THIS PLAN HAS BEEN PREPARED FOR PLANNING PURPOSES. AREAS, CONTOURS AND DIMENSIONS SHOWN ARE SUBJECT TO SURVEY.

BARLEE ROAD

UPSON ROAD

GOODWOOD ROAD

ROAD

PRIMARY SCHOOL OVAL

RIVER

EXTENT OF FLOOD STUDY

300
1.178ha

301
28.086ha

2426
29.968ha

1
4.6881ha

Entry Gate.

all good

- MAIN AREAS OF REMNANT VEGETATION
- EXTENT OF 100 YEAR FLOODPLAIN
- CAPEL RIVER
- STRATEGIC MINERALS AND BASIC RAW MATERIAL RESOURSE POLICY AREA
- EXISTING BUILDINGS
- EXISTING UNSEALED ROADS
- DISUSED QUARRY
- WET AREA (NOT EPP)
- POSSIBLE ACCESS
- EXISTING SEWER LINES
- LIKELY ROAD WIDENING
- VIEWS
- 22kva POWERLINES
- STANDARD POWERLINES
- VEGETATION IN "GOOD-VERY GOOD" CONDITION (Bennett, 2006)
- VEGETATION IN "GOOD" CONDITION (Bennett, 2006)
- VEGETATION IN "DEGRADED-GOOD" CONDITION (Bennett, 2006)
- POTENTIAL BLACK COCKATOOS NEST HOLLOWS (Harewood, 2005)
- AREAS IDENTIFIED AS HAVING WESTERN RINGTAIL POSSUM ACTIVITY (Harewood, 2005)
- AREAS IDENTIFIED AS HAVING COMMON BRUSHTAIL POSSUM ACTIVITY

SCALE	DATE
1:4000	FEB 2006

PLAN No. 04014P-04

SITE FEATURES & CONSTRAINTS

WELLINGTON LOTS 300,301, 1 & PT. LOC 2426
CAPEL

THOMPSON McROBERT EDGELOE 26 Wittenoom Street, Bunbury WA 6230 Telephone: (08) 9791 4411 Email: tmebunbury@tme.net.au

Ross Jamieson

Environmental Protection Authority

Westralia Square,
141 St Georges Terrace, Perth, Western Australia 6000.
Telephone: (08) 9222 7000. Facsimile: (08) 9222 7155.
Postal Address: PO Box K822,
Perth, Western Australia 6842.
Website: www.epa.wa.gov.au

Thompson McRobert Edgeloe
PO Box 733
BUNBURY WA 6231

Your Ref: 04014P
Our Ref: CRN217536 975/05
Enquires: Teresa Bryant (9222 7079)
Email: teresa.bryant@environment.wa.gov.au

Attention: Neville Dowling

Dear Sir

SE CAPEL OUTLINE DEVELOPMENT PLAN – SPRING FLORA & FAUNA SURVEYS

I refer to your letter dated 30 January 2006 and the attached flora and fauna survey reports for the Department's perusal and endorsement.

As mentioned during our telephone conversation on 2 March 2006, the Terrestrial Ecosystems Branch have reviewed the reports and would appreciate the opportunity to visit the site to clarify some concerns they have the vegetation condition ranking. It would also enable consideration of the suitability of remnants for protection and/or development as part of the Outline Development Plan process.

Following is a summary of the Terrestrial Ecosystems Branch's comments on the reports and recommendations for your consideration.

Vegetation and Flora

The botanical survey work is considered to be of suitable standard. However, based on the plant presence data and photographs it appears the vegetation condition ranking for several quadrants could be inaccurate.

The majority of weed species present in plots CAP1-3 are relatively non-aggressive species and in CAP1 only 6% cover of major weeds is recorded. Consequently the vegetation condition ranking as depicted in Map 3 seems to be incorrect, especially in the eastern and western portions of the site where plant community types are mapped in Map 1. Thus there would seem to be areas which could be in excellent condition and other areas which have excellent potential for rehabilitation.

Section 4.5 of the floristic survey addresses the presence of significant species within the location. It should be noted that under the clearing regulations the definition of significant flora also includes uncommon or restricted flora species and/or species outside of or at the limit of their range. While not proposed to be impacted as part of

the proposal, the location of *Callistachys lanceolata* within the Capel River fringing vegetation could be considered as significant. This species is commonly found in the surrounding scarp and Blackwood Plateau but through vegetation clearing has become a restricted species upon the Swan Coastal Plain.

Section 6 of the floristic survey suggests that the landowner should be encouraged to continue enhancing the fenced remnant vegetation. The ongoing protection and exclusion of grazing of this intact vegetation is supported. Consideration should be given to protecting the area through the use of a bushland protection mechanism, such as a covenant. In addition, based on aerial photograph interpretation the remnant vegetation on the eastern extent of the location surrounding the house and linking to the Capel river could all potentially be consolidated and enhanced through the use of a protective covenant with associated weed control and revegetation management plans.

Fauna

The fauna assessment report has been carried out to a suitable standard for the level of survey that was requested.

The area contains excellent habitat trees for fauna species and is important habitat for the Western Ringtail Possum (WRP). Given the number of individuals and dreys that were identified during the reconnaissance survey, the site is significant for the WRP. As recommended in the report, the vegetation should be retained and enhanced.

It is recommended that a more detailed survey be undertaken to determine the population size of WRP prior to any development of the site.

It should also be noted that there is a report of a priority species of fish in the Capel River nearby.

Please do not hesitate to contact Teresa Bryant on 9222 7079 should you have any queries or require additional information.

Yours sincerely

K J Taylor
Director
Environmental Impact Assessment

8 March 2006

cc Andrew Webb, Terrestrial Ecosystem Branch, DoE

Environmental Protection Authority

Westralia Square,
141 St Georges Terrace, Perth, Western Australia 6000.
Telephone: (08) 9222 7000. Facsimile: (08) 9222 7155.
Postal Address: PO Box K822,
Perth, Western Australia 6842.
Website: www.epa.wa.gov.au

Chief Executive Officer
Shire of Capel
PO Box 369
CAPEL WA 6271

Your Ref C5.37.025
Our Ref CRN215155
Enquiries Teresa Bryant

Attn: Mr C.M. Burwood

Dear Sir/Madam

SCHEME/AMENDMENT TITLE:	Shire of Capel, TPS 7 Amendment 25, Rezoning from Rural Zone to Urban Development Zone
SCHEME/AMENDMENT LOCATION:	Lot 300 Wellington Locs 619 & 246, Lot 301 Wellington Loc 1360, Pt Wellington Loc 2426
LOCALITY:	Capel
RESPONSIBLE AUTHORITY:	Shire of Capel
LEVEL OF ASSESSMENT:	Scheme Not Assessed - Advice Given under section 48A(1)(a)

Thank you for your letter of 16 August 2005 referring the above scheme amendment.

After consideration of the information provided by you, the Environmental Protection Authority (EPA) considers that the proposed scheme amendment should not be assessed under Part IV Division 3 of the *Environmental Protection Act 1986 (EP Act)* but nevertheless provides the following advice and recommendations.

ADVICE AND RECOMMENDATIONS

Entered on GIS
13/9/05

Scanned for Town

1. Environmental Issues

a. Remnant Vegetation
b. Declared Rare Flora
c. Significant Fauna
d. Foreshore Reserve
e. Stormwater Management

2. Advice and recommendations regarding Environmental Issues

a. Remnant Vegetation

The amendment is in the area covered by the EPA's *Guidance No. 10 Level of assessment for proposals affecting natural areas within the System 6 Region and Swan Coastal Plain portion of the System 1 Region*, which advises that, in order to protect biological diversity, more than 30% of all vegetation complexes should be retained. The Department of Environment (DoE) has advised the amendment area contains three vegetation complexes that are below the target 30% of that present pre-1750. However, it is noted that much of the area has been cleared and/or grazed and that detailed surveys are proposed as part of the Outline Development Plan/Structure Planning phase. It is expected that based on the results of the survey, measures will be taken to ensure the protection of vegetation worthy of retention within public open space and buffers.

b. Declared Rare Flora

A number of Declared Rare Flora (DRF) associated with the Heddle vegetation complex are found in the local area. Therefore, the proposed detailed surveys should include a search for the presence of any DRF species. Should any DRF species be located, the Department of Conservation and Land Management should be notified prior to commencement of any development.

c. Significant Fauna

Although most of the area has been cleared and/or grazed, remnant vegetation, particularly adjacent to the river foreshore, has the potential to be habitat for significant fauna, such as the Western Ringtail Possum. It is recommended that a Level 1 Survey as detailed in the EPA's *Guidance No. 56 Terrestrial Fauna Surveys for Environmental Impact in Western Australia* be undertaken to identify fauna and fauna habitat. Should significant species be identified, the advice of the Department of Conservation and Land Management should be sought.

d. Foreshore Management

It is recommended that an overall approach for the entire site be taken to identify and manage the Capel River foreshore reserve in the form of a Foreshore Management Plan. This will ensure the foreshore is identified and managed in a uniform manner.

General information on waterways and buffers is available in the EPA's *Guidance Statement No.33 Environmental Guidance and Planning Development* (June 2005) available at www.epa.wa.gov.au.

e. Stormwater Management

Stormwater management philosophies and best management practices have recently been revised, and in 2005 the DoE published the *Stormwater Management Manual for Western Australia* (the Manual).

Consequently, drainage and stormwater management measures should be implemented in accordance with the Manual. The Manual can viewed at DoE's website at www.environment.wa.gov.au/Water/Stormwater/Publications/Guidelines/Stormwater Management Manual.

3. General Advice

d. For the purposes of Part IV of the *EP Act,* the scheme amendment is defined as an assessed scheme. In relation to the implementation of the scheme amendment, please note the requirements of Part IV Division 4 of the *EP Act.*
e. There is no appeal right in respect of the EPA's decision on the level of assessment of scheme amendments.
f. A copy of this will be sent to the relevant authorities and will be available to the public on request.

Yours faithfully

K J Taylor
Director
Environmental Impact Assessment

12 September 2005

cc: Department for Planning & Infrastructure

INTRA-DEPARTMENTAL REFERRAL
ENVIRONMENTAL IMPACT ASSESSMENT DIVISION, BRANCH

TO:	Gary Whisson
SUBJECT:	Flora and Vegetation and Fauna Surveys for Lot 1, 300, 301 and Loc 2426, Capel
FROM:	Teresa Bryant (ext 7079)
DATE REFERRED:	14 February 2006

Gary
You can keep these reports if you want to.
Tess.

The Proposal

The Shire of Capel referred Amendment 25 proposing to rezone the above land from Rural to Urban Development zone to the EPA in August 2005. The area is to be identified as 'South East Capel – Development Precinct No.2'. The proposed zoning has provisions requiring the preparation of an Outline Development Plan (ODP) supported by additional information such as vegetation surveys. A draft ODP is still to be prepared.

The site has an area of 78.6ha and is located south east of the Capel townsite adjacent to the Capel River.

The EPA set level of assessment as Scheme Not Assessed – Advice Given (copy attached) regarding environmental issues including vegetation, DRF and fauna.

TME subsequently engaged Bennett Environmental Consulting and Greg Harewood to undertake a Flora and Vegetation Survey and Fauna Assessment, respectively. TME have submitted the reports to DoE for **perusal and endorsement**.

Information/advice requested

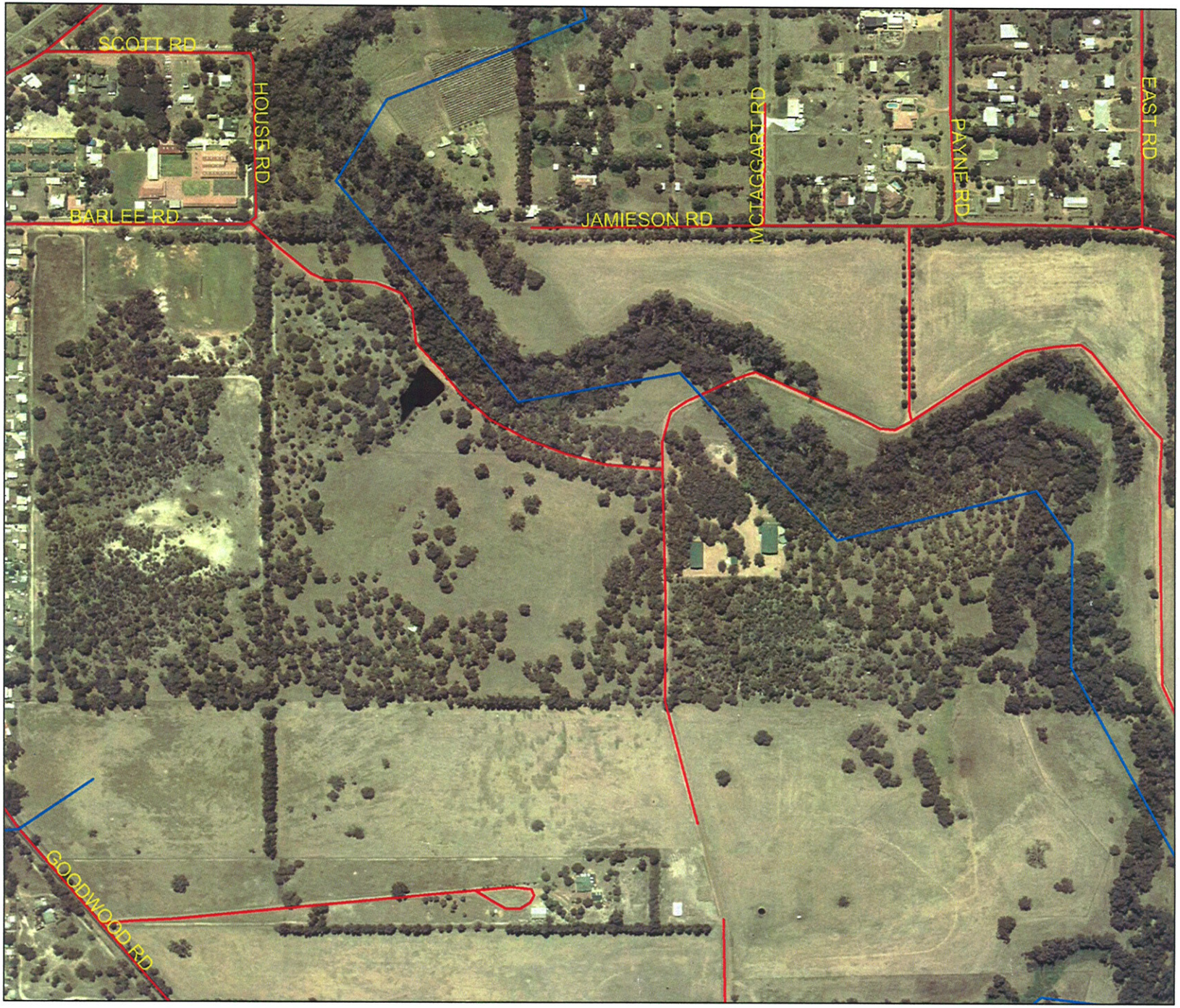
Your comments on the survey reports in general and in particular, the adequacy or otherwise of the surveys, the findings, recommendations etc would be appreciated.

Please contact me if you need any additional information.

PLEASE CAN YOU FORWARD YOUR REPLY TO ME BEFORE:

10 March 2006

IF YOU HAVE NO COMMENTS OR IF YOU CANNOT MEET THIS DATE PLEASE ADVISE ME ASAP - THANK YOU.



LEGEND

Declared Rare and Priority Flora List - CALM 01/07/05

- 1
- 2
- 3
- 4
- R
- X

Road Centrelines - DLI 1/5/04

Threatened Ecological Communities - CALM 12/4/05

Rivers 250K - GA

CALM Managed Lands and Waters - CALM 1/07/05

- 5(1)(h) Reserve
- 5(1)(g) Reserve
- Conservation Res
- Ex Dir Freehold
- Ex Dir Leasehold
- Marine Nature Re
- Marine Park
- Misc Reserve
- National Park
- Nature Reserve
- State Forest
- Timber Reserve

Augusta 1.4m Orthomosaic - DOLA 00

ANCA, Wetlands - CALM 08/01

- lake
- mangrove
- reservoir
- saln_cst_flt
- sub_to_inund
- swamp
- w_body_void
- watercours_a

Busselton 50cm Orthomosaic - DLI 03

N

0 ~150 m

Scale 1:6000
(Approximate when reproduced at A4)

Geocentric Datum Australia 1994

Note: the data in this map have not been projected. This may result in geometric distortion or measurement inaccuracies.

Prepared by: brundrm
Prepared for:
Date: 21/02/2006 1:02:09 PM

Information derived from this map should be confirmed with the data custodian acknowleged by the agency acronym in the legend.

Department of Environment

SCP NATURAL AREA FAUNA RECORDING SHEET **Note: For sites with more than one Veg. Unit a separate sheet needs to be used for each Unit**

LOCATION/SITE/RESERVE: CAPDS Parrott Landco MAP SHEET NO._____ REM No._____ REM 2 No._____ VEG UNIT _____

DATE: 30/3/06 TIME: _____to_____ WEATHER: Fine OBSERVER: E Harris

HABITAT WHERE FAUNA RECORDED: WETLAND: YES/NO: N UPLAND: YES/NO: Y UNDER-STOREY PRESENT: YES/NO: _____

HABITAT ELEMENTS PRESENT: LOGS/STUMPS PRESENT: (Tick Code: 0 = none; 1 = few; 2 = moderate; 3 = abundant)

LARGE TREES WITH HOLLOWS PRESENT: (Tick Code: 0 = none; 1 = few; 2 = moderate; 3 = abundant)

Species	Seen or heard, scats, tracks	No.	Activity (eg flying over, perched, on log, under rock, feeding etc)	If feeding - on what, or plant identification	Breeding (Y/N)	Remarks or Notes
Ringtail Possum	scats, tracks up trees					
Brushtail Possum	scats, tracks up trees					
Kite	scats, tracks					
Fox	tracks					
Sacred kingfisher/white	seen	3				
Whipbirds - big	seen + heard	2				
[illegible]	scats					
Red-tailed black cockatoos	feather					
Skink						mummified skeleton

FAUNA ASSESSMENT
(Level 1)

Lot 1, Lot 300, Lot 301 & Pt Loc 2426
(Wellington Land District)

CAPEL

NOVEMBER 2005

On behalf of:
TME
PO Box 733
BUNBURY WA 6231
Telephone (08) 9791 4411

Prepared by:
Greg Harewood B.Sc. (Zoology)
A.B.N. 95 536 627 336
PO Box 755
BUNBURY WA 6231
Mobile: 0402 141 197
Telephone/Facsimile (08) 9725 0982
Email: gharewood@iinet.net.au

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APPENDICES

STATEMENT OF LIMITATIONS

Scope of Services

This fauna assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Greg Harewood ("the Author"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on Data

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy of completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

Environmental Conclusions

In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

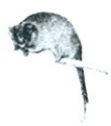
Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.



1. INTRODUCTION

This report has been prepared in response to an invitation from Thompson McRobert Edgeloe (TME) to carry out a Level 1 (EPA 2004) fauna assemblage survey over an area of land near Capel.

The study site is located directly south of the existing Capel townsite and is centred at approximately 33° 33' 46" S and 115° 34' 10" E (Figure 1 & 2). The fauna assessment was limited to the area as indicated on figures. The study area totals about 78 hectares.

The assessment was carried out with reference to guidance and position statements published by the WA Environmental Protection Authority on fauna surveys and environmental protection (EPA 2002b; EPA 2004). The minimum requirements for a Level 1 fauna assemblage survey as defined in these documents are:

Background research or 'desktop' study

The purpose is to gather background information on the target area (usually at the locality scale). This involves a search of all sources for literature, data and map-based information.

Reconnaissance survey

The purposes are: i) to verify the accuracy of the background study; ii) to further delineate and characterise the fauna and faunal assemblages present in the target area; and iii) to identify potential impacts. This involves a target area visit by suitably qualified personnel to undertake selective, low intensity sampling of the fauna and faunal assemblages, and to provide habitat descriptions and habitat maps of the project area.

2. METHODOLOGY

2.1 FAUNA HABITAT ASSESSMENT

A habitat assessment was carried out specifically targeting the likely habitats of listed (under the relevant Federal and State Acts) threatened vertebrate species potentially occurring in the general area. The aim of the habitat assessment was to determine if it was likely that any threatened species would be utilising the area, in addition to providing information on general fauna that may be present.

