5, 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.

Although the Quenda was not observed directly within the survey area, "runs", Quenda tunnels, were observed and dense vegetation associated with wetlands provides the ideal habitat for this species.



Photo of a Quenda “run”

Marine Bird Species

Four marine species were observed over the study area these being Black-faced Cuckoo-Shrike, Pallid Cuckoo, Nankeen Kestrel and Australian White Ibis. The study area is not deemed critical habitat to these species for survival due to its low biodiversity and its narrow, linear formation.

5.1.2 Potential Significant Fauna Species

The desktop surveys indicated that a number of protected fauna may occur within the study area. The habitat requirements of these species and the likelihood of their occurrence in the site (with information from the field survey) is considered below. The freshwater mussel (*Westralunio carteri*) did not appear in the desktop searches, however is known to be in the area.

Rakali / Water Rat, *Hydromys chrysogaster*

The Water Rat is listed as a Priority 4 species by the DEC, it 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. The Water Rat is widely distributed, occurring from Barrow Island in the Pilbara to the south coast, as well as in all other States.

Assessment The Vasse Diversion Drain links into the Vasse River and a conservation category wetland. These areas are all permanent water bodies and are suitable habitat for maintaining a Water Rat population. No animals or their signs were observed during the field investigation, however it is likely that Water Rats are present within the study area. The impacted area is small in relation to available habitat in the surrounding areas, i.e. the Vasse River and conservation wetland therefore individuals may be impacted, but the species on a local and regional level would not be affected.

Forest Red-tailed Black Cockatoo, *Calyptorhynchus banksii naso*

Forest Red-tailed Black-Cockatoo are listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act. The 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.

Assessment: Cockatoo species may use the survey area opportunistically. A small amount of feeding habitat is available however there are no breeding opportunities. Impacts from clearing would be minimal.

Baudin's Cockatoo, *Calyptorhynchus baudinii*

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 as this tree is its principal food source. Baudin's Cockatoo has been listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act.

Assessment: Cockatoo species may use the survey area opportunistically. A very small amount of feeding habitat is available however there are no breeding opportunities. Impacts from clearing would be minimal.

Carnaby's Black Cockatoo, *Calyptorhynchus latirostris*

Carnaby's Black Cockatoo, listed as Endangered under the EPBC Act and S1 under the WC Act, 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 that are to be reduced significantly in the future.

Assessment: Cockatoo species may use the survey area opportunistically. A small amount of feeding habitat is available however there are no breeding opportunities. Impacts from clearing would be minimal.

Chuditch, *Dasyurus geoffroi*

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). The reduction in range and decline in population numbers have been caused by habitat loss and predation from foxes and cats (Orell and Morris, 1994). This species is currently listed as Vulnerable on the EPBC Act and Schedule 1 under the WC 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.

Assessment The survey area is predominantly paddock with only small pockets of native vegetation. This habitat is not suitable for the long-term survival of the Chuditch. The Chuditch is not expected to occur within the survey area.

Pouched Lamprey, *Geotria australis*

Lampreys, listed as Priority 1 by the DEC, are a primitive jawless fish which are considered the group from which all jawed vertebrates evolved (Allan *et al.* 2002). The Pouched Lamprey has a broad distribution throughout the southern hemisphere including Australia, New Zealand, Chile and Argentina. In Western Australia the species utilises freshwater streams in the south west (Perth to Albany) to breed and grow before migrating to the ocean to mature (Allan *et al.* 2002). The species is regarded as secure but has declined due to modifications to breeding streams. Dams and weirs are the main obstacles for the species (Allan *et al.* 2002).

Assessment This species may occur within the survey area. The drain provides an important link between the ocean and freshwater systems which the lamprey may utilise seasonally and opportunistically. Based on the large distribution of the species



and that they are migratory the works to the drain would have little long term impact on the species.

Freshwater Mussel, *Westralunio Carteri*

The Freshwater Mussel is listed as a Priority 4 species by DEC (In need of future population monitoring). It is an endemic species to the freshwater drainage systems of the South West of Western Australia (Slack-Smith 2006). The species is known to be in the area (Geographe Bay region) (Slack-Smith 2006 and Lymbery *et al.* 2008).

Lymbery *et al.* (2008) conducted surveys in 28 sites throughout the Geographe Bay region with four sites being in the Vasse Diversion Drain. Of the surveyed sites in the VDD live mussels were found at two sites in the upper reaches at and close to the point where the drain meets the Vasse River (Lymbery *et al.* 2008). No live mussels were found west of Chapman Hill Road (Lymbery *et al.* 2008).

Assessment This species was recorded live between the Vasse River and Chapman Hill Road with one old shell found west of the Chapman Hill Road (Lymbery *et al.* 2008). Lymbery *et al.* 2008 suspect that the species is secure in the Vasse River and recruits into the VDD. The size distribution of the population found in the VDD implies that little recruitment occurs. This is probably due to inadequate soil types and lack of fish stock for the mussel to parasitise at the larval stage (Lymbery *et al.* 2008). The impact of the proposed works on the Freshwater Mussel would be minimal.

Oceanic Species

A number of the species included in the list of significant fauna species that could potentially occur in the project area (Table) are oceanic species. These included 11 species of albatross, a Noddy and four Petrels. These species were present in the search results as the survey area includes a coastal section. However, they are highly unlikely to utilise the study site as they are generally oceanic and would only be present in the project area very occasionally, as vagrants.

Migratory Bird Species

A number of the species included in the list of significant fauna species that could potentially occur in the project area are migratory terrestrial, marine and wetland species. There is the potential for migratory bird species, such as the White-bellied Sea Eagle, to occur occasionally within the study area. However, the study areas cannot be considered as significant habitat for migratory species.

5.1.3 Introduced Fauna Species

Six introduced and domestic fauna species were observed within the study area: four mammals (fox, dog, European rabbit and cattle) and two birds (Feral Pigeon and Laughing Kookaburra).

5.2 Habitat Types and value

The VDD is a man-made water system which is heavily disturbed and has little remaining native habitat. The dense introduced grasses along the drain now provide



cover for many reptile and bird species, as well as the Quenda (Southern Brown Bandicoot). On the boundary of the drain several areas of both native and introduced trees and shrubs remain. These areas support the Western Ring-tailed Possum (Figure 5).

The water body of the drain has established an ecosystem which has the potential to support populations of the Water Rat (Priority 5). Oblong turtles may also utilize this waterway.

Habitat Linkages

Habitat linkages are important to allow animals to move between areas of resource availability. Habitat linkage is important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction.

Fragmentation of habitat limits the resources available to species, particularly sedentary species, which means they may be more vulnerable to natural disasters or habitat changes over time. Fragmentation of habitat can also lead to edge effects, leading to degradation of the habitat. Where the distance between habitat fragments is small, species may still be able to move between these habitats areas, but may be more exposed to predation pressures in the cleared areas.

The drain creates a link between the ocean and fresh water and may be suitable and important for the survival for species that may migrate, such as the Pouched Lamprey. It is important that disturbance to the drain be kept to a minimum.



6. Assessment of Flora and Fauna Impacts

6.1 Potential Flora and Fauna Impacts

The main impacts to flora and fauna are:

- » *Vegetation Clearing and habitat loss:* This project will require the clearing of some native vegetation. Approximately 0.7 ha of vegetation, mostly of degraded, will be cleared. Two significant species were identified in the fauna assessment which utilise the native vegetation for feeding and/or breeding. The Western Ringtail Possum requires specific native vegetation to survive.
- » *Weed introduction and invasion:* All of the study area has had some degree of disturbance and contains weeds that are relatively widespread throughout the south west. Disturbance from the proposed activities has the potential to introduce new weeds and/or spread weeds to the area directly impacted by, and adjacent to, the clearing.
- » *Soil degradation and erosion:* Native vegetation serves an important role in the stabilisation of soil within the landscape. Removal of vegetation can cause land degradation, including erosion. However, as the amount of clearing required for this project is relatively minimal and is predominantly in or adjacent to previously disturbed areas the potential impacts of soil degradation should be minimal.
- » *Hydrological Changes:* Changes to natural drainage from clearing or other activities may impact on both vegetation structure and fauna habitat in adjoining areas.
- » *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.
- » *Impact to significant fauna.* Western Ringtail Possums were observed in several areas along the alignment. The total area where the animals were observed during the survey and which will be potentially impacted by the drain works is approximately 0.35 ha (Figure 3). The impact area was determined through detailed examination of the proposed clearing line overlain on aerial photography. The impact areas primarily consist of *Acacia saligna* shrubland regrowth along the border of the expected project area. This habitat would be classified as supportive habitat, not core habitat or a primary corridor under EPBC Policy Statement 3:10 due to its size, patchy nature and plant species present. The guidance for determining the likelihood of a significant impact in Western Ringtail Possum is clearing of a greater area than 0.5 ha of supportive remnant habitat (EPBC Policy Statement 3:10). The size of habitat to be impacted is approximately 0.35 ha in this case. Therefore the impact on the possum does not exceed the significant impact



threshold and would not warrant further investigation or special fauna management practices.