The initial phase of the assessment involved the review of available information on the habitats of the threatened species possibly occurring in the region. During the field survey the habitat at the site was assessed to determine its potential to be hosting any of the listed threatened species in addition to aiding in the compilation of a potential fauna list based on available habitats and opportunistic observations.

2.2 FAUNA INVENTORY

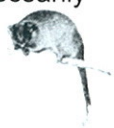
2.2.1 Opportunistic Fauna Survey

During the course of the reconnaissance field work non-systematic opportunistic observations of fauna species were made and recorded. Secondary evidence of fauna such as tracks, diggings and scats were also noted. Some active searching was undertaken in specific areas with the aim of locating the more elusive frog and reptile species that may inhabit the site. Invertebrate fauna species were not recorded.

2.2.2 Potential Fauna

A list of all vertebrate fauna potentially occurring within the study area was compiled from searches done on the WA Museum Database, the Department of Conservation and Land Managements Threatened Fauna Database, Department of the Environment and Heritage Departments Commonwealth Environment Protection and Biodiversity Conservation Database, Birds Australia's 'birdata", published and unpublished reports and specialist books detailing fauna of the general area. Species observed during field work have also been included. The results of the habitat assessment also provided information on the potential fauna assemblage.

Taxonomy and nomenclature for fauna species used in this report generally follow Allen *et al.* (2003) for fishes, Aplin and Smith (2001) for amphibians and reptiles, How *et al.* (2001) for mammals and Johnstone (2001) for birds. Some names, including common names recommended for national and international use by Christidis and Boles (1994) for birds, are also used. Common names for reptiles and amphibians come from a variety of sources and are not necessarily



generally accepted. Sources include Bush *et al* (2002), Tyler *et al.* (2000) and Glauret (1961).

2.2.3 Fauna of Conservation Significance

The conservation status of fauna species in Western Australia is assessed under the federal *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the state administered *Western Australian Wildlife Conservation Act 1950 (*WAWC Act*)*.

Under the EPBC Act threatened fauna may be listed in any one of the following categories as defined in Section 179 of the Act:

- Extinct;
- *Extinct in the wild;
- *Critically endangered;
- *Endangered;
- *Vulnerable; and
- Conservation dependent.

*Only species in those categories marked with an asterix are matters of national environmental significance under the EPBC Act.

The WAWC Act uses a set of schedules (see Table 1) in addition to utilising the categories defined by the EPBC Act.

Table 1: Western Australian Threatened Fauna Categories

Category	Code	Description
Schedule 1	S1	Fauna which is rare or likely to become extinct
Schedule 2	S2	Fauna which is presumed extinct
Schedule 3	S3	Birds which are subject to an agreement between the governments of Australia and Japan (JAMBA) relating to the protection of migratory birds and birds in danger of extinction
Schedule 4	S4	Fauna that is otherwise in need of special protection

In Western Australia, the Department of Conservation and Land Management (CALM) also produce a supplementary list of priority fauna. The species listed are not considered threatened under the WAWC Act, but due to lack of

knowledge or where species are poorly represented in secure conservation reserves some concern for there long term survival exists. The five classifications levels are shown in Table 2.

Table 2: CALM Priority Fauna Categories

Category	Code	Description
Priority 1	P1	Taxa with few, poorly know populations on threatened lands.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4	P4	Taxa in need of monitoring (Not currently threatened or in need of special protection, but could be if present circumstances change)
Priority 5	P5	Taxa in need of monitoring (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)

The EPBC Act also requires the compilation of a list of migratory species that are recognized under international treaties including the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA) and the Bonn Convention (The Convention on the conservation of Migratory Species of Wild Animals). Species listed under JAMBA are also protected under Schedule 3 of the WAWC Act.

The conservation status of all the vertebrate fauna species listed as occurring or possibly occurring in the vicinity of the study area have been assessed using the most recent lists published in accordance with the above-mentioned Acts and CALM's priority fauna list and are indicated in the fauna listings of this report.

It should be noted that there are currently discrepancies between the Western Australian and Commonwealth threatened species lists. In an attempt to address this issue CALM and the Commonwealth Department of Environment and Heritage (DEH) have initiated an "alignment of lists" project where CALM provides advice on threatened species to the DEH so specific species can be assessed under the EPBC Act and the DEH database updated. This project is still in progress and subsequent changes in the DEH database may result in variations to the listings and classifications used for the project reported on here.

2.2.4 Other Species of Significance

A number of other species not listed in official lists can also be considered of regional conservation significance. These include species that have a restricted range, those that occur in breeding colonies and those at the limit of their range.

While not classified as rare, threatened or vulnerable under any State or Commonwealth legislation, a number of bird species have been listed as of significance on the Swan Coastal portion of the Perth Metropolitan Region (Bush Forever - Government of Western Australia 1998 and 2000). The bird species are often referred to as Bush Forever Decreaser Species. The two categories used for birds within the Bush Forever documents are:

- Habitat specialists with reduced distribution on the Swan Coastal Plain (code Bh)
- Wide ranging Species with reduced population's on the Swan Coastal Plain. (code Bp)

Other fauna species of regional significance due to declining populations on the Swan Coastal Plain, especially between Mandurah and Busselton, include the Honey Possum and Pygmy Possum (Dell 2000).

If present the species listed should be taken into consideration when determining the fauna value of an area to ensure actions are taken that will aid in their continued existence in the region. Bush forever decreaser species are indicated as such within the species list held in Appendix A.

2.3 WESTERN RINGTAIL POSSUM SURVEY

As the presence of Western Ringtail Possums (WRPs - *Pseudocheirus occidentalis*) was anticipated a targeted survey for this listed threatened species was undertaken. The survey followed development planning guidelines for Western Ringtail Possums (WRPs) issued by CALM (2003).

The aims of the WRP assessment were:

- To determine the impact of the proposed development on resident or local WRPs;
- To provide a snapshot of WRP management issues that would need to be addressed prior to the proposal proceeding; and
- To provide an opportunity for the proposal to be amended to incorporate WRP conservation management strategies.

The assessment included a daytime (carried out during other opportunist and habitat surveys) and a night time survey for WRP dreys (nests made of

vegetation, located in trees), scats (droppings) and individuals both within the bounds of the development and in some adjacent areas. The amount and quality of WRP habitat within and adjacent to the proposed development site is documented.

Western Ringtail Possums are classified as threatened under the *Western Australian Wildlife Conservation Act* (1950) and under the federal *Environmental Protection and Biodiversity Conservation Act* (1999). The species distribution has reduced dramatically since European settlement for a number of reasons. Currently, in the south west, destruction of habitat is the main threatening process. The management strategies adopted to help maintain the existing populations in the region are aimed at minimising the impact of land developments. This is best achieved by encouraging the retention of as much in-situ habitat as possible. The translocation of individuals to other areas is the least preferred option.

2.4 BLACK COCKATOO NEST HOLLOW AND FORAGING HABITAT SURVEY

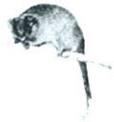
As the area is within the known range of Black Cockatoo's (Baudin's, Carnaby's and Forest Red-tailed Cockatoos) specific attention was made to determine the sites significance for these species. The main aim of this survey was to document the presence of trees containing hollows suitable for nesting. The survey aimed to assess all trees within the study site. The extent of foraging habitat (principally Marri and Banksia trees in this area) was also noted.

The assessment of hollows was conducted from ground level. Because it is generally very difficult to determine all the characteristics of hollows that are favoured by cockatoos, the assessment of suitability was based entirely on the size of each hollow's entrance. Hollows that were found to be large enough to allow the entry of a cockatoo were recorded as a potential nest site.

Hollows were also studied with binoculars for signs of use (eg wear and chewing) and trunks and branches checked for scarring which may indicate use by other parrot species (territory marking by other parrot species such as the Galah).

Trees containing potential cockatoo nest sites were scratched/raked with a large stick to mimic the climbing of a large varanid ("goanna"). If the hollow is in use by a cockatoo this action is likely to result in the individual either peering from the hollow entrance to assess the danger or prompt it to leave the hollow. The effectiveness of this technique is dependant on the timing of the survey.

Other prerequisites that determine the suitability of a hollow, not fully assessed as part of this study, include the project site location as obviously hollow trees must be within the cockatoo species breeding area. While cockatoo species pass through the area it has not been determined if they actually breed on site



or in the vicinity. In addition to entrance size, the depth and floor space of the hollow are important factors. The existence of suitable hollows, even in breeding areas does not necessarily make them available for breeding as hollows must be spatially, structurally and temporally correct (Johnstone 2004b).

2.5 LOCAL CONSERVATION SIGNIFICANCE OF THE STUDY AREA

The local (sub-regional) significance of the study area has been determined by applying site specific criteria such as:

- Fauna species and/or habitat present that is poorly represented in the general study area;
- Fauna habitat within the general study area supporting species of conservation or other significance;
- Fauna habitat in better condition than other similar locations in general study area.

2.6 VALUE OF THE STUDY AREA AS A WILDLIFE CORRIDOR

Corridors of native vegetation can be very important for the dispersal of species in otherwise cleared landscapes. Any areas of remnant vegetation making up part of the linkage is therefore of great value by facilitating the movement of species that cannot utilise cleared land.

During the field survey and by examination of plans and air photos of the study area, the value of the site as a corridor allowing movement between any reserves, conservation areas or other significant areas of remnant bush was assessed.

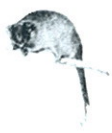
3. LIMITATIONS OF THE STUDY

The fauna assessment was designed and carried out to conform with a Level 1 survey as defined in EPA Guidance statement No. 56 (EPA 2004). The assessment was limited to a desktop analysis aimed at providing a list of expected species, a daytime site visit primarily aimed at habitat assessment and opportunistic fauna observations in addition to a night time survey specifically targeting WRPs. No fauna trapping or seasonal sampling has been conducted. The lack of observational data on some species should not be taken as necessarily indicating that a species is absence from the site.

In recognition of survey limitations a precautionary approach has been adopted for this assessment. Any species that would potentially occur within the study area as identified through ecological databases, publications and the habitat knowledge of the Author has been assumed to potentially occur in the study area.

4. SURVEY EFFORT

The daytime reconnaissance survey of the study site was carried out on the 1st November 2005 between about 12:00 noon and 5:00pm. Survey traverses were conducted on foot and in total covered about 12km. The night time survey, targeting WRPs was conducted on the 1st November 2005 between 9:00pm and 11:30pm with traverses covering about 7km.



5. RESULTS

5.1 FAUNA HABITAT ASSESSMENT

The project area is situated within the south west margin of the Swan Coastal Plain. The Swan Coastal Plain Bioregion (SWA) is classified as part of the Interim Biogeographical Regionalisation for Australia. The SWA bioregion is described as being a:

"Low lying coastal plain mainly covered with Woodlands. It is dominated by Banksia or Tuart on sandy soils, Casuarina obesa on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah Woodland. Warm Mediterranean. Three phases of marine sand dune development provide relief.

The outwash plains, once dominated by Casuarina obesa – Marri Woodlands and Melaleuca shrublands, are extensive only in the south." (Thackway and Cresswell, 1996; IBRA, 2000).

The site mostly lies within a section of the Bassendean Dunes System which in this area consists of a flat to very gently undulating sandplain with well drained, deep, leached grey sands. Adjacent to the river, and largely outside the study area, the landform typically consists of flat to gently undulating terraces, below the level of the adjacent sandplain, consisting of deep well drained and uniform brownish sands or loams. Some low lying areas adjacent to the river are subject to periodic flooding.

Over half the area of the study site has been totally cleared of native vegetation with significant portions of the remaining vegetation being parkland cleared. Mapping by Heddle *et al* (1980) shows that prior to disturbance the sandplain areas would have consisted primarily of an open woodland of Marri (*Corymbia calophylla),* Jarrah (*Eucalyptus marginata)* and *Banksia* sp. with fringing woodlands of Flooded Gum (*E. rudis)* and Swamp Paperbark (*Melaleuca rhaphiophylla*) along minor creek beds (Southern River Complex). The Capel River is mapped as consisting of the Swan Complex which typically consists of fringing woodlands of Flooded Gum (*E. rudis*) and Swamp Paperbark (*Melaleuca rhaphiophylla*) with localised occurrences of low open forest of Swamp Sheoak (*Casuarina obesa*) and Saltwater Paperbark (*M. cuticularis).*

5.1.1 Fauna Habitats within the Study Area

The extent of the broadly defined fauna habitats within the study area are shown in Figure 3 with a description of each given below. More specific detail on the composition of each bush remnant can be found within the flora report.

1. **Cleared Pasture –** Cleared farmland with a mixture of introduced pasture grasses, clovers, weeds and degraded sedgelands. This area also contains

scattered trees of various species (*Agonis flexuosa, Corymbia calophylla, Eucalyptus* sp, *Melaleuca* sp. and exotics). Some areas of the cleared pasture are inundated during winter and provide foraging habitat for birds of prey, waterbird species and breeding grounds for frogs. While scattered and limited in number, the remaining trees provide roosting, foraging and breeding opportunities for fauna. No fallen logs or understorey are generally present.

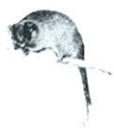
2. **Dams/Watercourses:** The small dam located in the north west of the property is about 30m in diameter. It has some fringing Flooded Gums (*Eucalyptus rudis*) and Peppermints (*Agonis flexuosa*). A small seasonal tributary to the Capel River cuts through the south west corner of the property. Both waterbodies provide some refuge and foraging opportunities for waterbirds and frog species.

3 **Marri *(Corymbia calophylla*) Open Woodland:** Parkland cleared Marri is present over areas of pasture in the northern half of the study area. Most trees are relatively young and contain no hollows. Occasional Peppermints, Banksia, Flooded Gum and *Nuytsia floribunda* are also present. Potential breeding and foraging habitat for a number of fauna species. No fallen logs or understorey are generally present.

3. **Peppermint (*Agonis flexuosa)* Open Woodland:** Several small patches of Peppermint dominated, parkland cleared woodland are present in certain areas of the property. Most have a limited extent but still provide potential Western Ringtail Possum habitat. No understorey is present and a groundcover of grasses and weed species is present.

4. **Marri *(Corymbia calophylla*) and Peppermint (*Agonis flexuosa)* Open Woodland:** Consists of a combination of Marri and Peppermint trees in varying densities. Some areas parkland cleared while others (fenced areas) have groundcover and understorey. Occasional Banksia, Flooded Gum (typically nearer the Capel River) and *Nuytsia floribunda* are also present. Potential breeding and foraging habitat for a number of fauna species. Generally no fallen logs are present.

5. ***Banksia attenuata* and *Banksia ilicifolia* Open Woodland over *Kunzea ericifolia* and mixed low shrubs:** Present in two separate areas. The western area has been open to grazing and has, as a consequence, a degraded understorey. The eastern area has been fenced from stock for some time and has denser understorey and leaf litter present. Also contains common emergent Jarrah (*Eucalyptus marginata) with Nuytsia floribunda,* Woody Pear (*Xylomelum occidentale*) and rare Marri. Provides suitable habitat for a wide range of fauna species. Some small fallen logs present.



6. ***Planted Eucalypts and other species*:** Several windbreaks and areas of planted Eucalypts and other species of trees and shrubs (some endemic) are present around the study area.

5.2 FAUNA INVENTORY

5.2.1 Opportunistic Fauna Surveys

The results of the opportunistic fauna survey are summarised in Table 4 and listed in Appendix A. A total of 39 fauna species were observed (or positively identified from scats, tracks, skeletons or calls) within the study area during the reconnaissance survey, four of which are introduced feral species. Three listed threatened species were observed (Baudin's Black Cockatoo, Forest Red-tailed Black Cockatoo and the Western Ringtail Possum). Four bush forever decreaser bird species were observed (includes the two threatened species).

5.2.2 Potential Fauna

Table 4 summarises the numbers of potential species based on vertebrate class. A complete list of terrestrial vertebrate fauna possibly inhabiting or frequently the study area is held in Appendix A.

Details on specially protected and priority species expected and/or listed as potentially occurring in the general area are given in the section 5.2.3.

Not all species listed as potentially occurring within the study area (based on searches of the EPBC Act's Threatened Fauna and Migratory species lists, CALM's Threatened Fauna Database and various publications) are shown in the expected listing in Appendix A. Some species have been excluded from this list based largely on the lack of suitable habitat within the study area.

Table 4: Summary of Potential Fauna Species (As listed in Appendix A)

Group	Total number of potential species	Number of specially protected species	Number of priority /migratory species	Number of species observed
Amphibians	10	0	0	3
Reptiles	37	1	1	1
Birds	111[B]	4	5	29[A]
Mammals	25[D]	2	4	6[C]

Note: some species fall into more than one category of protection, A= includes one introduced species B= includes two introduced species, C= includes three introduced species, D= includes six introduced species

5.2.3 Fauna of Conservation Significance

A search of EPBC Act's Threatened Fauna list, CALM's Threatened Fauna Database and Priority List and scientific publications identified 20 specially protected, priority or migratory fauna species as potentially occurring in the general study area. A brief account of these species with details on their distribution and habitat preference are given below.

Pouched Lamprey *Geotria australis*

Status and Distribution: Listed as Priority 1 by CALM. Status is secure but abundance has decreased due to proliferation of obstacles to upstream spawning migration such as dams and weirs. A southern hemisphere species. Western Australian distribution includes coastal drainages of the south west from Perth to Albany (Allen *et al* 2003). . CALM database records show this species as being recorded from the Capel River.

Habitat: This species lives in mud burrows in the upper reaches of coastal streams for the first 4 years of life until migrating to the sea. Adults migrate up to 60km upstream during spawning (Allen *et al* 2003).

Likely presence in study area: The small tributary of the Capel river located in the south eat corner of the study area may be used by this species though its suitability appears marginal due to its shallowness and probably seasonal nature.

Southern Carpet Python *Morelia spilota impricata*

Status and Distribution: The south western subspecies of the Carpet Python is classified as Priority 4 by CALM and is also listed in Schedule 4 under the *WAWC Act (1950)*. This sub species has wide distribution within the south west but is uncommon. Occurs north to Geraldton and Yalgoo and east to Pinjin, Kalgoorlie, Fraser Range and Eyre (Storr *et al*, 2002).

Habitat: This species has been recorded from semi-arid coastal and inland habitats, Banksia woodland, Eucalypt woodlands, and grasslands. It commonly utilises hollow logs for shelter.

Likely presence in study area: It has not been recorded in the general area in recent times and it is therefore considered unlikely to inhabit the study area. The extent of suitable habitat within the study area is limited.

Great Egret *Ardea alba*

Status and Distribution: This species of egret is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. The Great Egret is common and very widespread in any suitable permanent or temporary habitat (Morcombe, 2003).

Habitat: Wetlands, flooded pasture, dams, estuarine mudflats, mangroves and reefs (Morcombe, 2003).

Likely presence in study area: Likely to visit the area in low numbers, particularly in winter when areas of pasture are flooded. No suitable breeding habit present on site.

Cattle Egret *Ardea ibis*

Status and Distribution: This species of egret is listed as migratory under the *EPBC Act 1999* and under international agreements to which Australia is a signatory. The Cattle Egret is common in the north sections of its range but is an irregular visitor to the better watered parts of the state (Johnstone and Storr 1998). The population is expanding (Morcombe, 2003).

Habitat: Moist pastures with tall grasses, shallow open wetlands and margins, mudflats (Morcombe, 2003).

Likely presence in study area: As with the Great Egret, this species may occasionally utilise the dam and flooded paddocks present in the study area but is very unlikely to breed here.

White-bellied Sea Eagle *Haliaeetus leucogaster*

Status and Distribution: This species is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. White-bellied sea eagles are common in coastal and near coastal areas of Australia and are also found in New Guinea, Indonesia, China, southeast Asia and India.

Habitat: They nest and forage mainly near the coast but will also live near large rivers and lakes inland, often moving on a seasonal basis. White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession.

Likely presence in study area: The species may occasionally fly over the study site but is unlikely to specifically target the area for foraging or nesting.

Peregrine Falcon *Falco perigrinus*

Status and Distribution: This species is listed as Schedule 3 under the *WAWC Act 1950*. Individuals of this species are uncommon/rare but wide ranging across Australia. Moderately common at higher levels of the Stirling Range, uncommon in hilly, north west Kimberley, Hamersley and Darling Ranges; rare or scarce elsewhere (Johnstone and Storr 1998).

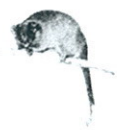
Habitat: Diverse from rainforest to arid shrublands, from coastal heath to alpine (Morcombe, 2003). Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes (Johnstone and Storr 1998). The species utilises the ledges, cliff faces and large hollows/broken spouts of trees for nesting. It will also occasionally use the abandoned nests of other birds of prey.

Likely presence in study area: The species potentially utilises some sections of the study area as part of a much larger home range. No evidence of this species nesting within the study area was found.

Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*

Status and Distribution: This species is listed as Scheduled 1 under the *WAWC Act (1950)* and as Vulnerable under the *EPBC Act (1999)*. Inhabits the humid and subhumid south west, mainly hilly interior, north to Gingin and east to Mt Helena, Christmas Tree Well, North Bannister, Mt Saddleback, Rock Gully and the upper King River (Johnstone and Storr 1998), Scarce on the Swan Coastal Plain.

Habitat: Eucalypt forests, feeds on Marri, Jarrah, Blackbutt, Karri, Sheoak and Snottygobble. Breeding occurs in winter/spring (Johnstone and Storr 1998).



Likely presence in study area: Two individuals, a male and female together were seen during the survey feeding in Marri trees. This species is probably only an infrequent visitor to the area, in small numbers as generally they prefer forest in closer proximity to the Darling and Whicher Scarps. Suitable foraging and roosting habitat exists. Potential nest sites exist though no evidence was found that any were in use.

Carnaby's Black- Cockatoo *Calyptorhynchus latirostris*

Status and Distribution: Carnaby's Black Cockatoo is listed as Scheduled 1 under the *WAWC Act (1950)* and as Endangered under the *EPBC Act (1999)*. Confined to the south-west of Western Australia, north to the lower Murchison River and east to Nabawa, Wilroy, Waddi Forest, Nugadong, Manmanning, Durokoppin, Noongar (Moorine Rock), Lake Cronin, Ravensthorpe Range, head of Oldfield River, 20 km ESE of Condingup and Cape Arid; also casual on Rottnest Island (Johnstone and Storr 1998).

Habitat: Forests, woodlands, heathlands, farms; feeds on banksia, hakeas, dryandras and Marri. Breeding occurs in winter/spring mainly in eastern forest and wheatbelt where they can find mature hollow bearing trees to nest in (Morcombe, 2003).

Likely presence in study area: This species is probably a common visitor to the area mostly during non- breeding season. Suitable foraging and roosting habitat exists. Potential nest sites exist though no evidence was found that any were in use. There appears to be very few records of nesting occurring in the general area.

Baudin's Black- Cockatoo *Calyptorhynchus baudinii*

Status and Distribution: Listed as Scheduled 1 under the *WC Act (1950)* and as Endangered under the *EPBC Act (1999)*. Confined to the south-west of Western Australia, north to Gidgegannup, east to Mt Helena, Wandering, Quindanning, Kojonup, Frankland and King River and west to the eastern strip of the Swan Coastal Plain including West Midland, Byford, Nth Dandalup, Yarloop, Wokalup and Bunbury. (Johnstone and Storr 1998).

Habitat: Mainly eucalypt forests where it feeds primarily on the Marri seeds, (Morcombe, 2003), banksia, hakeas and *Erodium* sp. Also strips bark from trees in search of beetle larvae (Johnstone and Storr 1998).

Likely presence in study area: A flock of about ten Baudin's Cockatoos were observed feeding on Marri trees during the survey and the species is probably a frequent visitor to the general area. Potential nest sites exist though no evidence was found that any were in use.

Barking Owl *Ninox connivens connivens*

Status and Distribution: Listed as Priority 2 by CALM. Found north to Perth (formerly) and east to Northam, Katanning and nearly to Bremer Bay. Declining in south west (Johnstone and Storr 1998).

Habitat: Dense vegetation, especially forest and thickets of waterside vegetation such as melaleucas (Johnstone and Storr 1998). In south west commonly associated with tall eucalypt woodland such as Tuart.

Likely presence in study area: Potentially inhabits suitable habitat directly adjacent to the Capel River and if present may move into parts of the study area at night to hunt.

Masked Owl *Tyto novaehollandae*

Status and Distribution: Listed as Priority 2 by CALM. Found north to Yanchep and east to Yealering, Gnowangerup and Albany, casual further north. Locally common in south west but generally uncommon (Johnstone and Storr 1998).

Habitat: Roosts and nests in heavy forest, hunts over open woodlands and farmlands (Morcombe, 2003). Probably breeding in forested deep south west with some autumn–winter wanderings northwards (Johnstone and Storr 1998).

Likely presence in study area: Potentially inhabits suitable habitat directly adjacent to the Capel River and may move into parts of the study area at night to hunt.

Fork-tailed Swift *Apus pacificus*

Status and Distribution: The Fork-tailed Swift is listed as migratory under the *EPBC Act 1999* and under international agreements to which Australia is a signatory. It is a summer migrant (Oct-Apr) to Australia (Morcombe, 2003).

Habitat: Low to very high airspace over varied habitat from rainforest to semi desert (Morcombe, 2003).

Likely presence in study area: It is potentially an occasional summer visitor to the study site but is not likely to be specifically attracted to the general area.

Rainbow Bee-eater *Merops ornatus*

Status and Distribution: This species is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. The Rainbow Bee-eater is a common summer migrant to southern Australia but in the north they are resident (Morcombe, 2003).

Habitat: Open Country, of woodlands, open forest, semi arid scrub, grasslands, clearings in heavier forest, farmlands (Morcombe, 2003). Breeds underground in areas of suitable soft soil firm enough to support tunnel building.

Likely presence in study area: Sighted during opportunistic surveys. Potentially breeds within and nearby the study site where soil conditions allow.

Chuditch *Dasyurus geoffroii*

Status and Distribution: Listed as Scheduled 1 under the *WAWC Act (1950)* and as Vulnerable under the *EPBC Act (1999)*. Formerly occurred over nearly 70 per cent of Australia. The Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of southwest Western Australia. Also occurs in very low numbers in the Midwest, Wheatbelt and South Coast Regions with records from Moora to the north, Yellowdine to the east and south to Hopetoun.

Habitat: Chuditch are known to have occupied a wide range of habitats from woodlands, dry sclerophyll (leafy) forests, riparian vegetation, beaches and deserts. Riparian vegetation appears to support higher densities of Chuditch, possibly because food supply is better or more reliable and better cover is offered by dense vegetation. Chuditch appear to utilise native vegetation long road sides in the wheatbelt (CALM, 1994). The estimated home range of a male Chuditch is over 15 km^2 whilst that for females is 3-4 km^2 (Sorena and Soderquist 1995).

Likely presence in study area: There appears to be no recent documented records of the Chuditch from the general area and the species is rarely recorded anywhere on the Swan Coastal Plain (Dell 2000). Closest, most recent records are from surveys conducted at the proposed Gwindinup minesite 15km east (Bamford 2000). Individuals may use vegetation adjacent to the Capel River as a corridor from inland state forest areas and therefore the presence of this species can not be discounted, but is appears at best to be a rare visitor to the study site.

Southern Brush-tailed Phascogale *Phascogale tapoatafa tapoatafa*

Status and Distribution: Listed as Priority 4 by CALM. Present range is believed to have been reduced to approximately 50 per cent of its former range. Now known from Perth and south to Albany, west of Albany Highway. Occurs at low densities in the northern Jarrah forest. Highest densities occur in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton (CALM information pamphlet). Records are less common from wetter forests.

Habitat: This subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. A

nocturnal carnivore relying on tree hollows as nest sites. The home range for a female Brush-tailed Phascogale is estimated at between 20 and 70 ha, whilst that for males is given as twice that of females. In addition, they tend to utilise a large number (approximately 20) of different nest sites throughout their range (Soderquist 1995).

Likely presence in study area: The majority of the site is unsuitable for this species as suitable hollows appear to be rare or absent. Potentially present but in low numbers.

Quenda *Isoodon obesulus fusciventer*

Status and Distribution: Listed as Priority 5 by CALM. Widely distributed in the south west from near Cervantes north of Perth to east of Esperance, patchy distribution through the Jarrah and Karri forest and on the Swan Coastal Plain, and inland as far as Hyden. Has been translocated to Julimar State Forest, Hills Forest Mundaring, Tutanning Nature Reserve, Boyagin Nature Reserve, Dongolocking Nature Reserve, Leschenault Conservation Park, and Karakamia and Paruna Sanctuaries (CALM information pamphlet) and most recently Nambung National Park (CALM pers. coms.)

Habitat: Dense scrubby, often swampy, vegetation with dense cover up to one metre high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting Jarrah and Wandoo forests are usually associated with watercourses. Quendas will thrive in more open habitat subject to exotic predator control (CALM information pamphlet).

Likely presence in study area: No evidence of this species was found within the study area. The only habitat that appears suitable is the section of fenced vegetation near the central section of the study area where reasonably dense ground cover is present, though it should be noted that an occupied fox den was located here. Quenda's are most likely to be present in areas of dense vegetation along the Capel River.

Western Ringtail Possum *Pseudocheirus occidentalis*

Status and Distribution: Listed as Scheduled 1 under the *WAWC Act (1950)* and as Vulnerable under the *EPBC Act (1999).* Most populations are now restricted to near coastal areas of the south west from the Australind/Eaton area to the Waychinicup National Park. It is relatively common and abundant in a small part of the lower Collie River valley and the proposed Perup Nature Reserve and surrounding forest blocks near Manjimup.

Habitat: The Western Ringtail Possum was once located in a variety of habitats including Coastal Peppermint, Coastal Peppermint-Tuart, Jarrah-Marri associations, Sheoak woodland, and eucalypt woodland and mallee. Present

populations mostly inhabit Coastal Peppermint-Tuart associations from Bunbury to Albany. Along the Swan Coastal Plain near Busselton the highest densities occur in habitats with dense, relatively lush vegetation. In these areas the main determinants of suitable habitat for WRPs appears to be the presence of *Agonis flexuosa* either as the dominant tree or as an understorey component of Eucalypt forest or woodland (Jones *et al*. 1994).

Likely presence in study area: During the targeted surveys a number of dreys and several individuals of this species were found throughout remnant vegetation in the study area and the in areas along the Capel River (see section 5.3) . Two dead specimens were found in the vicinity of the fox den located in remnant vegetation south of the existing building on the property.

Western Brush Wallaby *Macropus irma*

Status and Distribution: Listed as Priority 4 by CALM. The Western Brush Wallaby is distributed across the south-west of Western Australia from north of Kalbarri to Cape Arid (CALM information pamphlet).

Habitat: The species optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest (CALM information pamphlet).

Likely presence in study area: Given the patchy and largely open nature of the remnant vegetation left in the study area it is unlikely this species is present.

Western False Pipstrelle *Falsistrellus mackenziei*

Status and Distribution: Listed as Priority 4 by CALM. Confined to south west W.A., south of Perth and east to the wheat belt. Most records from Karri forests but also recorded in wetter stands of jarrah and tuart and woodlands on the Swan Coastal Plain (Menkhorst and Knight 2001).

Habitat: This species of bat occurs in high jarrah forest and coastal woodlands. It roosts in small colonies in tree hollows and forages in the cathedral-like spaces between trees.

Likely presence in study area: This species may be present in the study area as suitable habit appears to be present, though the number of hollows suitable for day time refuge appears limited. Several small bats were seen during the nigh time survey but which species they represented was not determined.

Water Rat *Hydromys chrysogaster*

Status and Distribution: Listed as Priority 4 by CALM. The water rat is widely distributed around Australia and its offshore islands, New Guinea and some adjacent islands. It occurs in fresh brackish water habitats in the south-west of Western Australia, but occurs in marine environments along the Pilbara coastline and offshore islands.

Habitat: The water rat occupies habitat in the vicinity of permanent water, fresh, brackish or marine.

Likely presence in study area: May utilise the dam and small tributary on occasions but is unlikely to be resident due to the disturbed nature of these sites.

5.2.4 Other Species of Significance

Fourty species of birds potentially frequent or occur in the study area that are noted as Bush Forever Decreaser Species in the Perth metropoltan region though only four species were sighted during the survey (see Appendix A). The lack of observational data suggests that the study site is largely unsuitable for significant populations of most of these species to persist, though it should be noted that some are wide ranging species that may only visit the site occassionally. The lack of understorey in most of the study site reduces its sutability for some species such as the White-browed Scrub Wren and to a lesser extent the Broad-tailed Thornbill for example.

Decreaser species are a significant issue in biodiversity conservation in the Perth section of the Coastal Plain as there have been marked reductions in range and population levels of many sedentary bird species as a consequence of disturbance and land clearing (Dell & Hyder-Griffiths 2002). It can be expected that with increasing pressures on land use, populations and the ranges of some fauna species will further decline unless preventative measures are implemented.

5.3 WESTERN RINGTAIL POSSUM SURVEY

5.3.1 WRP Habitats

In the coastal areas of the south west the main determinants of suitable habitat for WRPs appears to be the presence of Peppermint (*Agonis flexuosa*) either as the dominant tree or as an understorey component of Eucalypt forest or woodland (Jones *et al.* 1994).

Peppermints are widespread within the remnant vegetation throughout the study site though in the Banksia and Marri dominated woodlands they are uncommon. Areas most favoured will be those areas with greatest

concentrations of Peppermint and where the canopy is more continuous. These include the Peppermint Woodland areas and the Marri-Peppermint association (see Figure 3). Peppermint is also common along the Capel River.

5.3.2 Daytime Survey

Observations for dreys, scats and WRPs were carried out as part of the opportunistic fauna survey conducted on the 1st November 2005. As many trees as practical were examined for dreys, scats and individual WRPs. Particular attention was paid the most likely habitat, where Peppermints were a dominant or subdominant component of the vegetation structure.

Drey sightings recorded during the daytime survey are shown in Figure 4. In total 10 dreys were located within the project area. An additional four dreys were located within the Capel River reserve directly adjacent to the study area boundary. Due to the location of the dreys generally high in trees it was not possible to positively determine if some were occupied by WRPs or not. Two of the dreys (unoccupied) were found within the shed located near the centre of the property.

Scats were rarely found and only in small numbers, all in the area where dreys were located.

Three WRPs were sighted during the day survey, one alive and two dead specimens. The dead WRPs were found adjacent to (what was assumed to be) a fox den. Also nearby were the remains of a Magpie, a Black Duck, a Brushtail Possum and a small Grey Kangaroo.

5.3.3 Night Time Survey

A night time survey was conducted on foot over the study area on 1st November 2005 using a head torch. The aim of the survey was to document the distribution and abundance of WRPs. Close spaced traverses were conducted in the most likely habitat with wider spaced lines in areas considered less likely to be utilised by WRPs.

Eight Western Ringtail Possums were located within the study area during the course of the night survey (Figure 5). A further 8 were found within the Capel River reserve directly adjacent to the study area boundary.

Seven Brushtail Possums (*Trichosurus vulpecular*) were sighted during the surveys (see Figure 5).

5.4 BLACK COCKATOO NEST HOLLOW AND FORAGING HABITAT SURVEY

During the course of the daytime survey on the 1st November 2005 observations on potential Cockatoo nest sites and foraging habitat were made. The surveys aimed to assess all trees within the study site. The location of each potential nest site was recorded using a GPS. The location of each potential nest site is shown in Figure 4.

Two potential nest hollows were found within the study area. It was noted that very few trees examined had even small or medium size hollows suitable for other obligate hollow nesting fauna (e.g. Brush-tailed Phascogale, Galah, Regent Parrot, Twenty Eight Parrot, Red-capped Parrot, Western Rosella, Elegant Parrot, Boobook Owl, Australian Owlet-nightjar, Kookaburra, Sacred Kingfisher, Rufous Treecreeper, Striated Pardalote and Tree Martin), a reflection of the relatively young age of most of the trees. Feral bees were seen utilising some hollows.

As the survey did not take into account all factors relating to the suitability of a nest hollows the number of potential nest sites recorded very likely represents an overestimation of the actual number of suitable hollows. No evidence was found to suggest any of the hollows identified as potential nest sites had been or were in use by cockatoo's or that the general area is in fact used for nesting by these species.

Foraging black cockatoo species are principally attracted to seeding and flowering *Eucalyptus*, *Corymbia*, *Banksia, Dryandra, Hakea, Grevillea, Pinus* and *Allocasuarina* (Johnstone and Storr, 1998). Most of the remnant vegetation of the study area is Marri (*Corymbia calophylla*) and Baudin's and the Forest Red-tailed Black Cockatoo were seen feeding on the ripening fruits of this tree species. The areas of Banksia on the property also provide a potential food source for Cockatoo species.

5.5 LOCAL CONSERVATION SIGNIFICANCE OF THE STUDY AREA

The majority of the study site is cleared or degraded and as a consequence the diversity of fauna species present prior to disturbance has been reduced dramatically. Habitat degradation as a result of partial clearing, altered fire regimes and predation by introduced predators is also likely to have had an effect on species diversity in other areas of the study site, in particular the smaller bush remnants. The impact of introduced predators was graphically illustrated during the survey with the discovery of a number of dead native fauna species in the vicinity of what was presumed to be a fox den.

The site was found to provide suitable habitat for a number of bird species that have reduced populations and distributions in more developed areas of the Perth section of the Swan Coastal Plain though it appears that most may only

be occasional visitors to the site due the relatively high level of disturbance that has already taken place and the limited extent of relatively intact habitat.

Despite the considerable disturbance of the majority of the area the results of the fauna assessment indicate that the study site potentially hosts a range of fauna species, some of which are of special conservation significance. Of most significance is the presence of the threatened Western Ringtail Possum and for this reason alone the study site must be considered of local significance.

5.6 VALUE OF THE STUDY AREA AS A WILDLIFE CORRIDOR

Linkage with adjacent bushland areas has been identified as a natural attribute of high priority in the assessment of a sites regional significance (EPA 2002a). Two types of linked (or potentially linked) sequences of ecological communities were identified in the EPA's Strategy, vegetated sequences and river corridors. The vegetated sequences are further divided into two groups – those that link North-South predominantly along landforms and vegetation complexes; and those that link East-West across landform and vegetation complexes (EPA 2002a).

The Greater Bunbury Region (GBR) ecological linkages plan (Appendix 4, EPA 2003) shows the Capel River as a riverine ecological linkage that extends from the coast to the Whicher Scarp.

The GBR ecological linkages plan also shows the more conceptual North South orientated Capel/Boyanup ecological linkage. The plan shows the linkage passing just above the study area. Specific vegetated elements of the linkage are not identified. The EPA state that the identification process is expected to be achieved through the update of the System 6 and part System 1 area in a coordinated program similar to Bush Forever. Naturally vegetated areas (in particular the larger relatively intact remnants) in the area of the linkages will be priorities for retention and protection, being expected to meet the criteria for regional significance against at least two criteria, that is 'Representation of ecological communities' and 'Maintaining of ecological processes or natural systems' (Appendix 4, EPA 2003).

The remnant vegetation within the study site does not provide a direct link between other areas of vegetation but does adjoin the Capel River corridor thereby providing additional value to this linkage. The site could also form part of the Capel Boyanup linkage though the remnant vegetation on site and to the south may not meet EPA criteria for specific retention and protection due to it being generally degraded, fragmented and with a limited extent.

6. FAUNAL VALUES & DEVELOPMENT IMPACT

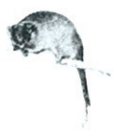
Over half the area of the study site has been totally cleared of native vegetation with significant portions of the remaining vegetation being parkland cleared. As a consequence the diversity of fauna has been reduce significantly from that which would have originally been present in the area prior to its development and use as a farm. The area of remnant vegetation containing any degree of native groundcover and understorey is very limited and makes up less than about 5% or the area proposed for rezoning.

Despite this the results of the fauna assessment indicate that the study site potentially hosts a range of fauna species, some of which are of special conservation significance, including the Black Cockatoo species and the Western Ringtail Possum.

Any proposed development of the site may require the clearing of remnant vegetation and consequently the loss or degradation of potential fauna habitat. The impact on specific fauna species will vary depending on population densities and the quantity and quality of potential foraging and breeding sites, both within the area of impact and adjacent areas. Development of the site also has the potential to restrict the movement of some fauna species such as the Western Ringtail Possum which favours areas with continuous canopy connections.