6.2 Management of Potential Impacts

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

- » Due to the potentially long time frame to project commencement, it is recommended that a re-assessment of the presence and location of the Western Ringtail Possum be undertaken. Populations of possums can move to other areas of suitable habitat and further growth of plants in the project area may create new habitat opportunities.
- » If this re-assessment indicates similar levels of possum activity immediately prior to project works the following should apply. Where possible, modify the upgrades of the VDD to minimise clearing impacts on Western Ringtail Possum populations. Areas delineated in Figure 3 5 should be avoided if possible or minimum clearing practices adopted (trim trees where possible rather than remove). Where clearing is inevitable a qualified zoologist should be present during clearing or trimming of branches to assist in minimising the impacts on the possum population. The fauna clearance team will move animals into a safe area of adjoining habitat after trapping or hand catching the animals.
- » For any clearing occurring on site, the clearing line should be clearly defined in order to prevent impacts on native vegetation that is to be retained.
- » Management measures should be implemented to ensure clearing does not cause appreciable land degradation, including preventing erosion from cleared areas.
- » Management measures should be implemented to minimize the introduction and spread of weeds, such as avoiding movement of soils containing weedy species.
- » Management measures should be implemented to prevent impacts on adjacent fauna from pollution, such as litter and oil spills.
- » Implement measures to reduce the risk of fire starting from activities on site.
- » Destruction of fauna habitat (such as riparian vegetation) should be minimised during clearing. Dead, standing, or fallen timber should be retained as habitat wherever possible. Where micro-habitats, such as logs, and other debris must be disturbed for construction, these should be retained and used in site rehabilitation.

6.3 Potential Requirement for Referral to State and Federal Agencies

6.3.1 EPBC Act

The Western Ringtail Possum is the only species recorded in the project area which could require the project to be referred to DEWHA under the EPBC Act, 1999. However, the level of clearing impact on the habitat of this species does not reach the



threshold level of 0.5 ha indicated in EPBC Act Policy Statement 3.10 (2009) and therefore is not considered significant. The size of habitat to be impacted is approximately 0.35 ha.

Carnabys, Baudins and Forest Red-tailed Black Cockatoo, also EPBC Act listed species, are potentially present in the general area, but no specific breeding or feeding habitat will be cleared or impacted as part of the project works.

6.3.2 Environmental Protection Act

The study has indicated that there are no impacts on flora, fauna or other issues of significance that would warrant referral of the project to the Environmental Protection Authority under the *Environmental Protection Act 1986*. The project is within close proximity to a Conservation Category Wetland and an Environmentally Significant Area but it is unlikely that the impacts on these areas would warrant referral.

6.4 Assessment against Clearing Principles

Any clearing of native vegetation will require a permit under Part V Division 2 of the *Environmental Protection Act 1986* (EP Act), except where an exemption applies under Schedule 6 of the Act or is prescribed by regulation in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, and it is not in an ESA.

Table 8 provides an assessment of the proposed project against the “10 Clearing Principles” as outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003* to determine whether it is at variance to the Principles. These Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

This project is considered to be possibly at variance with one of the Ten Clearing Principles, that relating to clearing of vegetation in association with a watercourse or wetland.

The Water Corporation will be required to acquire a Clearing Permit as the areas to be cleared intersect a wetland/ESA and the drain reconstruction is not classified as a ‘structure’ under the guidelines of it’s agreement with DEC.



Table 8 Assessment against the 10 Clearing Principles

Principle Number	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	Most of the VDD is on cleared lands and within the remaining bushland remnants the biodiversity is considerably lower than for bushland in the local area.	The proposal is not at variance with the Principle.
(b)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	<p>Areas of the project area that have native vegetation have demonstrated the capacity to accommodate Western Ringtail Possum and Quenda populations</p> <p>The Western Ringtail Possum has a reduced population range due to land clearing. No specific habitat was noted within the study areas that are not present in the local area, however, the loss of further vegetation may impact on the species in the long term.</p> <p>However, under the EPBC Act, Policy Statement 3.10, the threshold level of clearing is 0.5 ha for significant impact to Western Ringtail Possum habitat. The clearing for this project is a maximum of 0.35 ha.</p> <p>Other species such as Red-tail Black Cockatoo, Baudin Black Cockatoo, Carnaby Black Cockatoo and the Pouched Lamprey may use the VDD site opportunistically.</p>	The proposal is unlikely to be at variance with the Principle.
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No DRF or Priority flora species were recorded during the survey of the study areas.	The proposal is not at variance with the Principle.
(d)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a TEC.	There are no TECs or PECs within 2 km of the study area.	The proposal is unlikely to be at variance with the Principle.



Principle Number	Principle	Assessment	Outcome
(e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	Clearing native vegetation within the study area will reduce the extent of remaining native vegetation in association 1000, which is considered <i>Vulnerable</i> . Approximately 0.5 ha of this association in the study area could be cleared as a result of the project works. This constitutes a very small fraction of the approximately 22, 000 ha of this association remaining. This will not be significant due to the poor condition of much of the vegetation in the project area.	The proposal is unlikely to be at variance with the Principle.
(f)	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	A small section of the survey area, located between Bussell Highway and Busselton Bypass, is adjacent to a Conservation Category Wetland. Approximately one quarter of the project area is classified multiple use wetland. A very small amount of very low quality (rating 5) vegetation within the Multiple Use wetland zone will be cleared. No native vegetation will be cleared within the Conservation Category Wetland.	The proposal is possibly at variance with the Principle.
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The clearing of native vegetation may cause some alterations to the health of adjacent lands. Short-term soil erosion and weed dispersal may occur within the project area following any potential clearing. The clearing area is already highly weed infested and in poor condition and it is unlikely that any further degradation will occur as a result of the project works. Soil erosion and the introduction and spread of weeds can be mitigated by use of appropriate management plans.	The proposal is unlikely to be at variance with the Principle.



Principle Number	Principle	Assessment	Outcome
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	There are no conservation areas within or in close proximity to the study areas.	The proposal is not at variance with the Principle.
(i)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The clearing of native vegetation is not considered likely to alter the quality of surface or ground waters within the project area. Erosion may occur following any potential clearing. Erosion can be mitigated by the use of appropriate surface water management and rehabilitation techniques.	The proposal is unlikely to be at variance with the Principle.
(j)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	The clearing of native vegetation is not considered likely to cause or exacerbate the incidence or intensity of flooding. The project is designed to improve the efficiency of the Vasse Diversion Drain, in order to reduce the risk of flooding within the Busselton town site.	The proposal is unlikely to be at variance with the Principle.



7. Report Limitations

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

Where previous reports, flora surveys 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.

An understanding of site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experience based. Hence, this report should not be altered, amended or abbreviated, issued in part or incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances that arise from the issue of the report that has been modified in any way as outlined above



8. References

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Appendix A

Figures

Figure 1 Locality Map

Figure 2 Environmental Constraints

Figure 3 Vegetation Descriptions and Western Ringtail
Possum Sightings, Dreys and Scats

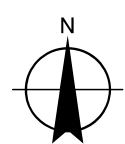
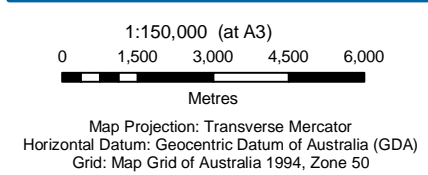
Figure 4 Vegetation Condition