Future planning proposals for the study site should aim to retain as much of the existing remnant vegetation as possible with particular emphasis on those areas favoured by the Western Ringtail Possum and those having the best quality understorey. The maintenance, enhancement and the creation of vegetated linkages between areas of remnant vegetation on the site and the Capel River reserve should also be a priority.

The impact on fauna should be reviewed when detailed development plans become available.



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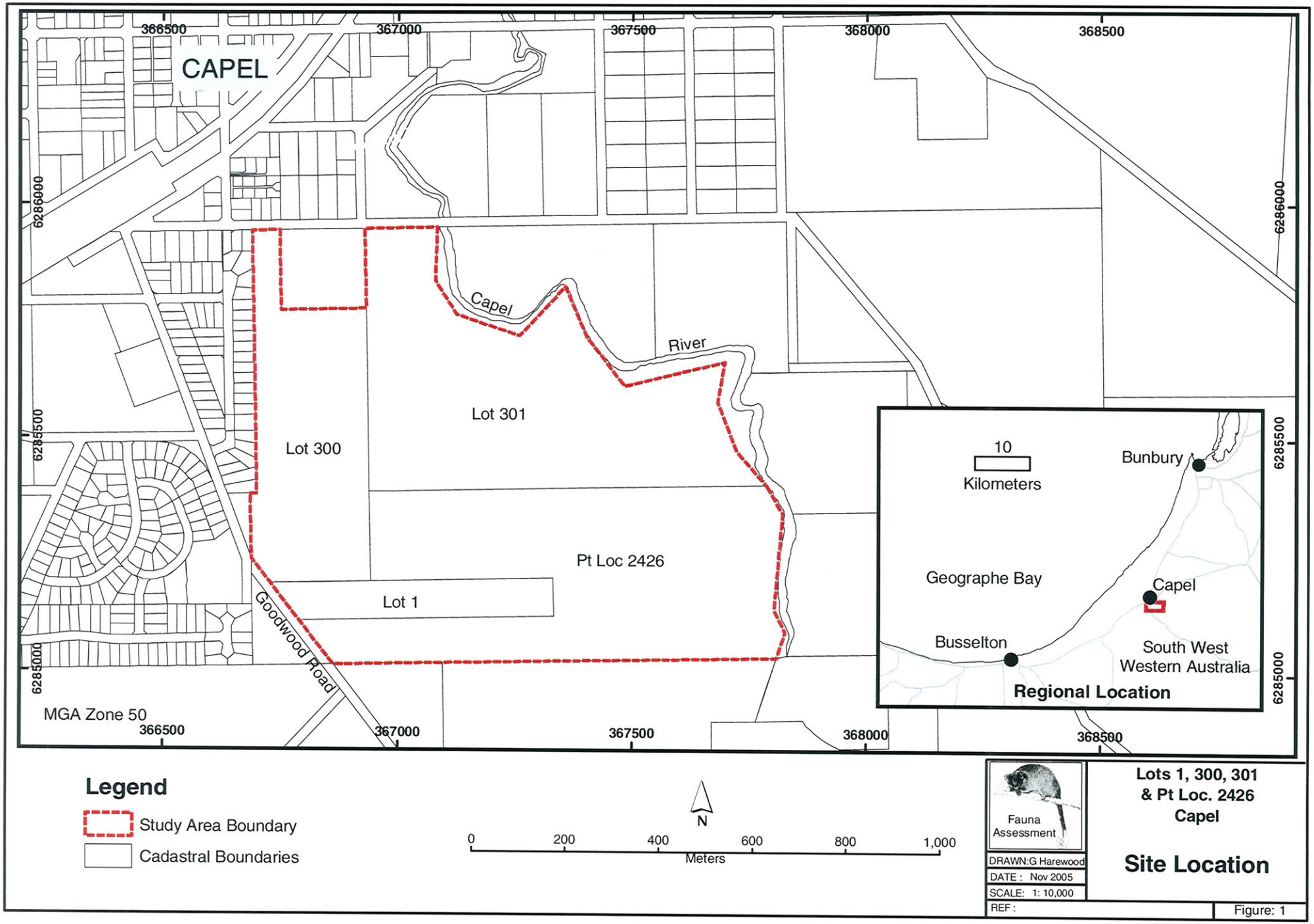
FIGURES


CAPEL
366500
367000
367500
368000
368500
6286000
6285500
6285000
Capel River
Lot 300
Lot 301
Pt Loc 2426
Lot 1
Goodwood Road
MGA Zone 50
10
Kilometers
Bunbury
Geographe Bay
Capel
Busselton
South West
Western Australia
Regional Location
Legend
Study Area Boundary
Cadastral Boundaries
N
0
200
400
600
800
1,000
Meters
Fauna Assessment
DRAWN:G Harewood
DATE : Nov 2005
SCALE: 1: 10,000
REF :
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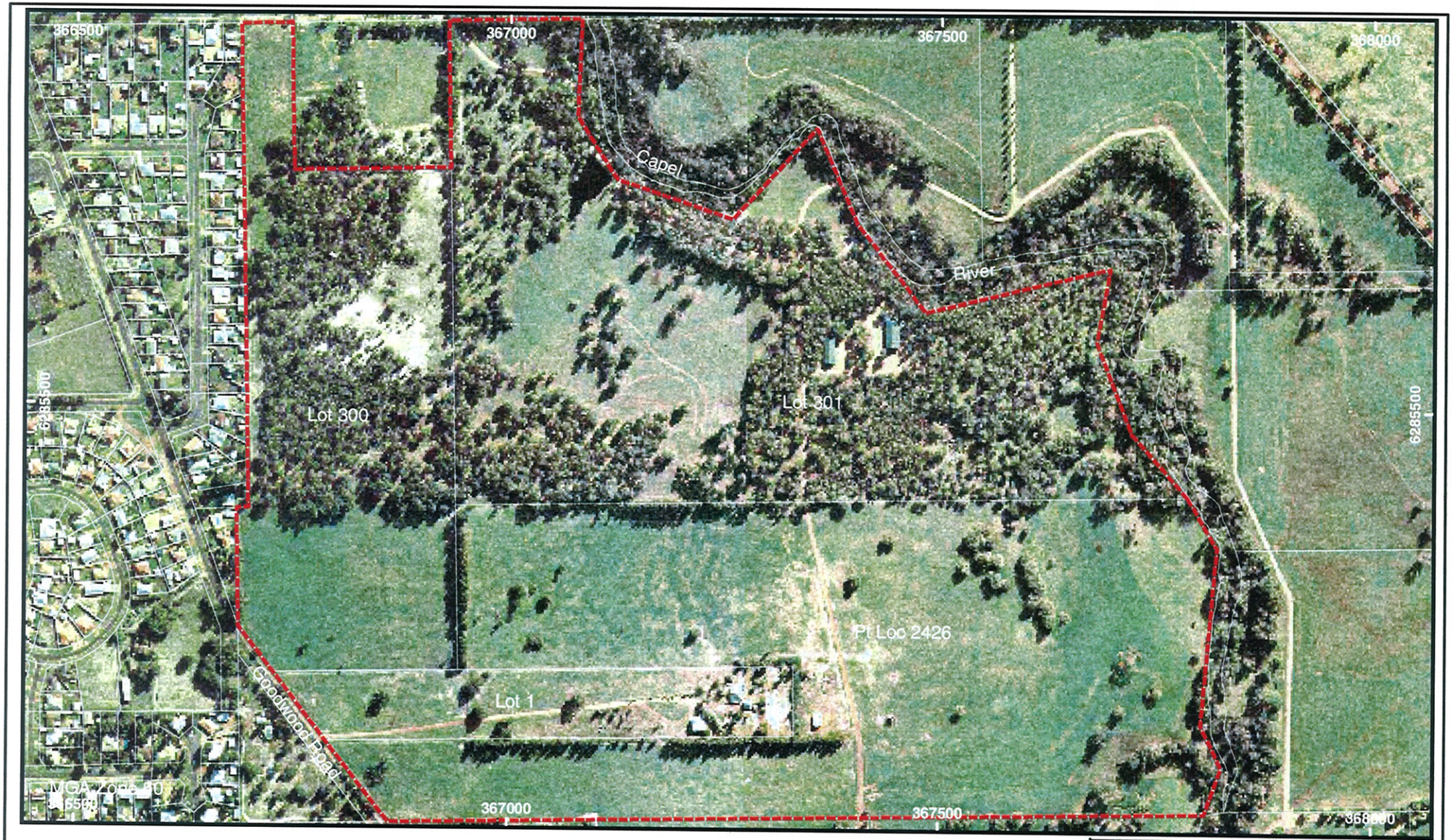
& Pt Loc. 2426
Capel
Site Location
Figure: 1



Legend

Study Area Boundary

Cadastral Boundaries

N

0 100 200 300 400 500

Meters

Fauna Assessment

DRAWN:G Harewood

DATE : Nov 2005

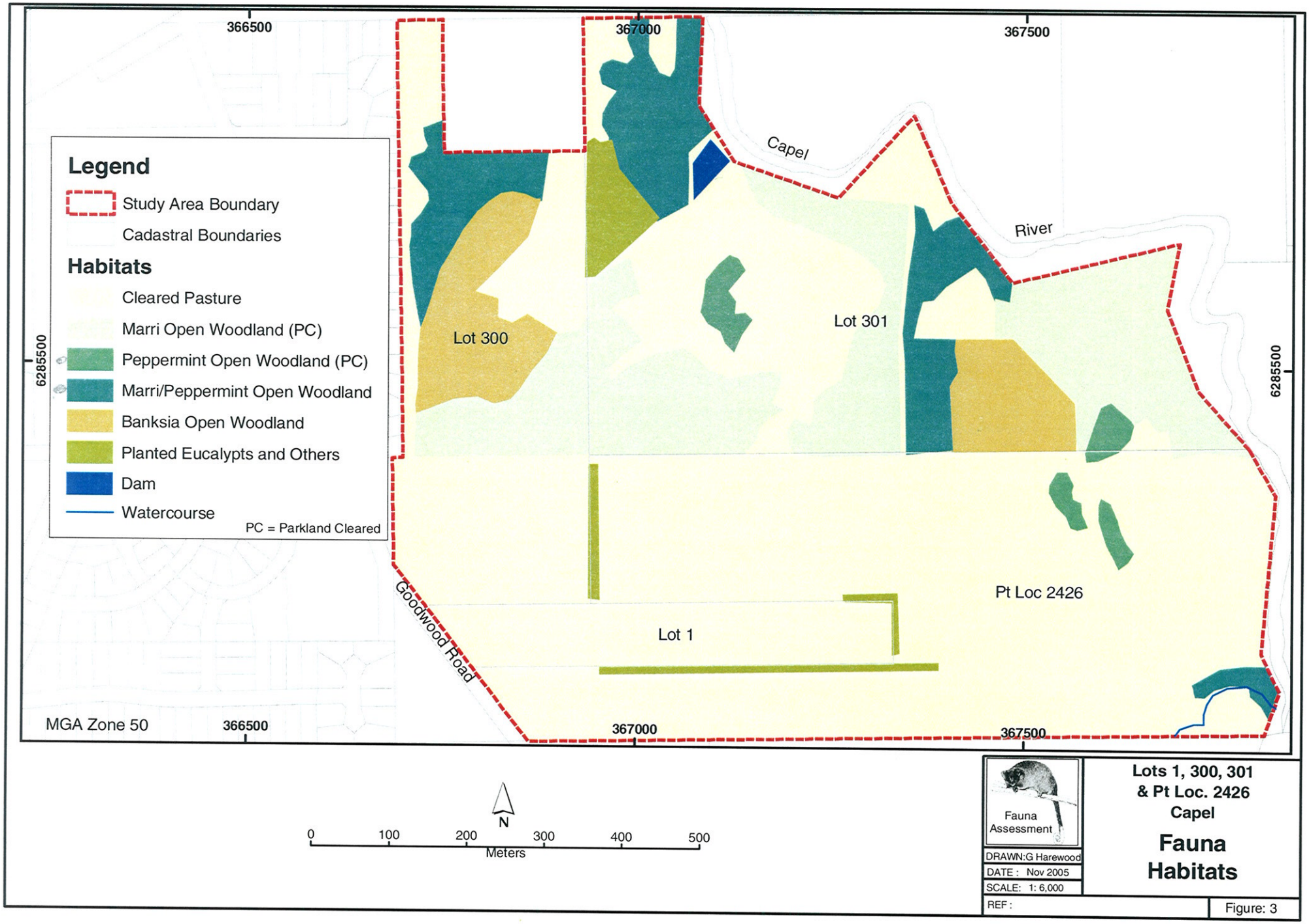
SCALE: 1: 6,000

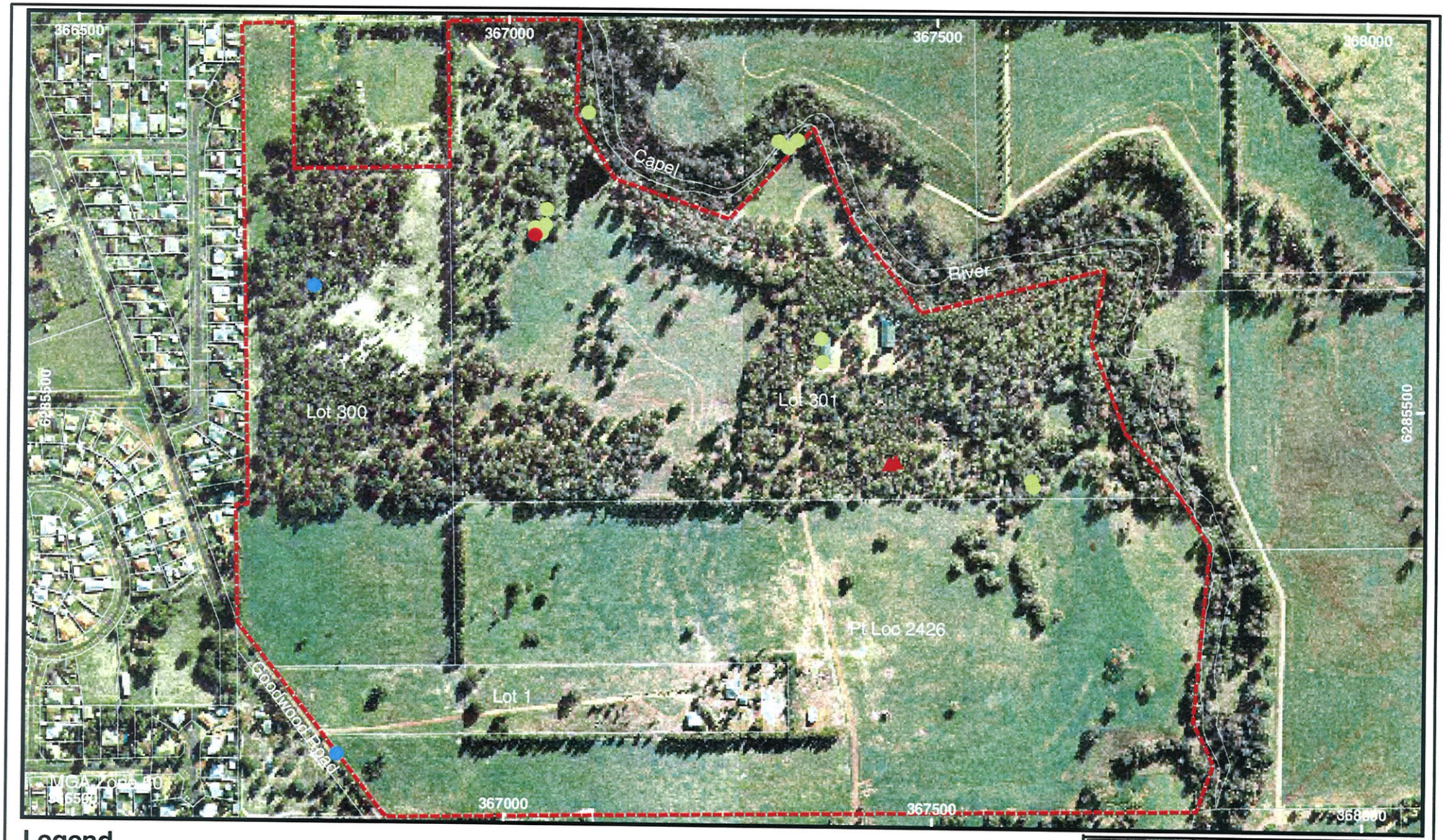
REF :

Lots 1, 300, 301 & Pt Loc. 2426 Capel

Study Area Airphoto

Figure: 2


366500
367000
367500
6285500
Capel
River
Lot 300
Lot 301
Pt Loc 2426
Lot 1
Goodwood Road
Legend
Study Area Boundary
Cadastral Boundaries
Habitats
Cleared Pasture
Marri Open Woodland (PC)
Peppermint Open Woodland (PC)
Marri/Peppermint Open Woodland
Banksia Open Woodland
Planted Eucalypts and Others
Dam
Watercourse
PC = Parkland Cleared
MGA Zone 50
N
0
100
200
300
400
500
Meters
Fauna Assessment
DRAWN:G Harewood
DATE : Nov 2005
SCALE: 1: 6,000
REF :
Lots 1, 300, 301 & Pt Loc. 2426 Capel
Fauna Habitats
Figure: 3



Legend

- Study Area Boundary
- Cadastral Boundaries
- WRP Drey
- WRP
- WRP - Dead
- Potential Cockatoo Nest Hollows

N

0 100 200 300 400 500

Meters

Fauna Assessment

DRAWN:G Harewood

DATE : Nov 2005

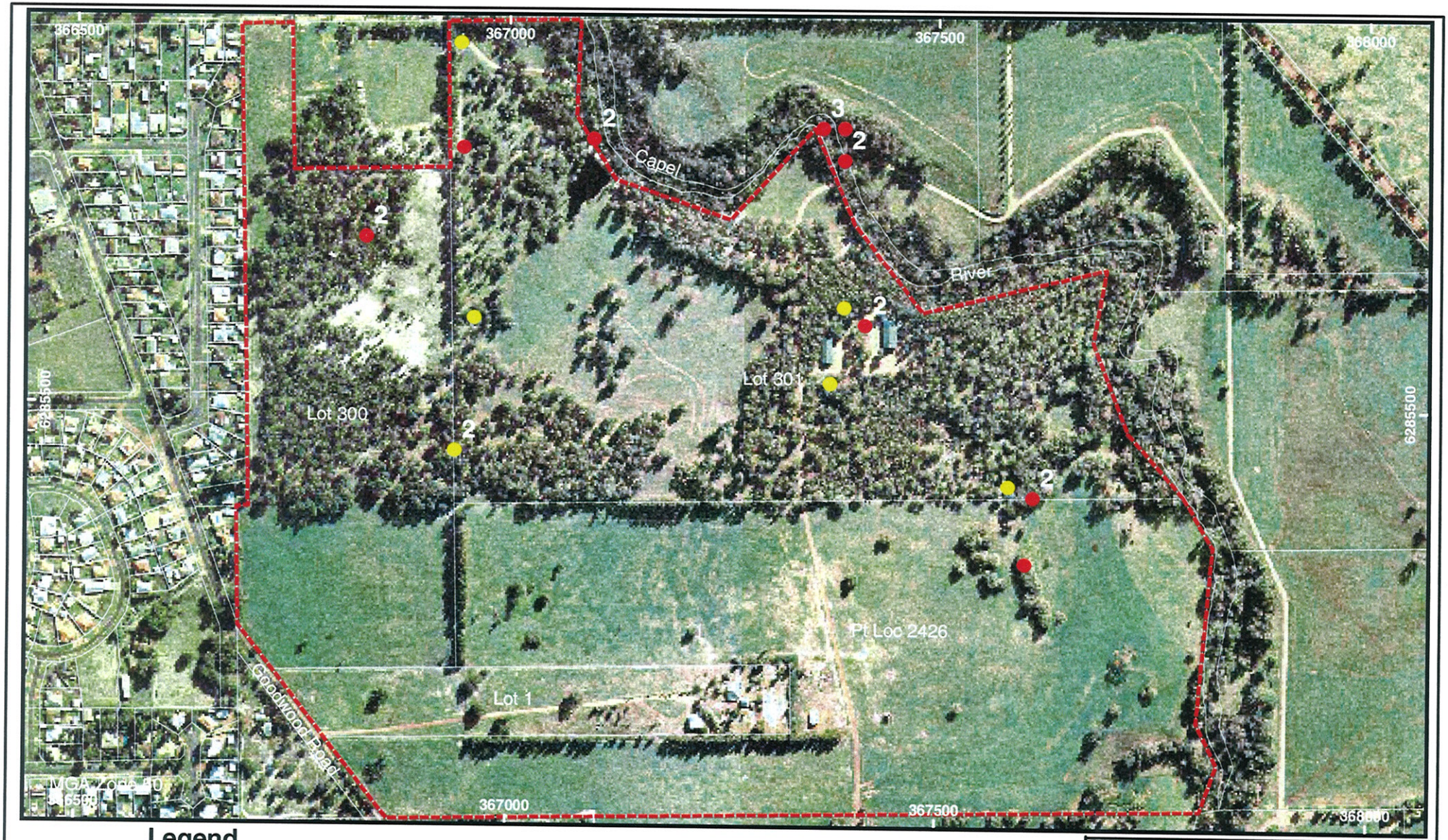
SCALE: 1: 6,000

REF :

Lots 1, 300, 301 & Pt Loc. 2426 Capel

Daytime Survey Results

Figure: 4



Legend

- Study Area Boundary
- Cadastral Boundaries
- Western Ringtail Possum
- Common Brushtail Possum

N

0 100 200 300 400 500

Meters

Fauna Assessment

DRAWN: G Harewood

DATE : Nov 2005

SCALE: 1: 6,000

REF :

Lots 1, 300, 301 & Pt Loc. 2426 Capel

Nightime Survey Results

Figure: 5

APPENIDIX A

POTENTIAL FAUNA SPECIES LIST

Fauna Potentially in Study Area

Lot 1, Lot 300, Lot 301 and Pt Loc 2426 - Capel

Compiled by Greg Harewood - November 2005
Sighted/Heard/Signs = +

Class **Family** *Species*	Common Name	Conservation Status	Sighted Nov. 05
Amphibians			
Myobatrachidae Ground or Burrowing Frogs			
Crinia georgiana	Quacking Frog		+
Crinia glauerti	Glauert`s Froglet		+
Crinia insignifera	Squelching Froglet		
Geocrinia leai	Lea`s Frog		
Heleioporus eyrei	Moaning Frog		
Heleioporus psammophilus	Sand Frog		
Limnodynastes dorsalis	Banjo Frog		
Pseudophryne guentheri	Güenther`s Toadlet		
Hylidae Tree Frogs			
Litoria adelaidensis	Slender Tree Frog		+
Litoria moorei	Motorbike Frog		
Reptiles			
Chelidae Side-necked Tortoises			
Chelodina oblonga	Long-necked Tortoise		
Gekkonidae Geckoes			
Diplodactylus polyophthalmus	Speckled Stone Gecko		
Phyllodactylus marmoratus	Marbled Gecko		
Pygopodidae Legless Lizards			
Aprasia pulchella	Pretty Worm Lizard		
Aprasia repens	Sandplain Worm Lizard		
Lialis burtonis	Common Snake Lizard		
Pygopus lepidopodus	Common Scaleyfoot		
Agamidae Dragon Lizards			
Pogona minor	Bearded Dragon		

* =Introduced, S1 to S4 = WAWC Act Status, EN = Endangered, VU = Vulnerable, EX = Extinct, P1 to P5 = CALM Priority Status, CA = CAMBA, JA = JAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region.

Class **Family** *Species*	Common Name	Conservation Status	Sighted Nov. 05
Varanidae Monitor's or Goanna's			
Varanus gouldii	Goulds Sand Monitor		
Varanus rosenbergi	Rosenbergs Monitor		
Scincidae Skinks			
Acritoscincus trilineatum	South-western Cool Skink		
Cryptoblepharus plagiocephalus	Fence Skink		
Ctenotus catenifer			
Ctenotus impar	South-western Odd-striped Ctenotus		
Ctenotus labillardieri	Red-legged Skink		
Egernia kingii	Kings Skink		
Egernia luctuosa	Mourning Skink		
Egernia napoleonis	Salmon-bellied Skink		
Glaphyromorphus gracilipes	Southern Mulch Skink		
Hemiergis peronii	Three-toed Skink		
Hemiergis quadrilineata	Two-toed Earless Skink		
Lerista elegans	West Coast Four-toed Lerista		
Menetia greyii	Dwarf Skink		
Morethia lineoocellata	Western Pale-flecked Morethia		
Morethia obscura	Southern Pale-flecked Morethia		
Tiliqua rugosa	Bobtail		
Typhlopidae Blind Snakes			
Ramphotyphlops australis	Southern Blind Snake		
Ramphotyphlops pinguis	Stout Blind Snake		
Boidae Pythons, Boas			
Morelia spilota imbricata	Southern Carpet Python	S4 P4	

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Class **Family** *Species*	Common Name	Conservation Status	Sighted Nov. 05
Elapidae Elapid Snakes			
Echiopsis curta	Bardick		
Elapognathus coronatus	Crowned Snake		
Neelaps bimaculatus	Black-naped Snake		
Notechis scutatus	Tiger Snake		
Parasuta gouldii	Gould`s Snake		
Parasuta nigriceps	Black-backed Snake		
Pseudonaja affinis	Dugite		+
Simoselaps bertholdi	Jan`s Banded Snake		
Birds			
Casuariidae Emus, Cassowarries			
Dromaius novaehollandiae	Emu	Bp	
Phasianidae Quails, Pheasants			
Coturnix pectoralis	Stubble Quail		
Coturnix ypsilophora	Brown Quail		
Anatidae Geese, Swans, Ducks			
Anas gracilis	Grey Teal		
Anas superciliosa	Pacific Black Duck		+
Aythya australis	Hardhead	Bh	
Biziura lobata	Musk Duck	Bh	
Chenonetta jubata	Australian Wood Duck		
Cygnus atratus	Black Swan		
Oxyura australis	Blue-billed Duck	Bh	
Tadorna tadornoides	Australian Shelduck		
Podicipedidae Grebes			
Poliocephalus poliocephalus	Hoary-headed Grebe		
Tachybaptus novaehollandiae	Australasian Grebe		
Anhingidae Darters			
Anhinga melanogaster	Darter		

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Class **Family** *Species*	Common Name	Conservation Status	Sighted Nov. 05
Phalacrocoracidae Cormorants			
Phalacrocorax melanoleucos	Little Pied Cormorant		
Phalacrocorax sulcirostris	Little Black Cormorant		
Ardeidae Herons, Egrets, Bitterns			
Ardea alba	Great Egret	Migratory CA JA	
Ardea ibis	Cattle Egret	Migratory CA JA	
Ardea intermedia	Intermediate Egret		
Ardea pacifica	White-necked Heron		
Egretta novaehollandiae	White-faced Heron		
Nycticorax caledonicus	Rufous Night Heron	Bp	
Threskiornithidae Ibises, Spoonbills			
Platalea flavipes	Yellow-billed Spoonbill		
Threskiornis molucca	Australian White Ibis		
Threskiornis spinicollis	Straw-necked Ibis		+
Accipitridae Kites, Goshawks, Eagles, Harriers			
Accipiter cirrocephalus	Collared Sparrowhawk	Bp	
Accipiter fasciatus	Brown Goshawk	Bp	
Aquila audax	Wedge-tailed Eagle	Bp	
Aquila morphnoides	Little Eagle	Bp	
Circus approximans	Swamp Harrier		
Circus assimilis	Spotted Harrier		
Elanus caeruleus	Black-shouldered Kite		
Haliastur sphenurus	Whistling Kite	Bp	+
Hamirostra isura	Square-tailed Kite	Bp	
Falconidae Falcons			
Falco berigora	Brown Falcon	Bp	
Falco cenchroides	Australian Kestrel		
Falco longipennis	Australian Hobby		
Falco peregrinus	Peregrine Falcon	S4 Bp	

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Class **Family** *Species*	Common Name	Conservation Status	Sighted Nov. 05
Rallidae Rails, Crakes, Swamphens, Coots			
Fulica atra	Eurasian Coot		
Turnicidae Button-quails			
Turnix varia	Painted Button-quail	Bp	
Charadriidae Lapwings, Plovers, Dotterels			
Charadrius melanops	Black-fronted Dotterel		
Columbidae Pigeons, Doves			
Columba livia	Domestic Pigeon		
Ocyphaps lophotes	Crested Pigeon		
Phaps chalcoptera	Common Bronzewing	Bh	+
*Streptopelia senegalensis**	Laughing Turtle-Dove		
Cacatuidae Cockatoos, Corellas			
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	S1 VU Be	+
Calyptorhynchus baudinii	Baudin`s Cockatoo	S1 EN Bp	+
Calyptorhynchus latirostris	Carnaby`s Cockatoo	S1 EN Bp	
Eolophus roseicapilla	Galah		+
Psittacidae Parrots			
Glossopsitta porphyrocephala	Purple-crowned Lorikeet		
Neophema elegans	Elegant Parrot		
Platycercus icterotis	Western Rosella	Bp	
Platycercus spurius	Red-capped Parrot		+
Platycercus zonarius	Twenty-eight Parrot		+
Polytelis anthopeplus	Regent Parrot		+
Cuculidae Parasitic Cuckoos			
Cacomantis flabelliformis	Fan-tailed Cuckoo		
Chrysococcyx basalis	Horsfield`s Bronze Cuckoo		
Chrysococcyx lucidus	Shining Bronze Cuckoo		
Cuculus pallidus	Pallid Cuckoo		

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Class **Family** *Species*	Common Name	Conservation Status	Sighted Nov. 05
Strigidae Hawk Owls			
Ninox connivens connivens	Barking Owl	P2 Be	
Ninox novaeseelandiae	Boobook Owl		
Tytonidae Barn Owls			
Tyto alba	Barn Owl		
Tyto novaehollandiae novaehollandiae	Masked Owl	P3 Bp	
Podargidae Frogmouths			
Podargus strigoides	Tawny Frogmouth		+
Caprimulgidae Nightjars			
Eurostopodus argus	Spotted Nightjar		
Aegothelidae Owlet-nightjars			
Aegotheles cristatus	Australian Owlet-nightjar		
Halcyonidae Tree Kingfishers			
*Dacelo novaeguineae**	Laughing Kookaburra		+
Todiramphus sanctus	Sacred Kingfisher		
Meropidae Bee-eaters			
Merops ornatus	Rainbow Bee-eater	Migratory JA	+
Maluridae Fairy Wrens, GrassWrens			
Malurus splendens	Splendid Fairy-wren	Bh	
Pardalotidae Pardalotes, Bristlebirds, Scrubwrens, Gerygones, Thornbills			
Acanthiza apicalis	Broad-tailed Thornbill	Bh	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Bh	
Acanthiza inornata	Western Thornbill	Bh	
Gerygone fusca	Western Gerygone		+
Pardalotus punctatus	Spotted Pardalote		
Pardalotus striatus	Striated Pardalote		+
Sericornis frontalis	White-browed Scrubwren	Bh	
Smicrornis brevirostris	Weebill	Bh	

* =Introduced, S1 to S4 = WAWC Act Status, EN = Endangered, VU = Vulnerable, EX = Extinct, P1 to P5 = CALM Priority Status, CA = CAMBA, JA = JAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region.

Class **Family** *Species*	Common Name	Conservation Status	Sighted Nov. 05
Meliphagidae Honeyeaters, Chats			
Acanthorhynchus superciliosus	Western Spinebill		
Anthochaera carunculata	Red Wattlebird		+
Anthochaera lunulata	Western Little Wattlebird	Bp	
Epthianura albifrons	White-fronted Chat		
Lichenostomus virescens	Singing Honeyeater		
Lichmera indistincta	Brown Honeyeater		+
Melithreptus lunatus	White-naped Honeyeater	Bp	
Phylidonyris melanops	Tawny-crowned Honeyeater	Bp	
Phylidonyris nigra	White-cheeked Honeyeater	Bp	
Phylidonyris novaehollandiae	New Holland Honeyeater	Bp	
Petroicidae Australian Robins			
Eopsaltria australis	Western Yellow Robin	Bh	
Eopsaltria georgiana	White-breasted Robin	Bh	
Petroica multicolor	Scarlet Robin	Bh	
Neositidae Sitellas			
Daphoenositta chrysoptera	Varied Sittella	Bh	
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers			
Colluricincla harmonica	Grey Shrike-thrush	Bh	
Pachycephala pectoralis	Golden Whistler	Bh	
Pachycephala rufiventris	Rufous Whistler		+
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo			
Grallina cyanoleuca	Magpie-lark		+
Rhipidura fuliginosa	Grey Fantail		+
Rhipidura leucophrys	Willie Wagtail		+
Campephagidae Cuckoo-shrikes, Trillers			
Coracina novaehollandiae	Black-faced Cuckoo-shrike		+
Lalage sueurii	White-winged Triller		

* =Introduced, S1 to S4 = WAWC Act Status, EN = Endangered, VU = Vulnerable, EX = Extinct, P1 to P5 = CALM Priority Status, CA = CAMBA, JA = JAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region.

Class Family *Species*	Common Name	Conservation Status	Sighted Nov. 05
Artamidae Woodswallows, Butcherbirds, Currawongs			
Artamus cinereus	Black-faced Woodswallow	Bp	
Artamus cyanopterus	Dusky Woodswallow	Bp	
Cracticus tibicen	Australian Magpie		+
Cracticus torquatus	Grey Butcherbird		+
Corvidae Ravens, Crows			
Corvus coronoides	Australian Raven		+
Motacillidae Old World Pipits, Wagtails			
Anthus novaeseelandiae	Australian Pipit		
Dicaeidae Flowerpeckers			
Dicaeum hirundinaceum	Mistletoebird		+
Hirundinidae Swallows, Martins			
Hirundo neoxena	Welcome Swallow		+
Hirundo nigricans	Tree Martin		+
Sylviidae Old World Warblers			
Cincloramphus mathewsi	Rufous Songlark		
Zosteropidae White-eyes			
Zosterops lateralis	Grey-breasted White-eye		+

Mammals

Class Family *Species*	Common Name	Conservation Status	Sighted Nov. 05
Tachyglossidae Echidnas			
Tachyglossus aculeatus	Echidna		
Dasyuridae Carnivorous Marsupials			
Dasyurus geoffroii	Chuditch	S1 VU	+ Sminthopsis + Bandicoot[illegible]
Phascogale tapoatafa	Southern Brush-tailed Phascogale	P3	
Peramelidae Bandicoots			
Isoodon obesulus fusciventer	Southern Brown Bandicoot	P5	
Phalangeridae Brushtail Possums, Cuscuses			
Trichosurus vulpecula	Common Brushtail Possum		+

Class **Family** *Species*	Common Name	Conservation Status	Sighted Nov. 05
Leporidae Rabbits, Hares			
*Oryctolagus cuniculus**	Rabbit		+

* =Introduced, S1 to S4 = WAWC Act Status, EN = Endangered, VU = Vulnerable, EX = Extinct, P1 to P5 = CALM Priority Status, CA = CAMBA, JA = JAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region.

Class **Family** *Species*	Common Name	Conservation Status	Sighted Nov. 05
Burramyidae Pygmy Possums			
Cercartetus concinnus	Western Pygmy-possum		
Tarsipedidae Honey Possum			
Tarsipes rostratus	Honey Possum		
Pseudocheiridae Ringtail Posssums			
Pseudocheirus occidentalis	Western Ringtail Possum	S1 VU	+
Macropodidae Kangaroos, Wallabies			
Macropus fuliginosus	Western Grey Kangaroo		+
Molossidae Freetail Bats			
Mormopterus planiceps	Southern Freetail Bat		
Tadarida australis	White-striped Freetail-bat		
Vespertilionidae Ordinary Bats			
Chalinolobus gouldii	Gould`s Wattled Bat		
Chalinolobus morio	Chocolate Wattled Bat		
Falsistrellus mackenziei	Western False Pipistrelle	P4	
Nyctophilus geoffroyi	Lesser Long-eared Bat		
Nyctophilus gouldi	Gould`s Long-eared Bat		
Nyctophilus timoriensis	Greater Long-eared Bat		
Vespadelus regulus	Southern Forest Bat		
Muridae Rats, Mice			
Hydromys chrysogaster	Water Rat	P4	
*Mus musculus**	House Mouse		
*Rattus rattus**	Black Rat		
Canidae Dogs, Foxes			
*Canis lupus**	Dog		
*Vulpes vulpes**	Red Fox		+
Felidae Cats			
*Felis catus**	Cat		+

* =Introduced, S1 to S4 = WAWC Act Status, EN = Endangered, VU = Vulnerable, EX = Extinct, P1 to P5 = CALM Priority Status, CA = CAMBA, JA = JAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region.

FLORA AND VEGETATION
LOT 300 LOCS 619 & 246
LOT 301 WELLINGTON LOC 1360,
PT WELLINGTON LOC 2426
CAPEL, WESTERN AUSTRALIA

Prepared for:
TME
Bunbury

Prepared by:
Bennett Environmental Consulting Pty Ltd

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19th January 2006

STATEMENT OF LIMITATIONS

Scope of Services

This report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Eleanor Bennett ("the Author"). In some circumstances a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services.

Reliance on Data

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

Environmental Conclusions

In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report. The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

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SUMMARY

Bennett Environmental Consulting Pty Ltd was commissioned by TME Bunbury to undertake a vegetation and flora survey of Lot 300 Locs 619 & 246, Lot 301 Wellington Loc 1360 and Pt Wellington LOC 2426. It is proposed to develop a section adjoining the current housing, the remainder will be retained as its current use.

The vegetation complex at the site is Southern River (Heddle 1980) of which less than the required 30% remains with remnant vegetation. The vegetation condition of most of the site varied between good and degraded with a small area of remnant vegetation that had been fenced off from cattle by the owner, recording a vegetation condition of very good. This indicates that although less than 30% of the particular vegetation complex remains that surveyed where it is proposed to extend the development is not worthy of conservation.

Three vegetation units were identified at the site.

i. Low Woodland A of *Eucalyptus marginata* subsp. *marginata, Agonis flexuosa* var. *flexuosa, Corymbia calophylla* and *Xylomelum occidentale* over Open Scrub of *Kunzea glabrescens* over Low Heath D dominated by *Hibbertia hypericoides* over Very Open Low grass and Very Open Low Sedges.

This was the vegetation unit recorded in the fenced remnant vegetation.

ii. Low Forest B of *Eucalyptus marginata* subsp. *marginata, Banksia attenuata* and *Kunzea glabrescens* over Open Low Scrub of *Melaleuca thymoides* over Herbs dominated by **Romulea rosea* and **Hypochaeris glabra* and/or Low Grass of **Briza maxima*.

This vegetation unit was restricted to two areas at the site.

iii. Open Low Woodland A to Low Forest A of *Corymbia calophylla* and *Agonis flexuosa* var. *flexuosa* over Tall Grass and Low Grass of pasture species.

This was the dominant vegetation at the site as it was that associated with the pasture.

A total number of 41 vascular plant families, 111 genera and 145 taxa were recorded during the survey which was undertaken on 18th October 2005. Eight vascular plant families, Poaceae, Papilionaceae, Orchidaceae, Anthericaceae, Asteraceae, Proteaceae, Myrtaceae and Stylidiaceae represented 54.5% of the total number of taxa, 51.4% of the total number of genera and 19.5% of the total number of families.

In the bushland remnants the vegetation condition varied between good and degraded. The fenced area adjacent to the house, which is not included in the proposed development, was in very good condition. The majority of the area was paddocks where pasture species were dominant. The vegetation condition of these areas varied between degraded to completely degraded.

1. INTRODUCTION

1.1 Background

Bennett Environmental Consulting Pty Ltd was contracted by TME at Bunbury to undertake a flora and vegetation survey of Lot 300 Wellington Locs 619 & 246, Lot 301 Wellington Loc 1360, Pt Wellington Loc 2426, Capel. The eastern boundary of this property is adjacent to the Capel River. The property is bounded to the west by the Capel Primary School and houses, to the south west by Goodwood Road, to the south by farming properties, to the east by the Capel River and to the north by an access road to the property.

There was very little remnant vegetation remaining at the site. Mostly the site is currently used to graze cattle.