Figure 5 Detail of Western Ringtail Possum Sightings, Dreys
and Scats



LEGEND

Study Area



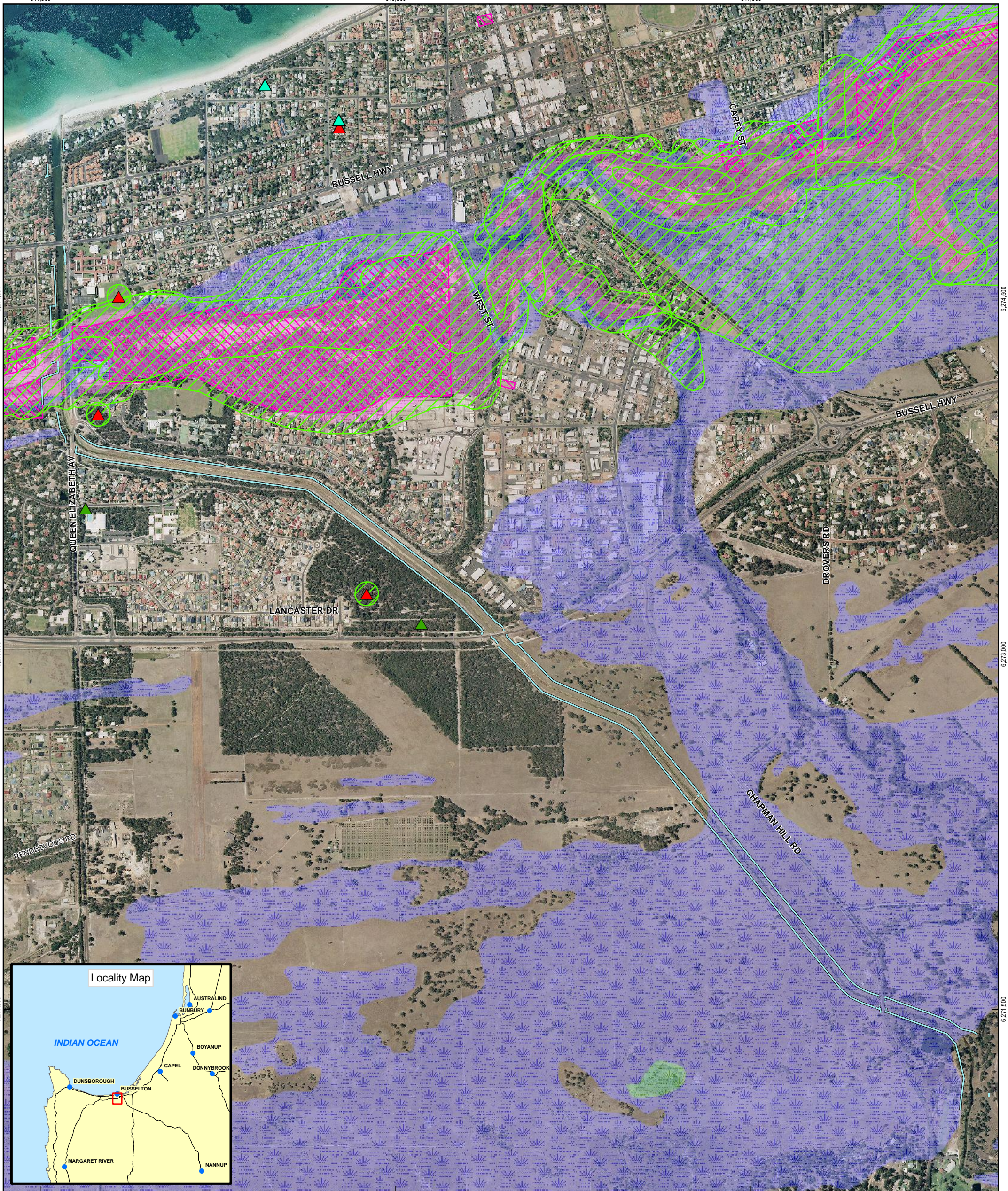
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Vasse Diversion Drain Flora and Fauna

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Revision | 0
Date | 26 FEB 2010

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Site Location

Figure 1



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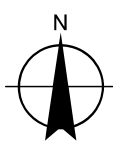
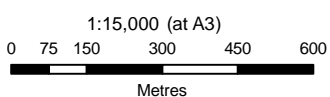
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LEGEND

- Fence Line
- DEC Estate
- Environmentally Sensitive Area
- Geomorphic Wetlands**
 - Conservation
 - Multiple Use
 - Not Assessed
 - Resource Enhancement
- Declared Rare & Priority Species**
 - (R) Declared Rare Flora - Extant Taxa
 - Priority 1 - Poorly Known Taxa
 - Priority 2 - Poorly Known Taxa
 - Priority 3 - Poorly Known Taxa
 - Priority 4 - Rare Taxa



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

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Environmental Constraints Map

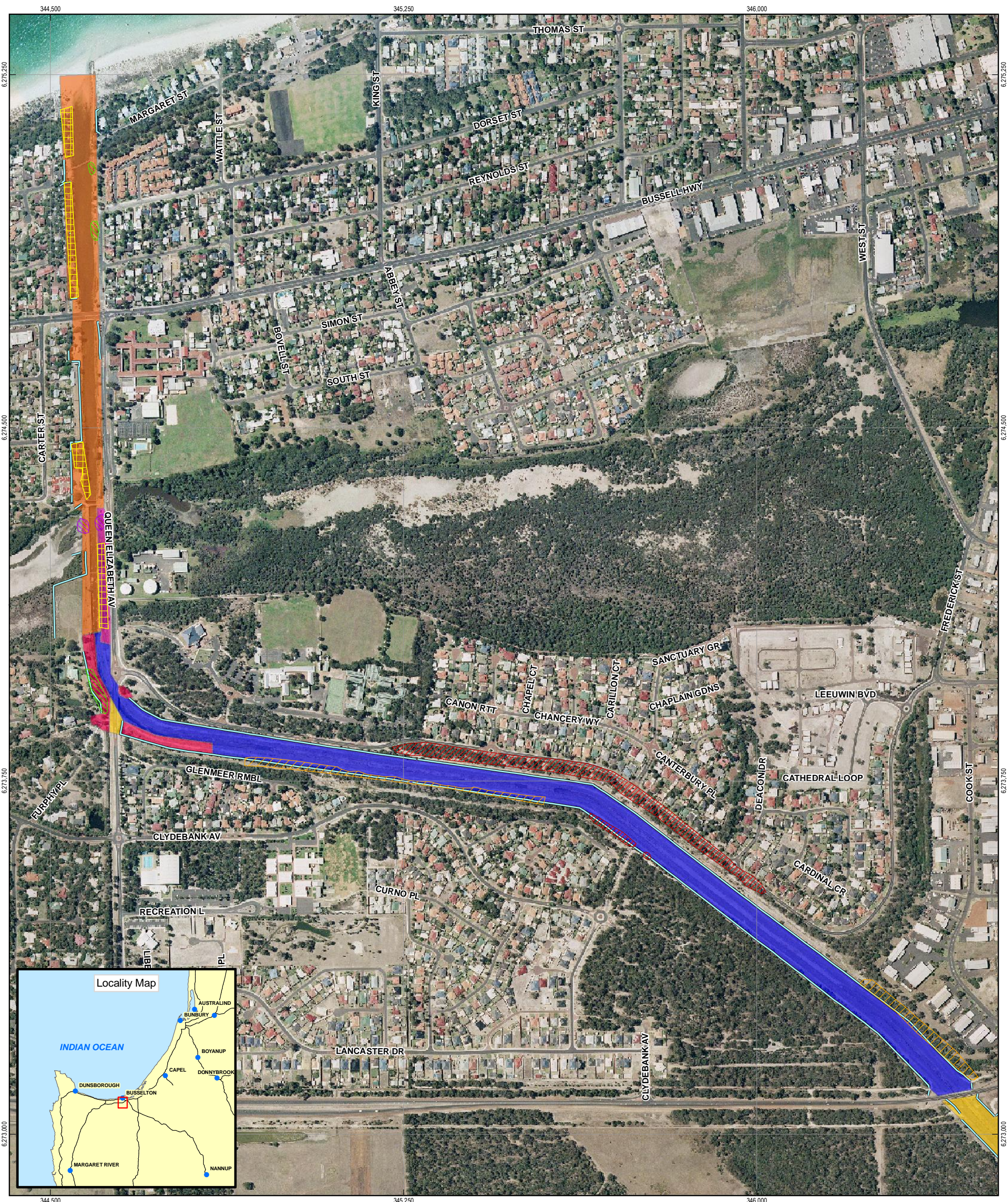
Figure 2

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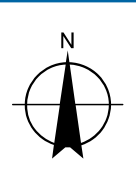
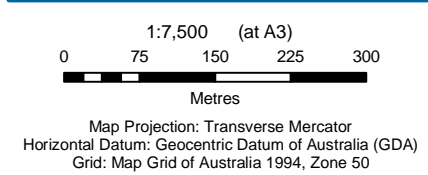
GHD House, 239 Adelaide Terrace Perth WA 6004 T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

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Data Source: Landgate (SLIP): Busseton 2007 Mosaic - 20091204; GHD: Fence Line - 200912; DEC: Environmentally Sensitive Areas - 20091217, DEC Estate - 20090601, Geomorphic Wetlands - Swan Coastal Plain, Declared Rare & Priority Flora Ref No 8-1209 - 20091203; GA 250 Topo Data (Series 3) 2006. Created by: sidris, xntan