1.2 Scope of Works

The requirements for this project were to:

i. Record the vegetation units and associated species at all the areas nominated.
ii. Search for Declared Rare and Priority Flora.
iii. Undertake an overview of the vegetation along the Capel River adjacent to the study area.

2. REGIONAL METHODOLOGY

2.1 Geology and Landform

The climate is a warm Mediterranean with a winter precipitation of 600-1000mm with 5-6 dry months per year.

Churchward *et al.* (1980) described the soils of the Swan Coastal Plain. There is an alluvial terrain along the eastern fringe of the Swan Coastal Plain. The Serpentine River Unit was formed on older alluvium in conditions of ponding, which is reflected in the fine textures and poor internal drainage of the soils. The Swan Unit, which is along present stream courses, is of younger origin. These are red earths and duplex soils.

Mapping of the soil/vegetation units has been prepared by the Department of Agriculture (2001). With these maps it is possible to home in on the individual lots. The survey area is included in the Bassendean System B1 Phase and B2 Phase. The edge of the Capel River, which is technically outside of the area studied, is included in the Pinjarra System P1a Phase. These mapping units are contrary to those of Churchward *et al.* (1980).

These are described by Department of Agriculture (2001) as:

- **Bassendean B1 Phase** - Extremely low to very low relief dunes, undulating sandplain and discrete sand rises. Deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m.
- **Bassendean B2 Phase** - Flat to very gently undulating well drained sandplain on the surface. Deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.
- **Pinjarra System P1a Phase** - Flat to very gently undulating plain. Imperfect to poorly drained and generally not susceptible to salinity. Deep acidic mottled yellow duplex soils. Shallow pale sand to sandy loam over clay.

2.2 Vegetation

The Interim Biogeographical Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995) recognises 85 bioregions. The IBRA is used as the common unit to compare biological and biophysical attributes. Bioregions represent a landscape based approach to classifying the land surface and each region is defined by a set of major environmental influences, which shape the occurrence of flora and fauna and their interaction with the physical environment. The study area is in the Swan Coastal Plain (SWA2 – Swan Coastal Plain Subregion). The Swan Coastal Plain Subregion has a very high degree of species diversity (Mitchell et al., 2002)

Prior to the above classification Beard (1980) classified the vegetation of Western Australia. Western Australia was divided into three main Botanical Provinces, Southwest, Eremaean and Northern. Capel is within the Drummond Subdistrict of the Darling Botanical District within the Southwest Botanical Province (Beard, 1990). The Drummond Botanical Subdistrict is mainly *Banksia* Low Woodland on leached sands with *Melaleuca* swamps where ill-drained. Woodlands of Tuart (*Eucalyptus gomphocephala*), Jarrah (*Eucalyptus marginata* subsp. *marginata*) and Marri (*Corymbia calophylla*) occur on less leached soils. Beard (1981) mapped the vegetation as *Corymbia calophylla* Woodlands (e3Mi). Shepherd *et al.* (2002) have determined the pre-European and current extent of the vegetation associations described by Beard. In addition they have assessed the percentage of each remaining, the amount in IUCN reserves and the percentage in other reserves. The pre-European area is estimated to be 275380ha; the current extent is 32451ha; percentage remaining vegetated 11.8% of which 18% is in conservation.

Heddle *et al.* (1980) in their study of the Darling System mapped the vegetation of the study area in the Southern River Complex with the Capel River in the Swan Complex.

- The Southern River Complex consists of an Open Woodland of *Corymbia calophylla, Eucalyptus marginata* subsp. *marginata* and *Banksia* species on the elevated areas and a fringing Woodland of *Eucalyptus rudis – Melaleuca rhaphiophylla* along the streams. South of the Murray River *Agonis flexuosa* var. *flexuosa* occurs in association with *Eucalyptus rudis – Melaleuca rhaphiophylla* (Heddle *et al.* (1980).
- The Swan River Complex is dominated by a Woodland of *Eucalyptus rudis – Melaleuca rhaphiophylla* with localized occurrences of Low Open Forest of *Casuarina obesa* and *Melaleuca cuticularis* (Heddle *et al.* (1980).

Southern River and Swan complexes are included in the Pinjarra Plain of which 7% remains vegetated (Department of Environmental Protection, 2000). Within the Greater Bunbury Region) there is 16% of the Swan Complex and 11% of the Southern River complex remaining vegetated. These percentages are below the 30% target of that present pre-1750 (Environmental Protection Authority, 2003 and Commonwealth of Australia, 2001).

3 METHODS

Field work was undertaken on 18th October 2005. The remnant vegetation was surveyed using the methods set out in the EPA Guidance No 51 (2004). All possible tracks were driven and transects walked through the remnant bushland. Each vegetation unit identified was recorded. A 10m x 10m quadrat was set up using a compass and placed due N,S,E,W. All quadrats were temporary with the 4 pegs being removed at the end of the data collection.

The vegetation, flora and weed surveys were conducted concurrently. For each quadrat, the following was recorded in the field:

- GPS reading (WGS84, equivalent to Geocentric Datum of Australia 1994 (GDA94)) at NW corner.
- Digital photograph taken at the NW corner.
- Soil type.

- Presence, size and type of any outcropping rocks.
- Topography – eg. ridge, upper slope, middle slope, lower slope, drainage line, minor creek, major creek, wetland.
- Aspect where this is applicable.
- Litter.
- Vegetation condition using the scale (Keighery, 1994).
- Presence of any Declared Rare or Priority Flora or other significant flora.
- Additional information including dieback, age since fire, predators, erosion, weeds, grazing, tracks etc.
- All species were listed together with their percentage cover within the quadrat and average height.

The area outside of the quadrat was also surveyed to record additional (opportunistic) species for that vegetation unit. All species unknown in the field were collected, pressed and identified later using appropriate keys and by comparison with collections housed at the Western Australian Herbarium. A collection of each Rare or Priority Flora was made and forms will be completed and sent to the Rare Flora section of the Department of Conservation and Land Management. The pressed and dried specimens will be sent to the Western Australian Herbarium for inclusion in their collection.

4. RESULTS

4.1 Number of Taxa

A total number of 41 vascular plant families, 111 genera and 145 taxa were recorded from the remnant bushland during the survey. The dominant plant families were:

Poaceae with 15 taxa, 9 of which were weeds;
Papilionaceae with 14 taxa of which 3 were weeds;
Orchidaceae with 11 taxa of which 1 was a weed;
Anthericaceae with 10 taxa none of which were weeds;
Asteraceae with 8 taxa of which 5 were weeds; and
Proteaceae, Myrtaceae and Stylidiaceae with 7 taxa none of which were weeds.

These 8 families represent 54.5% of the total number of taxa, 51.4% of the total number of genera and 19.5% of the total number of vascular plant families recorded from the survey area.

4.2 Vegetation Units

There were three remnant vegetation units identified at the site. In addition large areas consisted of pasture species with scattered trees. The vegetation units are described using the vegetation classification of Muir (1977) and are followed by the abbreviation used in Appendices B and D.

Table 1. Vegetation Classification (from Muir 1977)

LIFE FORM / HEIGHT CLASS	Canopy Cover			
	DENSE 70 % - 100%	MID DENSE 30% - 70%	SPARSE 10% - 30%	VERY SPARSE 2% - 10%
Trees > 30 m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30 m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15 m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
Trees < 5 m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2 m	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs 1.5 – 2 m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 - 1.5 m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1 m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 - 0.5 m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
Bunch grass > 0.5 m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < 0.5 m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges > 0.5 m	Dense Tall sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges < 0.5 m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

Low Woodland A of *Eucalyptus marginata* subsp. *marginata, Agonis flexuosa* var. *flexuosa, Corymbia calophylla* and *Xylomelum occidentale* over Open Scrub of *Kunzea glabrescens* over Low Heath D dominated by *Hibbertia hypericoides* over Very Open Low Gass and Very Open Low Sedges. **Af Hh** (Quadrats CAP1 and CAP2)

Low Forest B of *Eucalyptus marginata* subsp. *marginata, Banksia attenuata* and *Kunzea glabrescens* over Open Low Scrub B of *Melaleuca thymoides* over Herbs dominated by **Romulea rosea* and **Hypochaeris glabra* and/or Low Grass of **Briza maxima*. **BaMt**. (Quadrats 3 and 5) This vegetation unit was restricted to two areas at the site.

Open Low Woodland A to Low Forest A of *Corymbia calophylla* and *Agonis flexuosa* var. *flexuosa* over Tall Grass of **Avena barbata* over Low Grass of **Cynodon dactylon*. (Quadrat 4 and pasture areas). **CcAf**

This was the dominant vegetation at the site. The trees varied between *Eucalyptus marginata* subsp. *marginata, Banksia attenuata, Melaleuca preissiana, Corymbia calophylla* and *Agonis flexuosa* var. *flexuosa* depending upon position on landscape, soil moisture and vegetation unit prior to clearing.

None of these vegetation units are listed as Threatened Ecological Communities (Mitchell *et al.*, 2002).

4.3 Vegetation Condition

Using the vegetation condition of Keighery (Table 2) the vegetation condition recorded for each quadrat is listed in Table 3.

Table 2. Vegetation Condition Classification (Keighery, 1994)

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

Table 3. Vegetation condition of quadrats

Rating	Quadrats
3	CAP2
4	CAP3
4-5	CAP1, CAP5
5-6	CAP4
6	Paddocks

The fenced area of quadrat CAP2 included remnant bush areas in very good vegetation condition. This is adjacent to the house and is not included in the proposed development. All of the other areas surveyed were in good to degraded condition. To retain these in conservation and to restore them to very good or better condition would be very time consuming and costly.

4.4 Weeds

A total of 35 weeds (24.3%) of the total number of taxa) were recorded during the survey, all of which have been determined as weeds by the Department of Conservation and Land Management (1999). In addition three cultivated species and a group of unidentifiable grasses were also recorded. The rating allocated to each weed by CALM is based on three criteria:

Invasiveness – ability to invade natural bushland in good to excellent condition or ability to invade waterways.

Distribution – wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world.

Environmental impacts – Ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community.

Ratings indicate the following.

High indicates this weed is prioritised for control and/or research ie prioritising funding to it.

Moderate indicates control or research effort should be directed to it if funds are available, however it should be monitored (possibly a reasonably high level of monitoring).

Mild indicates monitoring of the weed and control where appropriate.

Low indicates that this species would require a low level of monitoring.

Table 4. Weeds recorded during the survey classified according to CALM (1999)

SCIENTIFIC NAME	COMMON NAME	CALM RATING	INVASIVENESS	IMPACTS
**Asparagus asparagoides*	Bridal creeper	High	✓	✓
**Bromus diandrus*	Great brome	High	✓	✓
**Ehrharta calycina*	Perennial veldt grass	High	✓	✓
**Freesia* hybrid	Freesia	High	✓	✓
**Romulea rosea*	Guildford grass	High	✓	✓
**Sparaxis bulbifera*	Harlequin flower	High	✓	✓
**Watsonia bulbillifera*	Bugle lily	High	✓	✓
**Zantedeschia aethiopica*	Arum lily	High	✓	✓
**Anagallis arvensis*	Pimpernel	Moderate	✓	
**Arctotheca calendula*	Cape weed	Moderate	✓	
**Avena barbata*	Bearded oat	Moderate	✓	
**Briza maxima*	Blowfly grass	Moderate	✓	
**Briza minor*	Shivery grass	Moderate	✓	
**Crassula glomerata*		Moderate	✓	
**Cynodon dactylon*	Couch grass	Moderate	✓	
**Disa bracteata*	South African orchid	Moderate	✓	
**Ehrharta longiflora*	Annual veldt grass	Moderate	✓	
**Hordeum leporinum*	Barley grass	Moderate	✓	
**Hypochaeris glabra*	Flat weed	Moderate	✓	
**Orobanche minor*	Lesser broomrape	Moderate	✓	
**Sonchus oleraceus*	Sow thistle	Moderate	✓	
**Trifolium subterraneum*	Subterraneum clover	Moderate	✓	
**Ursinia anthemoides*	Ursinia	Moderate	✓	
**Ornithopus compressus*	Yellow serradella	Mild		
**Oxalis corniculata*	Yellow wood sorrel	Mild		
**Oxalis glabra*		Mild		
**Oxalis pes-caprae*	Sour sob	Mild		
**Petrorhagia dubia*	Velvet pink	Mild		
**Acacia iteaphylla*	Flinders Range wattle	Low		
**Cotula turbinata*	Funnel weed	Low		
**Lolium perenne*	Perennial rye grass	Low		
**Trifolium angustifolium*		Low		
**Erica* sp.	Erica	Cultivated		
**Rosmarinus officinalis*		Cultivated		
**Westringia fruticosa*	Westringia	Cultivated		

4.5 Significant Species — not a true definition of sign flora

Species of flora are defined as rare or priority conservation status where their populations are restricted geographically or threatened by local processes. The Department of Conservation and Land Management recognised these threats of extinction and consequently applied regulations towards population and species protection. Rare Flora are gazetted under subsection 2 of section 23F of the Wildlife Conservation Act (1950) and therefore it is an offence to "take" or damage rare flora without approval from the Minister for the Environment.

Table 5. Code and description of Rare and Priority Flora categories

Code	Code Declared Rare and Priority Flora Categories
R	DRF (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.
X	DRF (Declared Rare Flora) -Presumed Extinct Taxa. Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently.
1	Priority One -Poorly Known Taxa. Taxa, which are known from one or a few (generally <5) populations, which are under threat.
2	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.
3	Priority Three -Poorly Known Taxa. Taxa, which are known from several populations, at least some of which are not believed to be under immediate threat.
4	Priority Four -Rare Taxa. Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.

Table 5 presents the definitions of Declared Rare and the four Priority Flora ratings under the Wildlife Conservation Act (1950) as extracted from Department of Conservation and Land Management (2005). Table 6 presents the definitions of the threatened species under the Environmental Protection and Diversity Conservation Act, 1999 (Environment Australia, 2005).

Table 6. Categories of Threatened Flora Species (Environmental Protection and Biodiversity Conservation Act, 1999)

Code	Code Declared Rare and Priority Flora Categories
Ex	Extinct Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of this species has died.
ExW	Extinct in the Wild Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered Taxa which at any particular time if, at that time, it is facing an extremely high rest of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	Endangered Taxa, which is not critically endangered, and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	Conservation Dependent Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Prior to undertaking the field work a list of the known Declared Rare and Priority Flora for the coordinates, 33^0 32' - 33^0 36' S and 115^0 32' - 115^0 35' E was obtained from the Department of

Conservation and Land Management. This resulted in six Declared Rare Flora, 1 Priority 1 Flora, 3 Priority 2 Flora, 13 Priority 3 Flora and 6 Priority 4 Flora. These species are listed in Table 7 together with a brief description of the plant.

Table 7. Declared Rare and Priority Flora recorded for the Capel area

SPECIES	CODE	DESCRIPTION
Caladenia busselliana	R	Tuberous, perennial, herb, 0.2–0.3 m high. Fl. green, yellow, cream, Sep–Oct. Sandy loam. Winter-wet swamps.
Caladenia huegelii	R	Tuberous, perennial, herb, 0.25–0.6 m high. Fl. green, cream, red, Sep–Oct. Grey or brown sand, clay loam.
Chamelaucium roycei ms	R	Bushy shrub, 0.3–1.5 m high. Fl. white, pink, Aug–Dec. Sandy clay, clay, lateritic soils. Winter-wet flats, swamps, stream banks.
Diuris drummondii	R	Tuberous, perennial, herb, 0.5–1.05 m high. Fl. yellow, Nov–Jan. Low-lying depressions, swamps.
Drakaea elastica	R	Tuberous, perennial, herb, 0.12–0.3 m high. Fl. red, green, yellow, Oct–Nov. White or grey sand. Low-lying situations adjoining winter-wet swamps.
Verticordia densiflora var. *pedunculata*	R	Erect to spreading shrub, 0.3–0.6 m high. Fl. pink, white, Dec–Jan. Grey/yellow sand, sandy loam. Winter-wet low-lying areas.
Amperea micrantha	2	Low, spreading, bushy perennial, herb, 0.1–0.3 m high. Fl. brown, Oct–Nov. Sandy soils.
SPECIES	**CODE**	**DESCRIPTION**
Mitreola minima	2	Slender, erect annual, herb, 0.025–0.04 m high. Fl. white, Oct–Dec. Grey sand. Peaty swampy areas.
Trichocline sp. Treeton (B.J. Keighery & N. Gibson 564)	2	Tuberous, perennial, herb, to 1.6 m high. Sand over limestone, sandy clay over ironstone. Seasonally wet flats.
Acacia semitrullata	3	Slender, erect, pungent shrub, (0.1–)0.2–0.7(–1.5) m high. Fl. cream, white, May–Oct. White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas.
Boronia tetragona	3	Perennial, herb, 0.3–0.7 m high, leaves sessile, entire, with papillate margins, branches quadrangular, sepals ciliate. Fl. pink, red, Oct–Dec. Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland.
Chamaescilla gibsonii	3	Clumped tuberous, herb. Fl. blue, Sep. Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.
Chordifex gracilior	3	Rhizomatous, erect perennial, herb, 0.3–0.5 m high. Fl. brown, Sep–Dec. Peaty sand. Swamps.
Eryngium ferox ms	3	Erect, open tuberous, herb, 0.1–0.3 m high. Fl. green, Nov. Grey to brown loamy to sandy clay, brown cracking clay. Winter-wet flats, swamps, dried claypans, ridges.
Isopogon formosus subsp. *dasylepis*	3	Low, bushy or slender, upright, non-lignotuberous shrub, 0.2–2 m high. Fl. pink, purple, red, Jun–Dec. Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas.
Lasiopetalum membranaceum	3	Multi-stemmed shrub, 0.2–1 m high. Fl. pink, blue, purple, Sep–Dec. Sand over limestone.
Pultenaea pinifolia	3	Erect, slender shrub, 1–3 m high. Fl. yellow, orange, Oct–Nov. Loam or clay. Floodplains, swampy areas.
Rhodanthe pyrethrum	3	Erect, slender annual, herb, 0.05–0.2 m high. Fl. white, yellow, Oct–Dec. Clay, sandy clay. Winter-wet depressions, clay pans, swamps.
Stylidium leeuwinense	3	Erect perennial, herb, to 0.45 m high, leaves appressed, tile-

		like, spiral, lacking mucro. Fl. red, purple, Feb–May. Black sandy soil. Swampy heathland.
Synaphea hians	3	Prostrate or decumbent shrub, 0.15–0.6 m high, to 1 m wide. Fl. yellow, Jul–Nov. Sandy soils. Rises.
Tetratheca parvifolia	3	Small shrub, 0.2–0.3 m high. Fl. pink, Oct.
Verticordia attenuata	3	Shrub, 0.4–1 m high. Fl. pink, Dec–May. White or grey sand. Winter-wet depressions.
Acacia flagelliformis	4	Rush-like, erect or sprawling shrub, 0.3–0.75(–1.6) m high. Fl. yellow, May–Sep. Sandy soils. Winter-wet areas.
Anthotium junciforme	4	Open, erect to prostrate perennial, herb, 0.05–0.4 m high, leaves linear to terete, 0.5–1 mm wide; flowering stems 12–40 cm long. Fl. blue, violet, purple, Nov–Mar. Sandy clay, clay. Winter-wet depressions, drainage lines.
Aponogeton hexatepalus	4	Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green, white, Jul–Oct. Mud. Freshwater: ponds, rivers, claypans.
Caladenia speciosa	4	Tuberous, perennial, herb, 0.35–0.6 m high. Fl. white, pink, Sep–Oct. White, grey or black sand.
Franklandia triaristata	4	Erect, lignotuberous shrub, 0.2–1 m high. Fl. white, cream, yellow, brown, purple, Aug–Oct. White or grey sand.
Thysanotus glaucus	4	Caespitose, glaucous perennial, herb, 0.1–0.2 m high. Fl. purple, Oct–Mar. White, grey or yellow sand, sandy gravel.

No Declared Rare or Priority Flora were located during the survey although considerable time was spent searching areas in the better condition. Declared Rare and Priority Flora had previously been located in similar vegetation units, but where the soil was moister

4.6 Capel River Vegetation

As a Foreshore Management Plan was requested by the Environmental Protection Authority (2005) an opportunistic list of species from several areas was recorded. Most of the river foreshore is degraded but there were occasional patches of vegetation in better condition. The section of the river below the dam on the property surveyed included the largest number of native taxa and was in the better condition. Appendix B lists the species located during the survey.