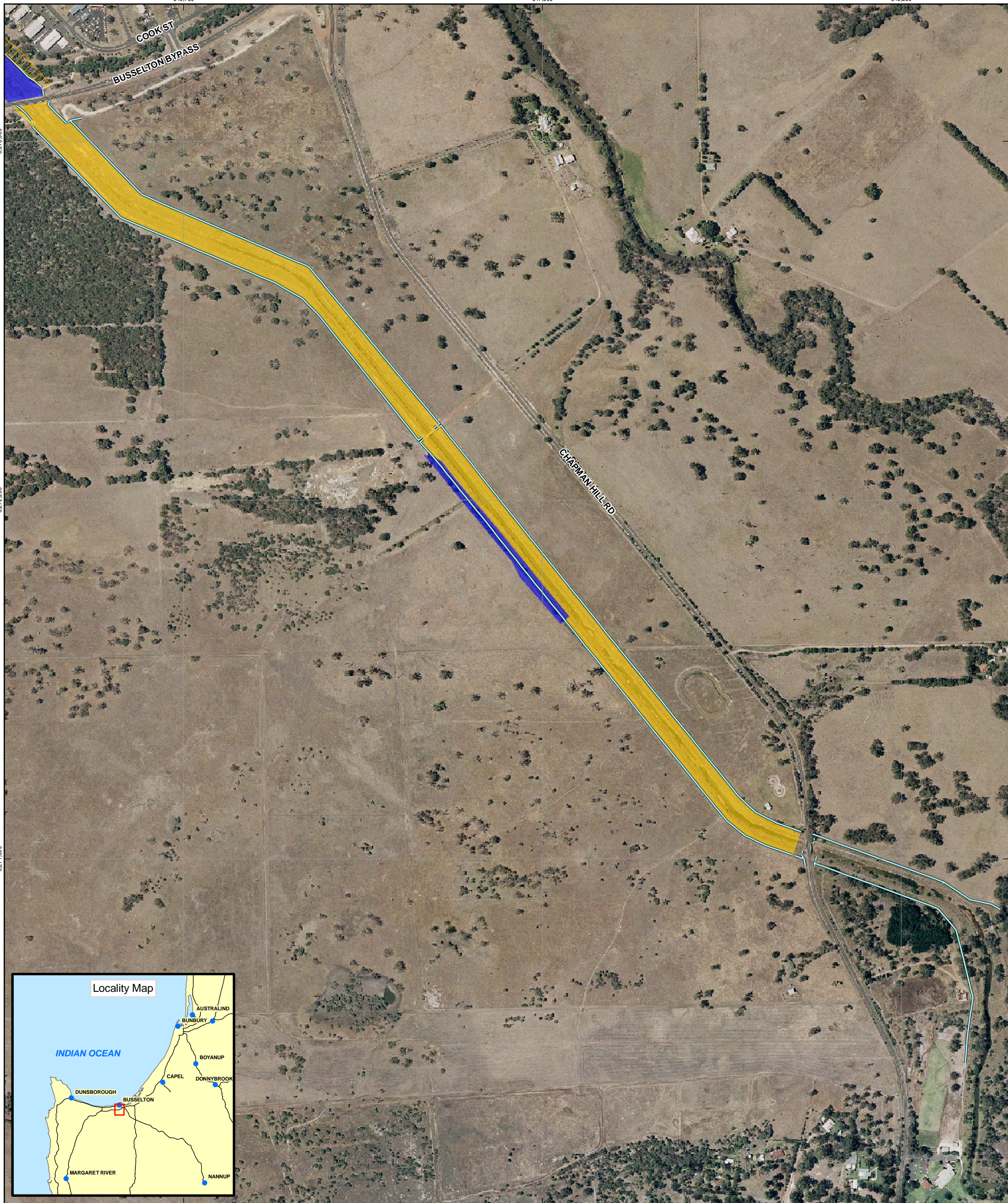
LEGEND	
	Fence Line
Fauna Indicators	
	Dreys
	Dreys & Possum Sightings
	Possum Sightings
	Scats
	Scats & Dreys
Vegetation Type	
	AsAf: Tall shrubland of <i>Acacia saligna</i> and <i>Agonis flexuosa</i> over weed species
	Mc*WmLc: Tall open scrub of <i>Melaleuca cuticularis</i> and <i>Agonis flexuosa</i> over herbland of <i>*Watsonia meriana</i> over sedgeland of <i>Lepidosperma carphoides</i>
	Espp.Af: Low open woodland of <i>Eucalypt</i> species over tall shrubland of <i>Agonis flexuosa</i> and mixed <i>Acacia</i> species over weed species
	AfLe: Tall shrubland of <i>Agonis flexuosa</i> and mixed <i>Acacia</i> species over sedgeland of <i>Lepidosperma effusum</i> , <i>Juncus kraussii</i> and <i>Ficinia nodosa</i> over weed species
	HD - Heavily disturbed / predominantly cleared areas but some disturbance opportunists such as grasses, including <i>*Avena fatua</i> , <i>*Cynodon dactylon</i> and <i>*Eragrostis curvula</i>



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Vegetation Type & Western Ringtail
Possum Sightings, Dreys and Scats **Map Sheet 1 Figure 3**



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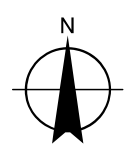
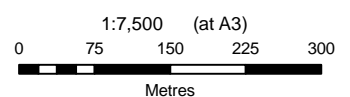


LEGEND

- Fence Line
- Fauna Indicators**
- Dreys
- Dreys & Possum Sightings
- Possum Sightings
- Scats
- Scats & Dreys

Vegetation Type

- AsAf: Tall shrubland of *Acacia saligna* and *Agonis flexuosa* over weed species
- Mc*WmLc: Tall open scrub of *Melaleuca cuticularis* and *Agonis flexuosa* over herbland of **Watsonia meriana* over sedgeland of *Lepidosperma carphoides*
- EspP.Af: Low open woodland of *Eucalypt* species over tall shrubland of *Agonis flexuosa* and mixed *Acacia* species over weed species
- AfLe: Tall shrubland of *Agonis flexuosa* and mixed *Acacia* species over sedgeland of *Lepidosperma effusum*, *Juncus kraussii* and *Ficinia nodosa* over weed species
- HD - Heavily disturbed / predominantly cleared areas but some disturbance opportunists such as grasses, including **Avena fatua*, **Cynodon dactylon* and **Eragrostis curvula*



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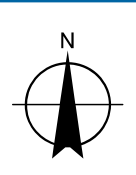
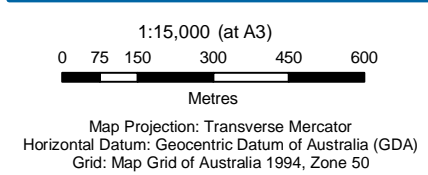
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Vegetation Type & Western Ringtail
Possum Sightings, Dreys and Scats **Map Sheet 2** **Figure 3**



- LEGEND**
- Fence Line
 - Vegetation Condition**
 1. Pristine or nearly so
 2. Excellent
 3. Very Good
 4. Good
 5. Degraded
 6. Completely degraded

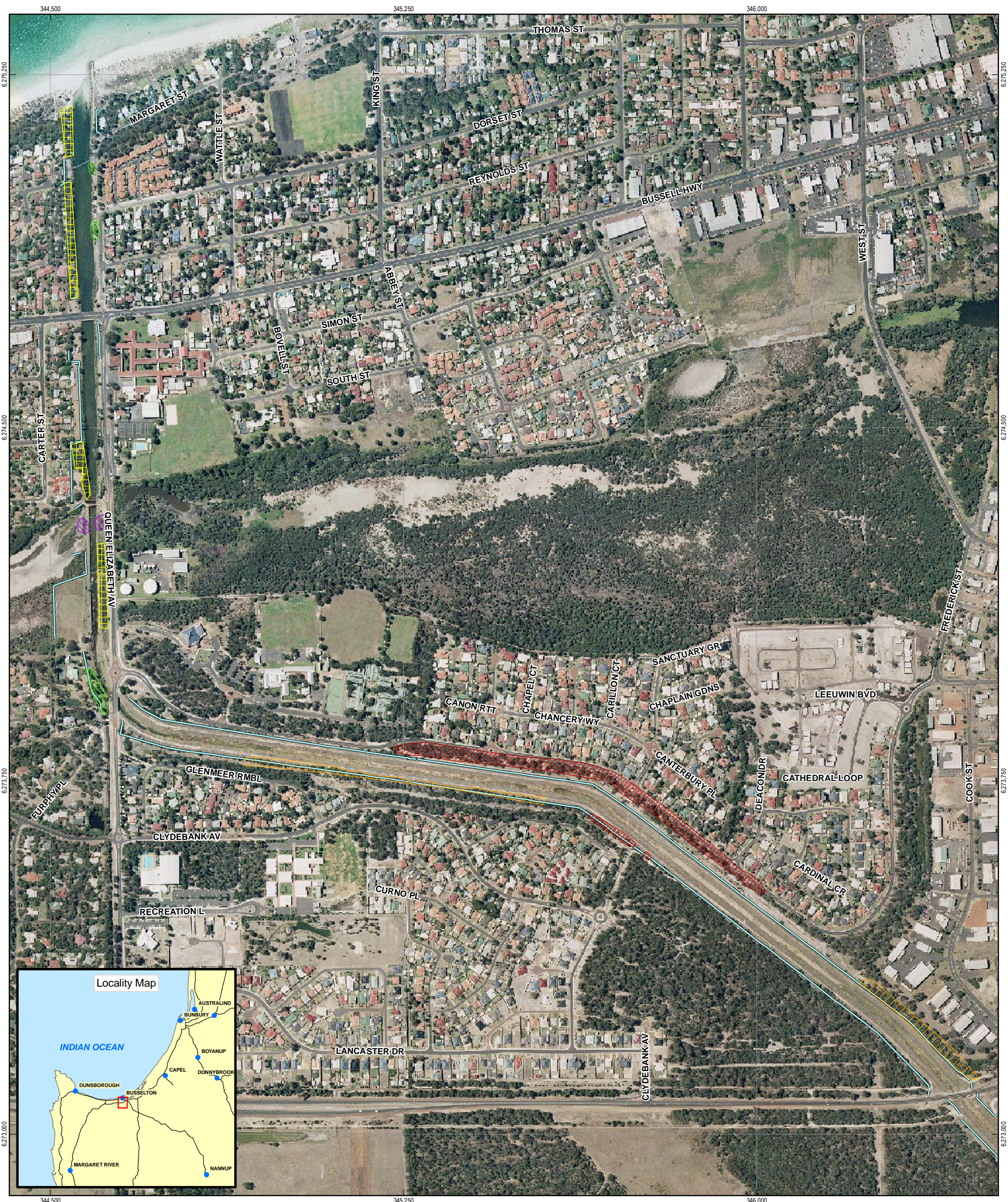


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Vegetation Condition

Figure 4



LEGEND

— Fence Line

Fauna Indicators

▨ Dreys

▨ Dreys & Possum Sightings

▨ Possum Sightings

▨ Scats

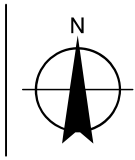
▨ Scats & Dreys

1:7,500 (at A3)

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Metres

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



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Water Corporation
Vasse Diversion Drain Flora and Fauna

Western Ringtail
Possum Sightings, Dreys and Scats

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Figure 5



Appendix B

Flora Conservation Codes

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

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



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

Conservation Category	Definition
<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

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

Conservation Code	Description
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.



Appendix C
Flora and Vegetation Descriptions

Vegetation Descriptions

Flora Relévés

Flora Species List



Vegetation Descriptions



Photo 1

HD: Heavily disturbed / predominantly cleared areas with introduced grasses, including **Avena fatua*, **Cynodon dactylon* and **Eragrostis curvula*.



Photo 2

AsAf: Tall shrubland of *Acacia saligna* and *Agonis flexuosa* over weed species.



Photo 3

AfLe: Tall shrubland of *Agonis flexuosa* and mixed *Acacia* species over sedgeland of *Lepidosperma effusum*, *Juncus kraussii* and *Ficinia nodosa* over weed species.



Photo 4

Esp.Af: Low open woodland of *Eucalypt* species over tall shrubland of *Agonis flexuosa* and mixed *Acacia* species over weed species.



Photo 5

Mc*WmLc.: Tall open scrub of *Melaleuca cuticularis* and *Agonis flexuosa* over herbland of **Watsonia meriana* over sedgeland of *Lepidosperma carphoides*.



Flora Relévéés

Releve	Easting	Northing	Family	Genus	Species	Common Name	Status
R1	347995	6271527	Iridaceae	<i>Watsonia</i>	<i>meriana</i>		*
			Poaceae	<i>Avena</i>	<i>fatua</i>	Wild oats	*
			Poaceae	<i>Ehrharta</i>	<i>calycina</i>	Perennial Veldt Grass	*
			Poaceae	<i>Cynodon</i>	<i>dactylon</i>	Couch	*
			Poaceae	<i>Eragrostis</i>	<i>curvula</i>	African Lovegrass	*
			Poaceae	<i>Briza</i>	<i>maxima</i>	Blow Fly Grass	*
			Araceae	<i>Zantedeschia</i>	<i>aethiopica</i>	Arum lily	*
			Papilionaceae	<i>Trifolium</i>	sp. (insufficient material)		*
			Geraniaceae	<i>Erodium</i>	<i>botrys</i>		*
			Oxalidaceae	<i>Oxalis</i>	<i>pes-caprae</i>	Soursob	*
			Primulaceae	<i>Anagallis</i>	<i>arvensis</i>	Pimpernel	*
			Papilionaceae	<i>Medicago</i>	<i>polymorpha</i>		*
			Apiaceae	<i>Apium</i>	<i>graveolens</i>	Celery	*
			Papilionaceae	<i>Lupinus</i>	<i>angustifolius</i>		*
			Asteraceae	<i>Arctotheca</i>	<i>calendula</i>	Cape Weed	*



Releve	Easting	Northing	Family	Genus	Species	Common Name	Status
			Cyperaceae	<i>Lepidosperma</i>	<i>?obtusum (insufficient material)</i>		
			Cyperaceae	sp. (insufficient material)			
			Papilionaceae	<i>Eutaxia</i>	<i>virgata</i>		
			Cucurbitaceae	<i>Cucumis</i>	<i>myriocarpus</i>		*
			Papaveraceae	<i>Fumaria</i>	<i>capreolata</i>		*
			Poaceae	<i>Bromus</i>	<i>diandrus</i>		*
			Papilionaceae	<i>Hardenbergia</i>	<i>comptoniana</i>		
			Polygonaceae	<i>Acetosella</i>	<i>vulgaris</i>		*
			Asteraceae	<i>Cotula</i>	<i>turbinata</i>		*
			Geraniaceae	<i>Pelargonium</i>	<i>capitatum</i>		*
			Papaveraceae	<i>Fumaria</i>	<i>muralis</i>		*
			Cucurbitaceae	<i>Citrullus</i>	<i>lanatus</i>	Pie melon	*
			Iridaceae	<i>Romulea</i>	<i>rosa</i>	Guildford grass	*
			Caryophyllaceae	<i>Petrorhagia</i>	<i>dubia</i>		*
			Poaceae	<i>Lagurus</i>	<i>ovatus</i>	Hare's Tail Grass	*
			Polygonaceae	<i>Rumex</i>	<i>bucephalophorus</i>		*
			Campanulaceae	<i>Wahlenbergia</i>	<i>communis</i>		
			Papilionaceae	<i>Trifolium</i>	<i>campestre</i>		*



Releve	Easting	Northing	Family	Genus	Species	Common Name	Status
			Iridaceae	<i>Ixia</i>	<i>maculata</i>		*
R2	346335	6273145	Mimosaceae	<i>Acacia</i>	<i>saligna</i>	Orange Wattle	
			Araceae	<i>Zantedeschia</i>	<i>aethiopica</i>	Arum lilly	*
			Myrtaceae	<i>Eucalyptus</i>	<i>rudis</i>	Flooded Gum	
			Myrtaceae	<i>Agonis</i>	<i>flexuosa</i>	Peppermint	
			Papilionaceae	<i>Jacksonia</i>	<i>furcellata</i>		
			Myrtaceae	<i>Melaleuca</i>	<i>rhaphiophylla</i>	Swamp Paperbark	
			Iridaceae	<i>Freesia</i>	<i>alba x leichtlinii</i>		*
			Iridaceae	<i>Watsonia</i>	sp. (insufficient material)		*
			Poaceae	<i>Briza</i>	<i>minor</i>		*
			Proteaceae	<i>Conospermum</i>	<i>caeruleum subsp. marginatum</i>		
			Mimosaceae	<i>Acacia</i>	<i>cochlearis</i>		
			Myrtaceae	<i>Kunzea</i>	<i>glabrescens</i>		
			Myrtaceae	<i>Melaleuca</i>	<i>lanceolata</i>		
			Proteaceae	<i>Conospermum</i>	<i>caeruleum subsp. marginatum</i>		
			Iridaceae	<i>Watsonia</i>	<i>meriana</i>		*
			Mimosaceae	<i>Acacia</i>	<i>stenoptera</i>		



Releve	Easting	Northing	Family	Genus	Species	Common Name	Status
			Poaceae	<i>Briza</i>	<i>maxima</i>		*
			Poaceae	<i>Bromus</i>	<i>diandrus</i>		*
			Iridaceae	<i>Romulea</i>	<i>rosa</i>	Guildford grass	*
			Poaceae	<i>Eragrostis</i>	<i>curvula</i>	African Lovegrass	*
			Asteraceae	<i>Cotula</i>	<i>turbinata</i>		*
			Asteraceae	<i>Arctotheca</i>	<i>calendula</i>	Cape Weed	*
			Papilionaceae	<i>Lupinus</i>	<i>angustifolius</i>		*
			Iridaceae	<i>Ixia</i>	<i>maculata</i>		*
			Iridaceae	<i>Freesia</i>	<i>alba x leichtlinii</i>		*
			Mimosaceae	<i>Acacia</i>	<i>cochlearis</i>		
			Haemodoraceae	<i>Conostylis</i>	<i>aculeata</i> subsp. <i>aculeata</i>		
			Asphodelaceae	<i>Trachyandra</i>	<i>divaricata</i>		*
			Papilionaceae	<i>Hardenbergia</i>	<i>comptoniana</i>		
			Hemerocallidaceae	<i>Agrostocrinum</i>	<i>scabrum</i>		
			Poaceae	<i>Pennisetum</i>	<i>clandestinum</i>	Kikuyu Grass	*
			Orchidaceae	<i>Microtis</i>	<i>media</i>		
R3	344610	6273892	Myrtaceae	<i>Corymbia</i>	<i>calophylla</i>	Marri	
			Myrtaceae	<i>Agonis</i>	<i>flexuosa</i>	Peppermint	