The tree canopy was generally in excellent condition and is the necessary habitat for many of the listed native taxa. There were occasional large patches of Maiden hair fern (*Adiantum aethiopicum*), which is not the form in cultivation in home gardens. Some areas of the river itself had a reasonable cover of sedges, which varied according to the dampness of the soil where they occurred. *Baumea articulatum* and *Lepidosperma effusum* occurred on the edge of the river where the soil was permanently moist. The *Juncus* species and *Baumea juncea* grew higher up the bank where the soil was not constantly damp.

Most of the bank was covered in a dense grassland or herbland of weeds, four of which are rated by CALM as high (Department of Conservation and Land Management, 1999). These weeds are ensuring that the river bank is not being eroded and should not be removed unless a rehabilitation plan is to be introduced. Weed removal and planting of trees, shrubs etc need to be undertaken concurrently to ensure the stability of the banks and the health of the river.

5. EPA REQUIREMENTS

The Environmental Protection Authority (EPA) required that Guidance Statement 10 (Environmental Protection Authority, 2003) be followed to assess the environmental potential of the area. The points are addressed below.

- The site is in the vegetation complex, Southern River of which 7% of the pre-1750 area remains as bushland in Swan Coastal Plain and 11% of the original area within the Bunbury Greater Region. This is below the 30% required by the EPA.
- The vegetation units in good to degraded and completely degraded condition are proposed to be developed for housing. The remnant vegetation in very good condition is not to be developed.
- There were no Declared Rare or Priority Flora recorded from the site.
- A total of 41 vascular plant families, 111 genera and 145 taxa were recorded from the site, of which 34 taxa were not endemic.
- The tree canopy of the remnant bushland was highly modified with only small areas of the original canopy cover remaining. Plantings of non-endemic trees has occurred over many years.
- The area of remnant bushland proposed for development is less than the Urban Bushland Strategy's lowest preferred area limit of 20ha (EPA, 2003).
- The remnant vegetation is of an irregular shape. Elongate remnants are stated by the EPA (2003) to have value as connecting links, but the more extended are the remnants the greater their susceptibility to weed invasion and disturbance.
- There is limited linkage with adjoining vegetation to the Capel River. The other linkage is with paddocks developed as pasture. There are therefore limited possibilities to develop 'linkage areas' through the restoration of ecological communities.
- The land is currently used for cattle grazing.
- The EPA is guided by the following points when an area is selected:
  A large remnant is preferable to a small one – the site is less than the preferred 20ha;
  A compact shape is preferred - the site is an irregular shape; and
  the site is an isolated area, with limited potential to be linked to other natural areas.

6. DISCUSSION

Only a section of the property surveyed is proposed for development, most is to be retained for its present use. The remnant vegetation in the better condition, close to the current home, is to be retained and is not included in the proposed development. This area is presently fenced to exclude stock.

The area proposed for development is adjacent to current housing development on the western side of the survey area. The remnant vegetation in that area varied from good to degraded and included many pasture cleared areas. Although the vegetation unit is representative of Southern River Complex of which less than the required 30% remains it is in poor condition and development should be allowed. The owner should be encouraged to continue enhancing the remnant bushland close to the house, which he has fenced from stock. This area had the vegetation in the best condition.

encourage mechanism of permanent veg protect ie: rezoning condition or covenant

None of the vegetation units identified at the site were Threatened Ecological Communities and no Declared Rare or Priority Flora were recorded during the survey.

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APPENDIX A

Quadrat Data

LEGEND

sp.	Species, used where plants cannot be identified beyond genus
subsp.	Subspecies
var.	Variety
affin.	Closest to that species
Hybrid	Where 1 or more species have interbred, often under cultivation
*	Introduced species, weed
ms	Manuscript name, as yet the name has not been published

QUADRAT CAP1

Location: Adjacent to the house
Datum: Easting - 367394 Northing – 6285641
Soil type: Brown sandy loam
Topography: Above Capel River
Field Vegetation Description: Open Woodland of *Corymbia calophylla* over Very Open Low Woodland of *Agonis flexuosa* var. *flexuosa* over lower storey of mixed species, including weeds
Vegetation Condition: 4 - 5
Other Notes: Most of the **Asparagus asparagoides* plants have rust on the leaves

Regrowth, young

TAXA	HEIGHT (cm)	% COVER
Agonis flexuosa var. *flexuosa*	1400	2
**Asparagus asparagoides*	Twiner	1
Austrostipa tenuifolia	90	5
Briza maxima	10	1
Caesia micrantha	70	1
Cheilanthes austrotenuifolia	30	<1
Conostylis aculeata	25	1
Corymbia calophylla	1400	70
Dichopogon preissii	15	5
Drosera stolonifera subsp. *stolonifera*	15	2
Hardenbergia comptoniana	Twiner	5
Hibbertia hypericoides	25	1

Hypocalymma robusta	50	1
**Hypochaeris glabra*	5	1
Kennedia prostrata	5	1
Kunzea glabrescens	120	1
Leucopogon propinquus	25	1
**Oxalis glabra*	5	5
Sowerbaea laxiflora	30	1
Tetraria octandra	70	5
Tetrarrhena laevis	15	5
Tricoryne elatior	70	<1
Xanthorrhoea preissii	90	1
**Acacia iteaphylla*	Opportunistic	
**Avena barbata*	Opportunistic	
Bossiaea linophylla	Opportunistic	
Cyathochaeta avenacea	Opportunistic	
Daviesia physodes	Opportunistic	
**Erica* sp.	Opportunistic	
**Freesia* hybrid	Opportunistic	
Lepidosperma squamatum	Opportunistic	
Macrozamia riedlei	Opportunistic	
Orthrosanthus laxus	Opportunistic	
**Oxalis corniculata*	Opportunistic	
Phyllanthus calycinus	Opportunistic	
**Rosmarinus officinalis*	Opportunistic	
**Sonchus oleraceus*	Opportunistic	
**Sparaxis bulbillifera*	Opportunistic	
Stypandra glauca	Opportunistic	
**Westringia fruticosa*	Opportunistic	
**Zantedeschia aethiopica*	Opportunistic	

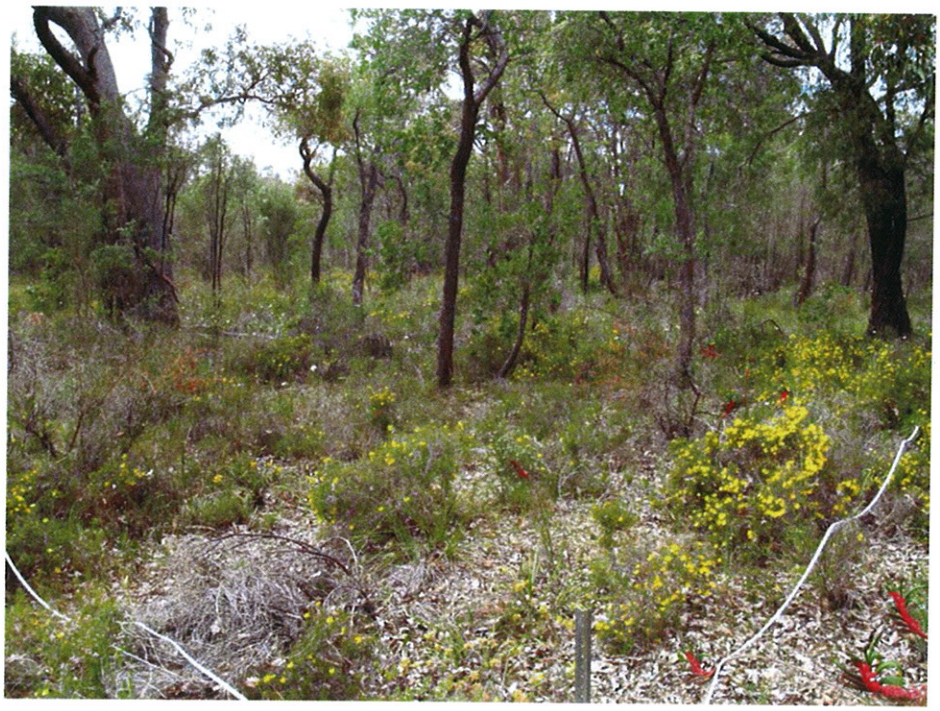
Andrew Webb
B. Keighery
E. Harris

30/03/04

Trees planted edge. Mist Mist.

QUADRAT CAP2

Location: Fenced area to the west of the house
Datum: Easting - 367393 Northing – 6285477
Soil type: Grey sand
Topography: Upper slope
Field Vegetation Description: Very Open Woodland of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Very Open Low Woodland of *Xylomelum occidentale* and *Kunzea glabrescens* over Open Low Shrubland dominated by *Hibbertia hypericoides*
Vegetation Condition: 3 (2)
Other Notes: Previously grazed but now fenced by owner. In some sections the *Kunzea glabrescens* cover was 10-20%. Owner has planted into this area



Lots Ag. flex

TAXA	HEIGHT (cm)	% COVER
Acacia stenoptera	30	<1
Adenanthos meisneri	40	2
Agonis flexuosa var. *flexuosa*	1000	5
Anigozanthos manglesii	90	1
Astroloma pallidum	20	1
Bossiaea eriocarpa	40	1
**Briza maxima*	10	5
Burchardia umbellata	70	1
Caladenia flava	10	<1
Chamaescilla corymbosa	10	3
Conostephium pendulum	30	1
Conostylis aculeata subsp. *aculeata*	20	1
Craspedia uniflora	90	1
Dasypogon bromeliifolius	15	3

Daviesia preissii

Daviesia physodes	120	3
Desmocladus fascicularis	15	2
Drosera pallida	Twiner	<1
Drosera stolonifera subsp. *stolonifera*	15	1
Eucalyptus marginata subsp. *marginata*	1200	5
Gompholobium capitatum	25	<1
Hibbertia hypericoides	60	40
Hibbertia racemosa	30	1
Hovea trisperma	40	<1
Hypocalymma robusta	70	2
Jacksonia sparsa	120	1
Kunzea glabrescens	400	5
Lagenophora huegelii	40	3
Laxmannia minor	20	3
Lomandra nigricans	40	<1
Lyginia barbata	70	5
**Petrorhagia dubia*	40	<1
Philotheca spicatus	50	2
Phlebocarya ciliata	20	<1
Phyllanthus calycinus	50	<1
Poa drummondiana	70	<1
Pterostylis vittata	70	<1
Pyrorchis nigricans	5	1
Sowerbaea laxiflora	60	1
Stylidium amoenum	40	1
Stylidium brunonianum	20	<1
Stylidium piliferum	15	1
Trachymene pilosa	10	<1
Tripterococcus brunonis	70	1
Xylomelum occidentale	800	5
Acacia extensa	Opportunistic	
Acacia huegelii	Opportunistic	
**Acacia iteaphylla*	Opportunistic	
Agrostocrinum scabrum	Opportunistic	
Allocasuarina humilis	Opportunistic	
**Anagallis arvensis* var. *arvensis*	Opportunistic	
**Asparagus asparagoides*	Opportunistic	
Austrodanthonia acerosa	Opportunistic	
Austrostipa campylachne	Opportunistic	
Austrostipa tenuifolia	Opportunistic	
**Avena barbata*	Opportunistic	
Banksia attenuata	Opportunistic	
**Briza minor*	Opportunistic	
**Bromus diandrus*	Opportunistic	
Caesia micrantha	Opportunistic	
Cartonema philydroides	Opportunistic	
Centrolepis glabra	Opportunistic	
Corymbia calophylla	Opportunistic	

**Cotula turbinata*	Opportunistic	
Crassula colorata	Opportunistic	
**Crassula glomerata*	Opportunistic	
**Disa bracteata*	Opportunistic	
Drosera erythrorhiza	Opportunistic	
**Ehrharta calycina*	Opportunistic	
**Ehrharta longiflora*	Opportunistic	
Elythranthera brunonis	Opportunistic	
Eriochilus dilatata	Opportunistic	
Gompholobium tomentosum	Opportunistic	
Hemiandra pungens	Opportunistic	
Hypolaena exsulca	Opportunistic	
Isolepis marginata	Opportunistic	
Jacksonia furcellata	Opportunistic	
Kennedia prostrata	Opportunistic	
Lepidosperma squamatum	Opportunistic	
Leucopogon propinquus	Opportunistic	
Lomandra hermaphrodita	Opportunistic	
Lomandra purpurea	Opportunistic	
Macrozamia riedlei	Opportunistic	
Melaleuca thymoides	Opportunistic	
Microtis media	Opportunistic	
~~*Monotaxis*~~ *huegelii*	Opportunistic	
Nuytsia floribunda	Opportunistic	
**Orobanche minor*	Opportunistic	
Orthrosanthus laxus	Opportunistic	
Patersonia umbrosa subsp. *umbrosa*	Opportunistic	
Petrophile linearis	Opportunistic	
Phyllangium paradoxum	Opportunistic	
Podolepis suaveolens	Opportunistic	
**Romulea rosea*	Opportunistic	
Scaevola calliptera	Opportunistic	
**Sonchus oleraceus*	Opportunistic	
**Sparaxis bulbillifera*	Opportunistic	
Stirlingia latifolia	Opportunistic	
Stylidium calcaratum	Opportunistic	
Stylidium schoenoides	Opportunistic	
Tetraria octandra	Opportunistic	
Tetrarrhena laevis	Opportunistic	
Thelymitra crinita	Opportunistic	
Thelymitra sp.	Opportunistic	
Thysanotus patersonii	Opportunistic	
**Trifolium angustifolium*	Opportunistic	
**Ursinia anthemoides*	Opportunistic	
**Watsonia bulbillifera*	Opportunistic	
Xanthosia huegelii	Opportunistic	

QUADRAT CAP3

Location: Adjacent to house
Datum: Easting - 367443 Northing – 6285521
Soil type: Pale grey sand
Topography: Upper slope
Field Vegetation Description: Open Woodland of *Banksia attenuata* and *Kunzea glabrescens* over Herbland of *Dasypogon bromeliifolius*
Vegetation Condition: 4
Other Notes: Small section only on the house side of CAP2

TAXA	HEIGHT (cm)	% COVER
Acacia huegelii	30	1
Austrostipa compressa	20	3
Banksia attenuata	1000	30
**Briza maxima*	20	50
Burchardia umbellata	90	5
Caladenia flava	15	1
Chamaescilla corymbosa	10	3
Conostylis aculeata	25	1
Dasypogon bromeliifolius	50	10
Dichopogon preissii	50	3
**Disa bracteata*	20	1
Drosera erythrorhiza	5	1
Drosera pallida	Twiner	<1

Hibbertia hypericoides	50	1
**Hypochaeris glabra*	5	10
Jacksonia furcellata	40	1
Jacksonia sparsa	50	1
Kunzea glabrescens	1000	35
Lyginia barbata	70	4
Microtis media	30	<1
Pyrorchis nigricans	5	1
**Romulea rosea*	25	10
Sowerbaea laxiflora	50	3
**Ursinia anthemoides*	40	5
Xanthosia huegelii	25	<1
Agonis flexuosa var. *flexuosa*	Opportunistic	
Austrostipa campylachne	Opportunistic	
Banksia grandis	Opportunistic	
Bossiaea eriocarpa	Opportunistic	
Gompholobium capitatum	Opportunistic	
Hypocalymma robusta	Opportunistic	
Kennedia prostrata	Opportunistic	
Lepidosperma squamatum	Opportunistic	
Petrophile linearis	Opportunistic	
Phlebocarya ciliata	Opportunistic	
Pteridium esculentum	Opportunistic	
Stirlingia latifolia	Opportunistic	
Tripterococcus brunonis	Opportunistic	

QUADRAT CAP4

Location: Paddock above the river
Datum: Easting - 367641 Northing – 6285534
Soil type: River loam
Topography: Middle slope
Field Vegetation Description: Woodland of *Corymbia calophylla* and *Agonis flexuosa* var. *flexuosa* over Grassland of weeds
Vegetation Condition: 5-6 Not 6 - trees good-

TAXA	HEIGHT (cm)	% COVER
Agonis flexuosa var. *flexuosa*	1200	0-50
**Avena barbata*	100	60
**Bromus diandrus*	70	20
Corymbia calophylla	1400	0-40
**Cynodon dactylon*	5	60
**Hordeum leporinum*	20	3
**Sparaxis bulbillifera*	40	5
**Lolium perenne*	Opportunistic	
**Trifolium subterraneum*	Opportunistic	
**Anagallis arvensis* var. *arvensis*	Opportunistic	
**Arctotheca calendula*	Opportunistic	
**Asparagus asparagoides*	Opportunistic	
Banksia attenuata	Opportunistic	

(5)

Banksia ilicifolia	Opportunistic	
**Briza maxima*	Opportunistic	
**Briza minor*	Opportunistic	
**Cotula turbinata*	Opportunistic	
**Crassula glomerata*	Opportunistic	
**Disa bracteata*	Opportunistic	
**Ehrharta calycina*	Opportunistic	
**Ehrharta longiflora*	Opportunistic	
Eucalyptus marginata subsp. *marginata*	Opportunistic	
**Hypochaeris glabra*	Opportunistic	
Melaleuca preissiana	Opportunistic	
**Oxalis glabra*	Opportunistic	
**Oxalis pes-caprae*	Opportunistic	
**Petrorhagia dubia*	Opportunistic	
**Romulea rosea*	Opportunistic	
**Sonchus oleraceus*	Opportunistic	
**Trifolium angustifolium*	Opportunistic	
**Ursinia anthemoides*	Opportunistic	
Xylomelum occidentale	Opportunistic	

A. Webb loc list 30/03/06.

QUADRAT CAP5

Location: On north western side of the property
Datum: Easting - 366843 Northing – 6285508
Soil type: Grey sand
Topography: Flat
Field Vegetation Description: Woodland of *Eucalyptus marginata* subsp. *marginata* and *Banksia attenuata* over Tall Shrubland of *Kunzea glabrescens* over Very Open Low Shrubland of mixed species
Vegetation Condition: 4-5
Other Notes: Cattle graze area. Along the edge of the paddock *Corymbia calophylla* over weeds

TAXA	HEIGHT (cm)	% COVER
Acacia huegelii	20	5
**Arctotheca calendula*	15	2
Banksia attenuata	800	15
Burchardia umbellata	70	1
Caesia micrantha	30	<1
Caladenia flava	10	<1
Caladenia latifolia	30	<1
Chamaescilla corymbosa	15	<1
Dasypogon bromeliifolius	20	3
Daviesia physodes	70	1
Eucalyptus marginata subsp. *marginata*	800	15
Hibbertia hypericoides	30	1

+ Pilostyles

Hypochaeris glabra	5	20
Jacksonia furcellata	120	1
Jacksonia sparsa	80	1
Kunzea glabrescens	400	10
Lagenophora huegelii	20	<1
Laxmannia minor	10	3
Melaleuca thymoides	110	3
Nuytsia floribunda	700	5
Ornithopus compressus	10	<1
Romulea rosea	30	40
Stylidium brunonianum	25	1
Stylidium calcaratum	5	<1
Stylidium piliferum	15	1
Ursinia anthemoides	40	1
Acacia stenoptera	Opportunistic	
Agonis flexuosa var. *flexuosa*	Opportunistic	
Amperea simulans	Opportunistic	
Austrodanthonia acerosa	Opportunistic	
Austrostipa tenuifolia	Opportunistic	
Banksia grandis	Opportunistic	
Banksia ilicifolia	Opportunistic	
Briza maxima	Opportunistic	
Conostylis aculeata	Opportunistic	
Corymbia calophylla	Opportunistic	
Craspedia uniflora	Opportunistic	
Crassula colorata	Opportunistic	
Dampiera linearis	Opportunistic	
Daviesia preissii	Opportunistic	
Desmocladus fascicularis	Opportunistic	
Disa bracteata	Opportunistic	
Drosera stelliflora	Opportunistic	
Drosera stolonifera subsp. *stolonifera*	Opportunistic	
Elythranthera brunonis	Opportunistic	
Hemiandra pungens	Opportunistic	
Hibbertia racemosa	Opportunistic	
Lepidosperma squamatum	Opportunistic	
Lomandra hermaphrodita	Opportunistic	
Lyginia barbata	Opportunistic	
Orobanche minor	Opportunistic	
Petrophile linearis	Opportunistic	
Petrorhagia dubia	Opportunistic	
Phlebocarya ciliata	Opportunistic	
Phyllangium paradoxum	Opportunistic	
Pterostylis recurva	Opportunistic	
Pyrorchis nigricans	Opportunistic	
Sonchus oleraceus	Opportunistic	
Stylidium carnosum	Opportunistic	
Stylidium repens	Opportunistic	

Stylidium schoenoides	Opportunistic	
Thelymitra sp.	Opportunistic	
Thysanotus patersonii	Opportunistic	
Thysanotus thyrsoideus	Opportunistic	
Xylomelum occidentale	Opportunistic	

APPENDIX B

Taxa Recorded from Banks of Capel River

LEGEND

sp.	Species, used where plants cannot be identified beyond genus
subsp.	Subspecies
var.	Variety
affin.	Closest to that species
Hybrid	Where 1 or more species have interbred, often under cultivation
*	Introduced species, weed
ms	Manuscript name, as yet the name has not been published

No quadrat was monitored on the bank of the Capel River. A species list was prepared as the Environmental Protection Authority (2005) required that a Management Plan be prepared for the Capel River foreshore.