Releve	Easting	Northing	Family	Genus	Species	Common Name	Status
			Poaceae	<i>Pennisetum</i>	<i>clandestinum</i>		*
			Papaveraceae	<i>Fumaria</i>	<i>capreolata</i>		*
			Iridaceae	<i>Watsonia</i>	<i>meriana</i>		*
			Araceae	<i>Zantedeschia</i>	<i>aethiopica</i>	Arum lily	*
			Papilionaceae	<i>Lupinus</i>	<i>angustifolius</i>		*
			Poaceae	<i>Avena</i>	<i>fatua</i>	Wild oats	*
			Iridaceae	<i>Freesia</i>	<i>alba x leichtlinii</i>		*
			Oxalidaceae	<i>Oxalis</i>	<i>pes-caprae</i>	Soursob	*
			Papilionaceae	<i>Medicago</i>	<i>polymorpha</i>		*
			Papilionaceae	<i>Vicia</i>	<i>sativa</i>		*
			Geraniaceae	<i>Pelargonium</i>	<i>capitatum</i>		*
			Mimosaceae	<i>Acacia</i>	<i>saligna</i>		*
			Papilionaceae	<i>Trifolium</i>	sp. (insufficient material)		*
			Poaceae	<i>Ehrharta</i>	<i>calycina</i>	Perennial Veldt Grass	*
			Mimosaceae	<i>Acacia</i>	<i>cochlearis</i>		*
			Poaceae	<i>Eragrostis</i>	<i>curvula</i>	African Lovegrass	*
			Apiaceae	<i>Apium</i>	<i>graveolens</i>	Celery	*
			Myrtaceae	<i>Melaleuca</i>	<i>rhaphiophylla</i>		*



Releve	Easting	Northing	Family	Genus	Species	Common Name	Status
			Euphorbiaceae	<i>Ricinus</i>	<i>communis</i>	Castor Oil Plant	*
			Myrtaceae	<i>Eucalyptus</i>	<i>rudis</i>		
			Asteraceae	<i>Lactuca</i>	<i>serriola</i>		*
			Papilionaceae	<i>Melilotus</i>	<i>indicus</i>		*
			Mimosaceae	<i>Acacia</i>	<i>littorea</i>		
R4	344567	6274374	Myrtaceae	<i>Agonis</i>	<i>flexuosa</i>	Peppermint	
			Mimosaceae	<i>Acacia</i>	<i>littorea</i>		
			Euphorbiaceae	<i>Ricinus</i>	<i>communis</i>	Castor Oil Plant	*
			Plantaginaceae	<i>Plantago</i>	<i>lanceolata</i>	Ribwort Plantain	*
			Poaceae	<i>Lolium</i>	<i>perenne</i>	Perennial Ryegrass	*
			Cyperaceae	<i>Ficinia</i>	<i>nodosa</i>		
			Mimosaceae	<i>Acacia</i>	<i>cyclops</i>		
			Juncaceae	<i>Juncus</i>	<i>kraussii</i>		
R5	344593	6274775	Cyperaceae	<i>Lepidosperma</i>	<i>effusum</i>		
			Geraniaceae	<i>Erodium</i>	<i>botrys</i>		
			Poaceae	<i>Bromus</i>	<i>diandrus</i>		*
			Asteraceae	<i>Cotula</i>	<i>turbinata</i>		*



Releve	Easting	Northing	Family	Genus	Species	Common Name	Status
			Asteraceae	<i>Sonchus</i>	<i>apser</i>		*
			Asteraceae	<i>Arctotheca</i>	<i>calendula</i>	Cape Weed	*
			Poaceae	<i>Eragrostis</i>	<i>curvula</i>	African Lovegrass	*
			Poaceae	<i>Festuca</i>	<i>arundinacea</i>		
			Iridaceae	<i>Freesia</i>	<i>alba x leichtlinii</i>		*
			Asteraceae	<i>Hypochaeris</i>	<i>glabra</i>		*
			Apiaceae	<i>Apium</i>	<i>graveolens</i>	Celery	*
			Poaceae	<i>Pennisetum</i>	<i>clandestinum</i>	Kikuyu Grass	*
			Juncaceae	<i>Juncus</i>	<i>kraussii</i>		
			Rhamnaceae	<i>Spyridium</i>	<i>globosum</i>		
			Papilionaceae	<i>Trifolium</i>	sp. (insufficient material)		*
			Euphorbiaceae	<i>Euphorbia</i>	<i>paralias</i>		*
			Geraniaceae	<i>Pelargonium</i>	sp. (insufficient material)		
			Asparagaceae	<i>Ornithogalum</i>	<i>arabicum</i>		*
			Mimosaceae	<i>Acacia</i>	<i>littorea</i>		
			Myrtaceae	<i>Agonis</i>	<i>flexuosa</i>		
			Chenopodiaceae	<i>Rhagodia</i>	<i>baccata</i>		
			Papaveraceae	<i>Fumaria</i>	<i>capreolata</i>		*



Releve	Easting	Northing	Family	Genus	Species	Common Name	Status
			Mimosaceae	<i>Acacia</i>	<i>cochlearis</i>		
			Oxalidaceae	<i>Oxalis</i>	<i>pes-caprae</i>	Soursob	*
			Geraniaceae	<i>Pelargonium</i>	<i>capitatum</i>		*
			Mimosaceae	<i>Acacia</i>	<i>cochlearis</i>		
			Papilionaceae	<i>Lathyrus</i>	<i>tingitanus</i>	Tangier Pea	*
			Mimosaceae	<i>Acacia</i>	<i>cochlearis</i>		
			Aizoaceae	<i>Tetragonia</i>	<i>decumbens</i>		*
			Poaceae	<i>Lagurus</i>	<i>ovatus</i>	Hare's Tail Grass	*
R6	344608.9	6274248	Melaleuca	<i>Melaleuca</i>	<i>cuticularis</i>	Saltwater Paperbark	
			Myrtaceae	<i>Agonis</i>	<i>flexuosa</i>		
			Iridaceae	<i>Watsonia</i>	<i>meriana</i>		*
			Geraniaceae	<i>Pelargonium</i>	<i>capitatum</i>		*
			Poaceae	<i>Briza</i>	<i>maxima</i>	Blow Fly Grass	*
			Mimosaceae	<i>Acacia</i>	<i>cochlearis</i>		
			Cyperaceae	<i>Lepidosperma</i>	<i>carphoides</i>		
			Mimosaceae	<i>Acacia</i>	<i>saligna</i>		
			Cyperaceae	<i>Lepidosperma</i>	<i>striatum</i>		



Table 6 Flora Species List

Family	Genus	Species	Common Name	Status
Aizoaceae	<i>Tetragonia</i>	<i>decumbens</i>		*
Apiaceae	<i>Apium</i>	<i>graveolens</i>	Celery	*
Araceae	<i>Zantedeschia</i>	<i>aethiopica</i>	Arum lily	*
Asparagaceae	<i>Ornithogalum</i>	<i>arabicum</i>		*
Asphodelaceae	<i>Trachyandra</i>	<i>divaricata</i>		*
Asteraceae	<i>Arctotheca</i>	<i>calendula</i>	Cape Weed	*
Asteraceae	<i>Cotula</i>	<i>turbinata</i>		*
Asteraceae	<i>Hypochaeris</i>	<i>glabra</i>		*
Asteraceae	<i>Lactuca</i>	<i>serriola</i>		*
Asteraceae	<i>Sonchus</i>	<i>apser</i>		*
Campanulaceae	<i>Wahlenbergia</i>	<i>communis</i>		
Caryophyllaceae	<i>Petrorhagia</i>	<i>dubia</i>		*
Chenopodiaceae	<i>Rhagodia</i>	<i>baccata</i>		
Cucurbitaceae	<i>Citrullus</i>	<i>lanatus</i>	Pie melon	*
Cucurbitaceae	<i>Cucumis</i>	<i>myriocarpus</i>		*
Cyperaceae	<i>Ficinia</i>	<i>nodosa</i>		
Cyperaceae	<i>Lepidosperma</i>	<i>?obtusum</i> (insufficient material)		
Cyperaceae	<i>Lepidosperma</i>	<i>carphoides</i>		
Cyperaceae	<i>Lepidosperma</i>	<i>effusum</i>		
Cyperaceae	<i>Lepidosperma</i>	<i>striatum</i>		
Cyperaceae	sp. (insufficient material)			
Euphorbiaceae	<i>Euphorbia</i>	<i>paralias</i>		*
Euphorbiaceae	<i>Ricinus</i>	<i>communis</i>	Castor Oil Plant	*
Geraniaceae	<i>Erodium</i>	<i>botrys</i>		*
Geraniaceae	<i>Pelargonium</i>	<i>capitatum</i>		*
Geraniaceae	<i>Pelargonium</i>	sp. (insufficient material)		
Haemodoraceae	<i>Conostylis</i>	<i>aculeata</i> subsp. <i>aculeata</i>		



Family	Genus	Species	Common Name	Status
Hemerocallidaceae	<i>Agrostocrinum</i>	<i>scabrum</i>		
Iridaceae	<i>Freesia</i>	<i>alba x leichtlinii</i>		*
Iridaceae	<i>Ixia</i>	<i>maculata</i>		*
Iridaceae	<i>Romulea</i>	<i>rosa</i>	Guildford grass	*
Iridaceae	<i>Watsonia</i>	<i>meriana</i>		*
Iridaceae	<i>Watsonia</i>	sp. (insufficient material)		*
Juncaceae	<i>Juncus</i>	<i>kraussii</i>		
Mimosaceae	<i>Acacia</i>	<i>cochlearis</i>		
Mimosaceae	<i>Acacia</i>	<i>cyclops</i>		
Mimosaceae	<i>Acacia</i>	<i>littorea</i>		
Mimosaceae	<i>Acacia</i>	<i>saligna</i>	Orange Wattle	
Mimosaceae	<i>Acacia</i>	<i>stenoptera</i>		
Myrtaceae	<i>Agonis</i>	<i>flexuosa</i>	Peppermint	
Myrtaceae	<i>Corymbia</i>	<i>calophylla</i>	Marri	
Myrtaceae	<i>Eucalyptus</i>	<i>rudis</i>	Flooded Gum	
Myrtaceae	<i>Kunzea</i>	<i>glabrescens</i>		
Myrtaceae	<i>Melaleuca</i>	<i>cuticularis</i>	Saltwater Paperbark	
Myrtaceae	<i>Melaleuca</i>	<i>lanceolata</i>		
Myrtaceae	<i>Melaleuca</i>	<i>rhaphiophylla</i>	Swamp Paperbark	
Orchidaceae	<i>Microtis</i>	<i>media</i>		
Oxalidaceae	<i>Oxalis</i>	<i>pes-caprae</i>	Soursob	*
Papaveraceae	<i>Fumaria</i>	<i>capreolata</i>		*
Papaveraceae	<i>Fumaria</i>	<i>muralis</i>		*
Papilionaceae	<i>Eutaxia</i>	<i>virgata</i>		
Papilionaceae	<i>Hardenbergia</i>	<i>comptoniana</i>		
Papilionaceae	<i>Jacksonia</i>	<i>furcellata</i>		
Papilionaceae	<i>Lathyrus</i>	<i>tingitanus</i>	Tangier Pea	*



Family	Genus	Species	Common Name	Status
Papilionaceae	<i>Lupinus</i>	<i>angustifolius</i>		*
Papilionaceae	<i>Medicago</i>	<i>polymorpha</i>		*
Papilionaceae	<i>Melilotus</i>	<i>indicus</i>		*
Papilionaceae	<i>Trifolium</i>	<i>campestre</i>		*
Papilionaceae	<i>Trifolium</i>	sp. (insufficient material)		*
Papilionaceae	<i>Vicia</i>	<i>sativa</i>		*
Plantaginaceae	<i>Plantago</i>	<i>lanceolata</i>	Ribwort Plantain	*
Poaceae	<i>Avena</i>	<i>fatua</i>	Wild oats	*
Poaceae	<i>Briza</i>	<i>maxima</i>	Blow Fly Grass	*
Poaceae	<i>Briza</i>	<i>minor</i>		*
Poaceae	<i>Bromus</i>	<i>diandrus</i>		*
Poaceae	<i>Cynodon</i>	<i>dactylon</i>	Couch	*
Poaceae	<i>Ehrharta</i>	<i>calycina</i>	Perennial Veldt Grass	*
Poaceae	<i>Eragrostis</i>	<i>curvula</i>	African Lovegrass	*
Poaceae	<i>Festuca</i>	<i>arundinacea</i>		
Poaceae	<i>Lagurus</i>	<i>ovatus</i>	Hare's Tail Grass	*
Poaceae	<i>Lolium</i>	<i>perenne</i>	Perennial Ryegrass	*
Poaceae	<i>Pennisetum</i>	<i>clandestinum</i>	Kikuyu Grass	*
Polygonaceae	<i>Acetosella</i>	<i>vulgaris</i>		*
Polygonaceae	<i>Rumex</i>	<i>bucephalophorus</i>		*
Primulaceae	<i>Anagallis</i>	<i>arvensis</i>	Pimpernel	*
Proteaceae	<i>Conospermum</i>	<i>caeruleum subsp. marginatum</i>		
Rhamnaceae	<i>Spyridium</i>	<i>globosum</i>		

* denotes weed species



Appendix D
Fauna Legislation

EPBC Act Fauna Conservation Categories

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 utilized 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 utilized 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.



Western Australian Wildlife Conservation Act 1950 Conservation Codes

Conservation Code	Description
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]"

DEC Priority Fauna Codes

(Species not listed under the *Wildlife Conservation Act 1950*, but for which there is some concern).

Conservation Code	Description
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 E
Fauna Results



Table 3 “Nature Map” Fauna Records within approximately 10 km of the survey area

T = Threatened, P4 = Priority 4

Species	Common Name	Status
Amphibian		
<i>Crinia insignifera</i>	Squelching Froglet	
<i>Limnodynastes dorsalis</i>	Western Banjo Frog	
<i>Litoria moorei</i>	Motorbike Frog	
<i>Pseudophryne guentheri</i>	Crawling Toadlet	
Bird		
<i>Acanthiza inornata</i>	Western Thornbill	
<i>Accipiter cirrocephalus</i> subsp. <i>cirrocephalus</i>		
<i>Anous stolidus</i> subsp. <i>pileatus</i>		
<i>Anous tenuirostris</i> subsp. <i>melanops</i>		T
<i>Aquila audax</i>	Wedge-tailed Eagle	
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	
<i>Chenonetta jubata</i>	Australian Wood Duck	
<i>Chrysococcyx lucidus</i> subsp. <i>plagosus</i>		
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	
<i>Cracticus nigrogularis</i>	Pied Butcherbird	
<i>Cracticus torquatus</i>	Grey Butcherbird	
<i>Dacelo novaeguineae</i> subsp. <i>novaeguineae</i>		
<i>Daption capense</i>	Cape Petrel	
<i>Diomedea cauta</i>	Shy Albatross	T
<i>Diomedea chrysostoma</i>	Grey-headed Albatross	
<i>Diomedea exulans</i> subsp. <i>exulans</i>		T
<i>Elanus caeruleus</i> subsp. <i>axillaris</i>	Australian Black-shouldered Kite	
<i>Eudyptes chrysocome</i> subsp. <i>moseleyi</i>		
<i>Eudyptes pachyrhynchus</i>	Fiordland Penguin	
<i>Eurostopodus argus</i>	Spotted Nightjar	
<i>Falco longipennis</i> subsp. <i>longipennis</i>		



Species	Common Name	Status
<i>Gallinula ventralis</i>	Black-tailed Native-hen	
<i>Gallirallus philippensis</i> subsp. <i>mellori</i>		
<i>Himantopus himantopus</i> subsp. <i>leucocephalus</i>		
<i>Hirundo neoxena</i>	Welcome Swallow	
<i>Macronectes giganteus</i>	Southern Giant Petrel	T
<i>Malurus splendens</i>	Splendid Fairy-wren	
<i>Myiagra inquieta</i>	Restless Flycatcher	
<i>Pachycephala pectoralis</i> subsp. <i>fuliginosa</i>		
<i>Pachycephala rufiventris</i> subsp. <i>rufiventris</i>		
<i>Pachyptila belcheri</i>	Slender-billed Prion	
<i>Pachyptila desolata</i>	Antarctic Prion	
<i>Pachyptila salvini</i>	Salvin's Prion	
<i>Pachyptila salvini</i> subsp. <i>macgillivrayi</i>		
<i>Pachyptila turtur</i>	Fairy Prion	
<i>Pachyptila vittata</i>	Broad-billed Prion	
<i>Petroica multicolor</i> subsp. <i>campbelli</i>		
<i>Phaethon rubricauda</i>	Red-tailed Tropicbird	
<i>Phaps chalcoptera</i>	Common Bronzewing	
<i>Phoebastria fusca</i>	Sooty Albatross	T
<i>Phoebastria palpebrata</i>	Light-mantled Sooty Albatross	T
<i>Platycercus icterotis</i> subsp. <i>icterotis</i>		
<i>Podargus strigoides</i>	Tawny Frogmouth	
<i>Procellaria cinerea</i>	Grey Petrel	
<i>Pterodroma lessonii</i>	White-headed Petrel	
<i>Pterodroma macroptera</i> subsp. <i>gouldi</i>		
<i>Rhipidura fuliginosa</i> subsp. <i>preissi</i>		
<i>Sericornis frontalis</i>	White-browed Scrubwren	
<i>Sterna anaethetus</i> subsp. <i>anaethetus</i>		
<i>Stictonetta naevosa</i>	Freckled Duck	
<i>Stipiturus malachurus</i> subsp. <i>westernensis</i>		