Above are two photographs taken to illustrate some of the variation noted along the bank of the river where it adjoins the property surveyed.

Juncus pauciflorus

FAMILY	TAXA	CALM RATING WEEDS
ADIANTACEAE	*Adiantum aethiopicum*	
ARACEAE	**Zantedeschia aethiopica*	High
ASPARAGACEAE	**Asparagus asparagoides*	High
ASTERACEAE	*Sonchus hydrophilus*	
CENTROLEPIDIACEAE	*Centrolepis glabra*	
CYPERACEAE	**Carex divisa*	Moderate
	Baumea articulata	
	Baumea juncea	
	Isolepis setiformis	
	Lepidosperma effusum	
	Lepidosperma tetraquetrum	
DENNSTAEDTIACEAE	*Pteridium esculentum*	
IRIDACEAE	**Sparaxis bulbillifera*	High
JUNCACEAE	**Juncus articulatus*	
	Juncus gregiflorus	
LOBELIACEAE	*Lobelia alata*	
MIMOSACEAE	*Acacia pulchella*	
	Paraserianthes lophantha subsp. *lophantha*	
MYRTACEAE	*Agonis flexuosa* var. *flexuosa*	
	Astartea affin. *fascicularis*	
	Corymbia calophylla	
	Eucalyptus rudis	
OXALIDACEAE	**Oxalis pes-caprae*	Mild
	**Oxalis purpurea*	Mild
PAPILIONACEAE	*Callistachys lanceolata*	
	Chorizema cordatum	
	Kennedia prostrata	
POACEAE	**Bromus diandrus*	High
	**Cynodon dactylon*	Moderate
	**Ehrharta longiflora*	Moderate
	**Pennisetum clandestinum*	Moderate
	**Poa annua*	Mild
RANUNCULACEAE	**Ranunculus muricatus*	Low

Taxa listed here are not included in the main body of the report as the Capel River was outside of the survey brief.

> 30 Flood at Gums
Emergent over Euc calophylla on
Agonis flax Overall low Fauna

APPENDIX C

Taxa listed under vegetation units

LEGEND

ABBREVIATION	DESCRIPTION
AfHh	Low Woodland A of *Eucalyptus marginata* subsp. *marginata, Agonis flexuosa* var. *flexuosa, Corymbia calophylla* and *Xylomelum occidentale* over Open Scrub of *Kunzea glabrescens* over Low Heath D dominated by *Hibbertia hypericoides* over Very Open Low Grass and Very Open Low Sedges
BaMt	Low Forest B of *Eucalyptus marginata* subsp. *marginata, Banksia attenuata* and *Kunzea glabrescens* over Open Low Scrub B of *Melaleuca thymoides* over Herbs dominated by **Romulea rosea* and **Hypochaeris glabra* and/or Low Grass of **Briza maxima*
CcAf	Open Low Woodland A to Low Forest A of *Corymbia calophylla* and *Agonis flexuosa* var. *flexuosa* over Tall Grass of **Avena barbata* over Low Grass of **Cynodon dactylon*
sp.	Species, used where plants not flowering
*	weed
subsp.	subspecies
var.	variety
affin.	closest to the species listed
?	unsure if this is the correct species as the plant was not flowering or fruiting
hybrid	not a naturally occurring species

FAMILY	TAXA	AfHh	BaMt	CcAf
ADIANTACEAE	*Cheilanthes austrotenuifolia*	+		
ANTHERICACEAE	*Agrostocrinum scabrum*	+		
	Caesia micrantha	+	+	
	Chamaescilla corymbosa	+	+	
	Dichopogon preissii	+	+	
	Laxmannia minor	+	+	
	Sowerbaea laxiflora	+	+	
	Stypandra glauca	+		
	Thysanotus patersonii	+	+	
	Thysanotus thyrsoideus		+	
	Tricoryne elatior	+		
APIACEAE	*Trachymene pilosa*	+		
ARACEAE	**Zantedeschia aethiopica*	+		
ASPARAGACEAE	**Asparagus asparagoides*	+		+
ASTERACEAE	**Arctotheca calendula*		+	+
	**Cotula turbinata*	+		+
	Craspedia uniflora	+	+	
	**Hypochaeris glabra*	+	+	+
	Lagenophora huegelii	+	+	
	Podolepis suaveolens	+		
	**Sonchus oleraceus*	+	+	+
	**Ursinia anthemoides*	+	+	+
CARYOPHYLLACEAE	**Petrorhagia dubia*	+	+	+
CASUARINACEAE	*Allocasuarina humilis*	+		
CENTROLEPIDACEAE	*Centrolepis glabra*	+		
COLCHICACEAE	*Burchardia umbellata*	+	+	
COMMELINACEAE	*Cartonema philydroides*	+		
CRASSULACEAE	*Crassula colorata*	+	+	
	**Crassula glomerata*		+	+
CYPERACEAE	*Cyathochaeta avenacea*	+		
	Isolepis marginata	+		
	Lepidosperma squamatum	+	+	
	Tetraria octandra	+		
DASYPOGONACEAE	*Dasypogon bromeliifolius*	+	+	
	Lomandra hermaphrodita	+	+	
	Lomandra nigricans	+		
	Lomandra purpurea	+		
DENNSTAEDTIACEAE	*Pteridium esculentum*		+	
DILLENIACEAE	*Hibbertia hypericoides*	+	+	
	Hibbertia racemosa	+	+	
DROSERACEAE	*Drosera erythrorhiza*	+	+	
	Drosera pallida	+	+	
	Drosera stelliflora		+	
	Drosera stolonifera subsp. *stolonifera*	+	+	

FAMILY	TAXA	AfHh	BaMt	CcAf
EPACRIDACEAE	*Astroloma pallidum*	+		
	Conostephium pendulum	+		
	Leucopogon propinquus	+		
ERICACEAE	**Erica* sp.	+		
EUPHORBIACEAE	*Amperea simulans*		+	
	Monotaxis huegelii	+		
	Phyllanthus calycinus	+		
GOODENIACEAE	*Dampiera linearis*		+	
	Scaevola calliptera	+		
HAEMODORACEAE	*Anigozanthos manglesii*	+		
	Conostylis aculeata subsp. *aculeata*	+	+	
	Phlebocarya ciliata	+	+	
IRIDACEAE	**Freesia* hybrid	+		
	Orthrosanthus laxus	+		
	Patersonia umbrosa subsp. *umbrosa*	+		
	**Romulea rosea*	+	+	+
	**Sparaxis bulbillifera*	+		+
	**Watsonia bulbillifera*	+		
LAMIACEAE	**Rosmarinus officinalis*	+		
	**Westringia fruticosa*	+		
	Hemiandra pungens	+	+	
LOGANIACEAE	*Phyllangium paradoxum*	+	+	
LORANTHACEAE	*Nuytsia floribunda*	+	+	
MIMOSACEAE	*Acacia extensa*	+		
	Acacia huegelii	+	+	
	**Acacia iteaphylla*	+		
	Acacia stenoptera	+	+	
MYRTACEAE	*Agonis flexuosa* var. *flexuosa*	+	+	+
	Corymbia calophylla	+		+
	Eucalyptus marginata subsp. *marginata*	+	+	+
	Hypocalymma robusta	+	+	
	Kunzea glabrescens	+	+	
	Melaleuca preissiana			+
	Melaleuca thymoides	+	+	
ORCHIDACEAE	*Caladenia flava*	+	+	
	Caladenia latifolia		+	
	**Disa bracteata*	+	+	+
	Elythranthera brunonis	+	+	
	Eriochilus dilatata	+		
	Microtis media	+	+	
	Pterostylis recurva		+	
	Pterostylis vittata	+		
	Pyrorchis nigricans	+	+	
	Thelymitra crinita	+		
	Thelymitra sp.	+	+	
OROBANCHACEAE	**Orobanche minor*	+	+	

FAMILY	TAXA	AfHh	BaMt	CcAf
OXALIDACEAE	**Oxalis corniculata*	+		
	**Oxalis glabra*	+		+
	**Oxalis pes-caprae*			+
PAPILIONACEAE	*Bossiaea eriocarpa*	+	+	
	Bossiaea linophylla	+		
	Daviesia physodes	+	+	
	Daviesia preissii		+	
	Gompholobium capitatum	+	+	
	Gompholobium tomentosum	+		
	Hardenbergia comptoniana	+		
	Hovea trisperma	+		
	Jacksonia furcellata	+	+	
	Jacksonia horrida		+	
	Kennedia prostrata	+	+	
	**Ornithopus compressus*		+	
	**Trifolium angustifolium*	+		+
	**Trifolium subterraneum*			+
POACEAE	**Avena barbata*	+		+
	Austrodanthonia acerosa	+	+	
	Austrostipa campylachne	+	+	
	Austrostipa compressa		+	
	Austrostipa tenuifolia	+	+	
	**Briza maxima*	+	+	+
	**Briza minor*	+		+
	**Bromus diandrus*	+		+
	**Cynodon dactylon*			+
	**Ehrharta calycina*	+		+
	**Ehrharta longiflora*	+		+
	**Hordeum leporinum*			+
	**Lolium perenne*			+
	Poa drummondiana	+		
	Tetrarrhena laevis	+		
PRIMULACEAE	**Anagallis arvensis* var. *arvensis*	+		+
PROTEACEAE	*Adenanthos meisneri*	+		
	Banksia attenuata	+	+	+
	Banksia grandis		+	
	Banksia ilicifolia		+	+
	Petrophile linearis	+	+	
	Stirlingia latifolia	+	+	
	Xylomelum occidentale	+	+	+
RESTIONACEAE	*Hypolaena exsulca*	+		
	Lyginia barbata	+	+	
	Desmocladus fascicularis	+	+	
RUTACEAE	*Philotheca spicatus*	+		
STACKHOUSIACEAE	*Tripterococcus brunonis*	+	+	

FAMILY	TAXA	AfHh	BaMt	CcAf
STYLIDIACEAE	*Stylidium amoenum*	+		
	Stylidium brunonianum	+	+	
	Stylidium calcaratum	+	+	
	Stylidium carnosum		+	
	Stylidium piliferum	+	+	
	Stylidium repens		+	
	Stylidium schoenoides	+	+	
XANTHORRHOEACEAE	*Xanthorrhoea preissii*	+		
	Xanthosia huegelii	+	+	
ZAMIACEAE	*Macrozamia riedlei*	+		

APPENDIX D

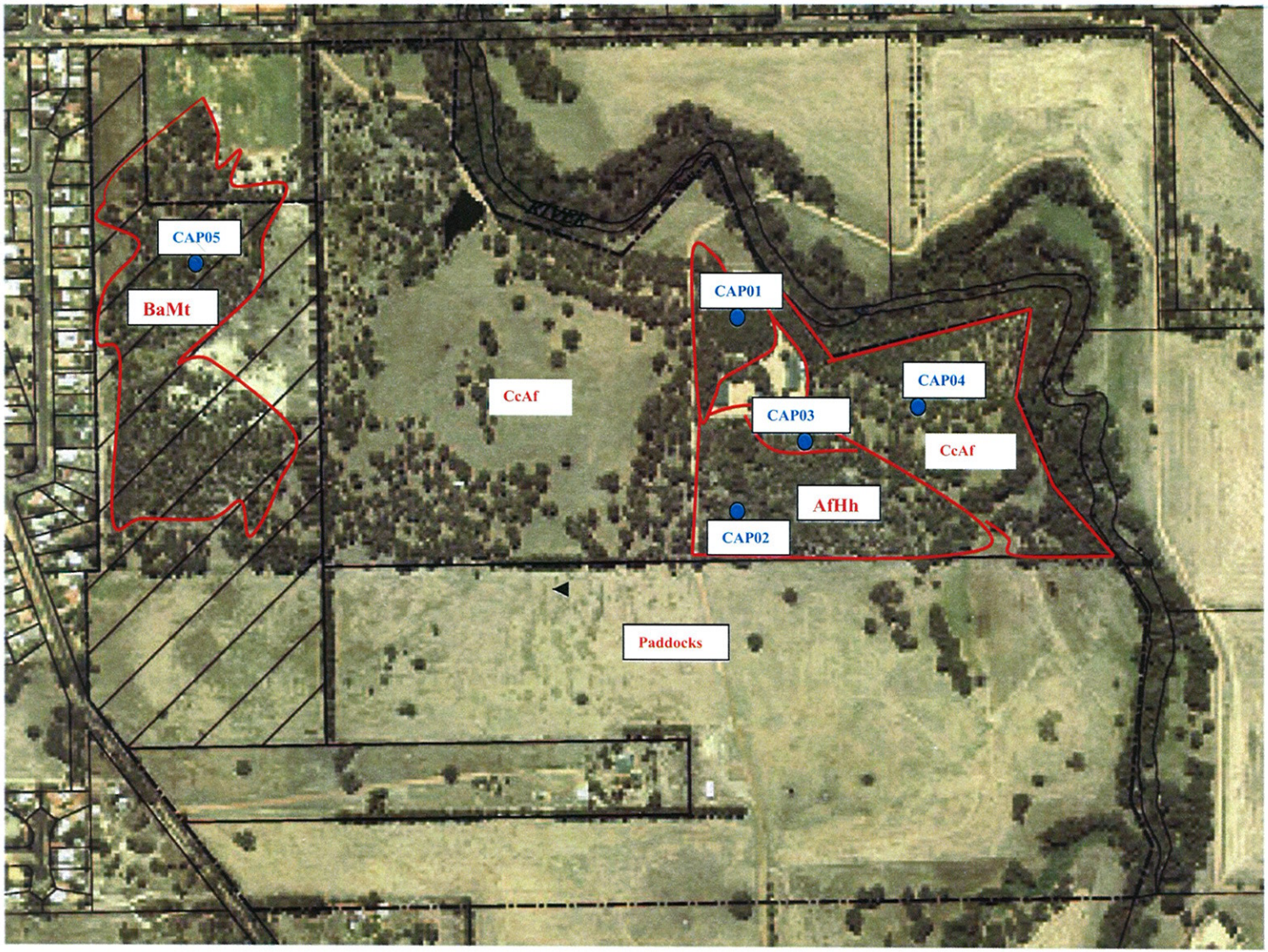
Maps

1. Location of Quadrats and Vegetation Units
2. Remnant Vegetation
3. Vegetation Condition

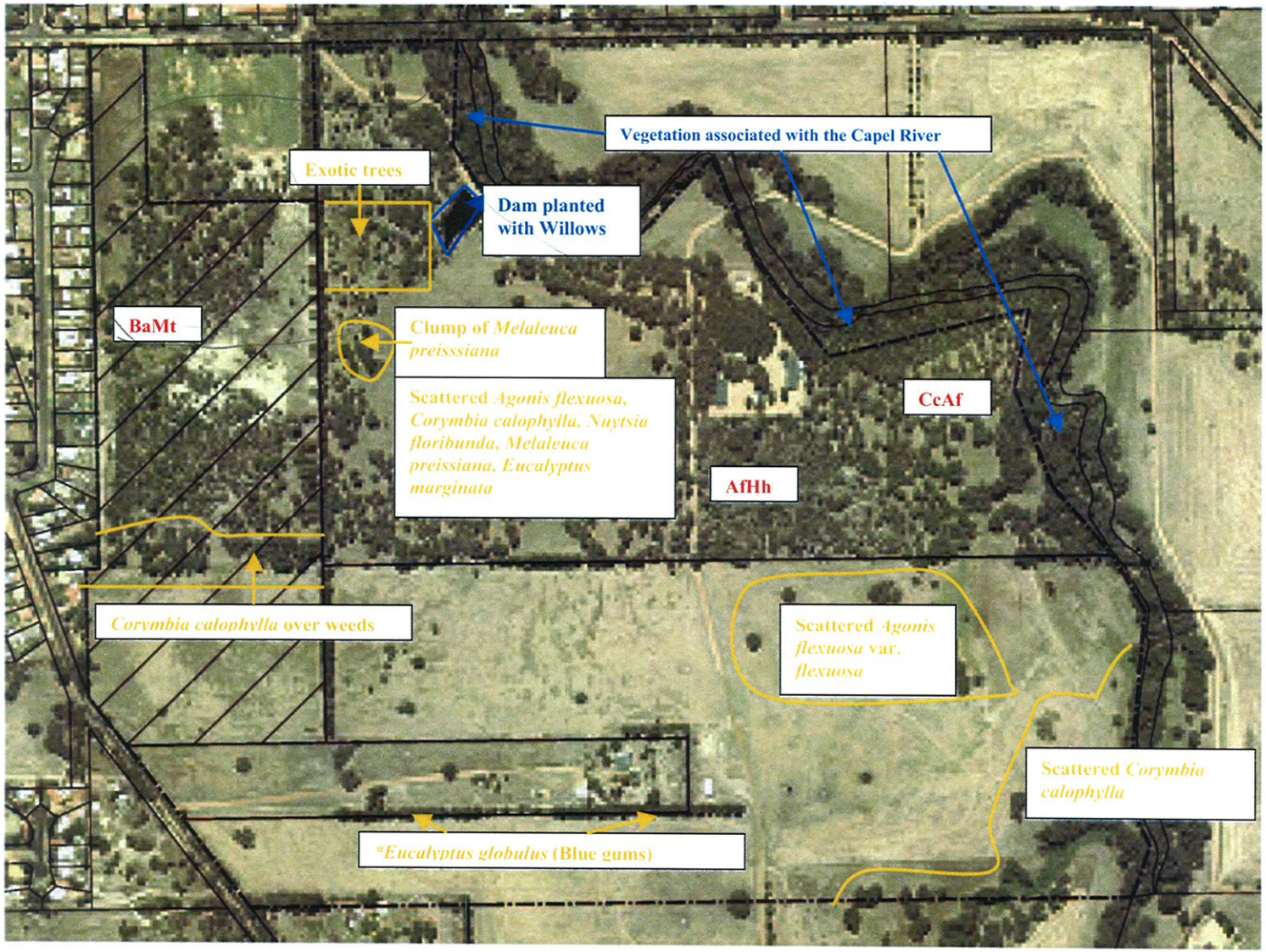
LEGEND

ABBREVIATION	DESCRIPTION
AfHh	Low Woodland A of *Eucalyptus marginata* subsp. *marginata, Agonis flexuosa* var. *flexuosa, Corymbia calophylla* and *Xylomelum occidentale* over Open Scrub of *Kunzea glabrescens* over Low Heath D dominated by *Hibbertia hypericoides* over Very Open Low Grass and Very Open Low Sedges
BaMt	Low Forest B of *Eucalyptus marginata* subsp. *marginata, Banksia attenuata* and *Kunzea glabrescens* over Open Low Scrub B of *Melaleuca thymoides* over Herbs dominated by **Romulea rosea* and **Hypochaeris glabra* and/or Low Grass of **Briza maxima*
CcAf	Open Low Woodland A to Low Forest A of *Corymbia calophylla* and *Agonis flexuosa* var. *flexuosa* over Tall Grass of **Avena barbata* over Low Grass of **Cynodon dactylon*
3	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
4	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
5	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.
6	Completely degraded

Map 1. Location of quadrats (blue) and vegetation units (red). Hatched area only to be developed.



Map2. Remnant vegetation



Map 3. Vegetation Condition