Species	Common Name	Status
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	
<i>Tyto novaehollandiae</i>	Masked Owl	
<i>Zosterops lateralis</i> subsp. <i>gouldi</i>		
Mammal		
<i>Bos taurus</i>	European Cattle	
<i>Cercartetus concinnus</i>	Western Pygmy-possum, Mundarda	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	
<i>Dasyurus geoffroii</i>	Western Quoll, Chuditch	T
<i>Felis catus</i>	Cat	*
<i>Hydromys chrysogaster</i>	Water-rat	P4
<i>Isodon obesulus</i> subsp. <i>fusciventer</i>	Southern Brown Bandicoot, Quenda	P5
<i>Mus musculus</i>	House Mouse	
<i>Phascogale tapoatafa</i> subsp. <i>tapoatafa</i>	Southern Brush-tailed Phascogale, Wambenger	
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	T
<i>Rattus rattus</i>	Black Rat	
<i>Sminthopsis gilberti</i>	Gilbert's Dunnart	
<i>Sminthopsis griseoventer</i> subsp. <i>griseoventer</i>	Grey-bellied Dunnart	
<i>Tarsipes rostratus</i>	Honey Possum, Noolbenger	
<i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i>	Common Brushtail Possum	
<i>Vespadelus regulus</i>	Southern Forest Bat	
Reptile		
<i>Aprasia pulchella</i>		
<i>Aprasia repens</i>		
<i>Chelodina oblonga</i>	Oblong Turtle	
<i>Christinus marmoratus</i>	Marbled Gecko	
<i>Cryptoblepharus buchananii</i>		
<i>Ctenotus impar</i>		
<i>Echiopsis curta</i>	Bardick	



Species	Common Name	Status
<i>Egernia napoleonis</i>		
<i>Elapognathus coronatus</i>	Crowned Snake	
<i>Hemiergis peronii</i> subsp. <i>peronii</i>		
<i>Hemiergis quadrilineata</i>		
<i>Hydrophis elegans</i>		
<i>Hydrophis ocellatus</i>		
<i>Lerista distinguenda</i>		
<i>Menetia greyii</i>		
<i>Notechis scutatus</i>	Tiger Snake	
<i>Parasuta nigriceps</i>		
<i>Pelamis platura</i>	Yellow-bellied Sea-snake	
<i>Pseudonaja affinis</i> subsp. <i>affinis</i>	Dugite	
<i>Pygopus lepidopodus</i>	Common Scaly Foot	
<i>Ramphotyphlops australis</i>		



Table 7 Fauna Observed within study area, October 2009

Family	Genus	Species	Common Name	Status	Introduced Fauna
Birds					
Acanthizinae	<i>Acanthiza</i>	<i>inornata</i>	Western Thornbill		
Acanthizinae	<i>Smicromis</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		
Anatidae	<i>Anus</i>	<i>gracilis</i>	Grey Teal		
Anatidae	<i>Chenonetta</i>	<i>jubata</i>	Australian Wood Duck		
Ardeidae	<i>Ardea</i>	<i>intermedia</i>	Intermediate Egret		
Ardeidae	<i>Egretta</i>	<i>novaehollandiae</i>	White-faced Heron		
Campephagidae	<i>Coracina</i>	<i>novaehollandiae</i>	Black-faced Cuckoo-shrike	Marine	
Charadriidae	<i>Euseyornis</i>	<i>melanops</i>	Black-fronted Dotterel		
Columbidae	<i>Columba</i>	<i>livia</i>	Feral Pigeon		X
Columbidae	<i>Phaps</i>	<i>chalcoptera</i>	Common Bronzewing		
Corvidae	<i>Corvus</i>	<i>coronoides perplexus</i>	Australian Raven		
Cracticidae	<i>Cracticus</i>	<i>tiibicen dorsalis</i>	Australian Magpie		
Cuculidae	<i>Cuculus</i>	<i>pallidus</i>	Pallid Cuckoo	Marine	
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		
Falconidae	<i>Falco</i>	<i>cenchroides</i>	Nankeen Kestrel	Marine	
Hirundinidae	<i>Hirundo</i>	<i>neoxena</i>	Welcome Swallow		
Hirundinidae	<i>Hirundo</i>	<i>ariel</i>	Fairy Martin		
Laridae	<i>Larus</i>	<i>novaehollandiae</i>	Silver Gull		
Malurinae	<i>Malurus</i>	<i>splendens</i>	Splendid Fairy-wren		
Meliphagidae	<i>Anthochaera</i>	<i>carunculata</i>	Red Wattlebird		
Meliphagidae	<i>Anthochaera</i>	<i>lunulata</i>	Western Wattlebird		
Meliphagidae	<i>Lichmera</i>	<i>indistincta</i>	Brown Honeyeater		
Meliphagidae	<i>Phylidonyris</i>	<i>novaehollandiae</i>	New Holland Honeyeater		
Meliphagidae	<i>Lichenostomus</i>	<i>virescens</i>	Singing Honeyeater		
Meliphagidae	<i>Lichenostomus</i>	<i>ornatus</i>	Yellow-plumed Honeyeater		
Motacillidae	<i>Anthus</i>	<i>australis</i>	Australian Pipit		
Phalacrocoracidae	<i>Phalacrocorax</i>	<i>carbo</i>	Great Cormorant		



Family	Genus	Species	Common Name	Status	Introduced Fauna
Phalacrocoracidae	<i>Phalacrocorax</i>	<i>melanoleucos</i>	Little Pied Cormorant		
Rallidae	<i>Gallinula</i>	<i>tenebrosa</i>	Dusky Moorhen		
Rallidae	<i>Fulica</i>	<i>atra</i>	Eurasian Coot		
Cacatuidae	<i>Cacatua</i>	<i>sanguinea westralensis</i>	Little Corella		
Cacatuidae	<i>Eolophurus</i>	<i>roseicapilla</i>	Pink and Grey Galah		
Psittacidae	<i>Platycercus</i>	<i>zonarius semitorquatus</i>	Twenty-eight Parrot		
Threskiornithidae	<i>Threskiornis</i>	<i>molucca</i>	Australian White Ibis	Marine	
Zosteropidae	<i>Zosterops</i>	<i>lateralis gouldi</i>	Silvereye		
Reptiles					
Cheluidae	<i>Chelodina</i>	<i>oblonga</i>	Oblong Turtle		
Elapidae	<i>Echiopsis</i>	<i>curta</i>	Bardick		
Elapidae	<i>Elapognathus</i>	<i>coronatus</i>	Crown Snake		
Elapidae	<i>Pseudonaja</i>	<i>affinis</i>	Dugite		
Elapidae	<i>Notechis</i>	<i>scutatus</i>	Tiger Snake		
Scincidae	<i>Cryptoblephorus</i>	<i>buchanani</i>	Fence Skink		
Scincidae	<i>Egernia</i>	<i>kingii</i>	King Skink		
Scincidae	<i>Egernia</i>	<i>luctuosa</i>	Mourning Skink		
Scincidae	<i>Lerista</i>	<i>distinguenda</i>			
Scincidae	<i>Menetia</i>	<i>greyii</i>	Greys Skink		
Scincidae	<i>Tiliqua</i>	<i>rugosa rugosa</i>	Bobtail		
Amphibia					
Hylidae	<i>Litoria</i>	<i>adelaidensis</i>	Slender Tree Frog		
Hylidae	<i>Litoria</i>	<i>moorei</i>	Motorbike Frog		
Myobatrachidae	<i>Crinia</i>	<i>glauerti</i>	Clicking Froglet		
Myobatrachidae	<i>Crinia</i>	<i>insignifera</i>	Squelching Froglet		
Myobatrachidae	<i>Heleioporus</i>	<i>eyrei</i>	Moaning Frog		
Mammals					
Canidae	<i>Vulpes</i>	<i>vulpes</i>	Fox		X
Canidae	<i>Canus</i>	<i>domesticus</i>	Dog		X
Leporidae	<i>Oryctolagus</i>	<i>cuniculus</i>	European Rabbit		X
Bovidae	<i>Bos</i>	<i>taurus</i>	Cow		X
Macropodidae	<i>Macropus</i>	<i>fuliginosus</i>	Western Grey Kangaroo		
Peramelidae	<i>Isodon</i>	<i>obesulus fusciventer</i>	Southern Brown Bandicoot *	P5	



Family	Genus	Species	Common Name	Status	Introduced Fauna
Pseudocheiridae	<i>Pseudocheirus</i>	<i>occidentalis</i>	Western Ringtail Possum	Vulnerable, S1	
Fish					
Galaxiidae	<i>Galaxias</i>	<i>occidentalis</i>	Western Minnow		
Mugilidae	<i>Aldrichetta</i>	<i>forsteri</i>	Yelloweye Mullet		
Crustaceans					
Portunidae	<i>Portunus</i>	<i>pelagicus</i>	Blue Manna Crab		



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