

**CRAIGIE BUSHLAND NATIVE WILDLIFE SANCTUARY
FEASIBILITY STUDY AND MANAGEMENT PLAN -
STRATEGIC OPTIONS AND DIRECTIONS**

Prepared by Jean-Paul Orsini and Associates

3 Sept. 2010



*Jean-Paul Orsini & Associates
Wildlife Management and Environmental Consultancy
15 Hooley Street - Swanbourne WA 6010
Phone/fax: (08) 9384 3756, mob 0405 006 720
Email: jporsini@bigpond.net.au
ABN 25 956 858 796*

TABLE OF CONTENTS

Terminology	1
Acronyms	1
Acknowledgements	2
Executive summary	3
Background	4
Objectives of this report	5
Setting the scene.....	6
Native mammal fauna of Perth's Swan Coastal Plain: former and present	6
Wildlife sanctuaries around Perth	7
Management principles for Craigie Bushland Native Wildlife Sanctuary.....	10
Benefits of a native fauna sanctuary at Craigie Bushland.....	11
Benefits for bushland and ecological processes	11
Benefits for fauna and threatened species	12
Benefits for the local community	12
Issues and challenges	12
Existing environment at Craigie Bushland.....	14
Location, tenure, zoning, vesting.....	14
Bush Forever status.....	15
Flora and fauna	15
Predation	19
Legal framework	20
Wildlife Conservation Act 1950 (Western Australia).....	20
Licencing process for fauna translocations.....	20
Licencing of fauna and flora survey activities	21
Bush Forever	21
Covenanting	22
Commonwealth legislation	22
Review of native mammal species with potential for translocation into the sanctuary.....	22
Species considered as suitable for Stage 1 release into the sanctuary	23
Species considered as potentially suitable for Stage 2 release into the sanctuary	25
Species considered as unsuitable for release into the sanctuary	27
Sourcing native mammals for translocation.....	29
Sanctuary management	29
Update of 1999 Draft Management Plan	29
Baseline surveys.....	30
Monitoring program.....	31
Carrying capacity, dealing with excess animals	31
Fauna habitat management	32
Wetland creation program.....	32
Weed control.....	33
Kangaroo management	33
Feral animal control	35
Perimeter fence design.....	35
Removal of cats from sanctuary	36
Removal of foxes from sanctuary.....	37
Control of rabbits.....	37
Control of feral bees	37
General remarks.....	37
Fire control.....	38
Fire risk assessment	38
Emergency gates.....	39
<i>Phytophthora</i> management	39
Technical reference panel	39

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

Community engagement	40
Community Engagement Plan	40
Community Stakeholder Group	40
Visitor management and tourism	41
Public access	41
Interpretation, signage.....	42
Visitor centre.....	42
Fence closure	42
Nature-based tourism potential	42
Potential wildlife threats and risk analysis	44
Business management	45
Financial viability	45
Personnel requirements.....	45
Partnerships.....	46
Sponsorships	47
Grants, funding	48
Milestones and timelines.....	49
Three-year indicative budget 2011 – 2014.....	50
References	52
Appendix 1: Craigie Open Space and Bushland Location Map.....	56
Appendix 2: Craigie Bushland Native Wildlife Sanctuary Location Map.....	57
Appendix 3: Common and scientific names of mammal species cited in this report.....	58
Native mammal species	58
Introduced and feral mammal species.....	58

TERMINOLOGY

Translocation: involves the intentional movement of a species from a site within its natural range to another site. Here we will extend this definition to the movement of a species from a site that is not within its natural range, e.g. a site where the species has been itself reintroduced, or a wildlife park or a wildlife rehabilitation centre where the species is kept in captivity or semi captivity.

Reintroduction: involves the release of animals of a species that previously existed at that site or in the area. The time scale could be decades, hundreds of years or even known from the subfossil record (thousands of years ago).

Introduction: involves the intentional movement of species from a site within its natural range to another site outside its natural range.

Release: involves the action of letting a species go into a particular area.

In this report we will use the terms ‘translocation’ or ‘release’ unless the terms ‘reintroduction’ or ‘introduction’ are specifically warranted.

ACRONYMS

AWC	Australian Wildlife Conservancy
CBD	Central Business District
DEWHA	Department of the Environment, Water, Heritage and the Arts (Commonwealth)
DEC	Department of Environment and Conservation (Western Australia)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FESA	Fire and Emergency Services Authority of Western Australia
FTE	Full time equivalent
IUCN	International Union for Conservation of Nature

Photo front cover: Woylie or Brush-tailed bettong, courtesy Dr Jacqueline Richards

ACKNOWLEDGEMENTS

The author would like to gratefully acknowledge representatives from the City of Joondalup and the following contributors for providing information and assisting in many ways in the preparation of this report:

Peter Mawson, Tamara Chapman (Species and Communities Branch, DEC)

Norm Press (Nature Protection Branch, DEC)

Keith Morris (Woodvale Research Centre, DEC)

Mathew Harding (Narrogin District Office - Barna Mia Animal Sanctuary, DEC)

Colleen Sims (Denham District Office - Project Eden, DEC)

Julia Cullity (Urban Nature, DEC)

Manda Page (Australian Wildlife Conservancy, Karakamia Sanctuary)

John Henderson (Fire and Emergency Services Authority of Western Australia)

June Butcher (Kanyana Wildlife Rehabilitation Centre)

Lizzie Aravidis (Native Animal Rescue, Malaga)

Liz Appelt (Chidlow Marsupial Hospital)

David Thorne (Caversham Wildlife Park)

Christine Rafferty (Whiteman Park)

David Croft (University of New South Wales)

Catherine Herbert (University of Sydney)

Christopher Mayberry (doctoral candidate, University of Western Australia)

Rob Davis (Edith Cowan University)

Brad Maryan (Western Australian Museum)

Mike Butcher (Animal Pest Management Services)

Jason Arnold (kangaroo management services)

Johnny Prefumo (the 'Frog Doctor')

Jeff Short (Wildlife Research and Management Pty Ltd)

Mike Bamford (Bamford Consulting Ecologists)

Joy Ensor (Yelverton Sanctuary, Margaret River)

Mike McCall (Herons Brook Sanctuary, Margaret River)

John and Cherie Wood (Friends of Craigie Bushland)

Ralph Henderson (Friends of Hepburn and Pinnaroo Bushland)

Heather Chester (Friends of Yellagonga)

Jacqui Richards is gratefully acknowledged for editing the manuscript and providing the front page photograaph.

EXECUTIVE SUMMARY

In 2008 the Joondalup Council resolved that a Feasibility Study and Management Plan should be prepared for the Craigie Bushland Sanctuary prior to progressing the native wildlife sanctuary concept and implementation. The concept of releasing a suite of native mammal species into an urban bushland reserve has many different benefits, both for natural ecosystems and for people, but also poses many challenges that require careful preparation and planning. The Craigie Bushland in which the sanctuary is located is zoned as Parks and Reserves vested in the City of Joondalup. It is part of a listed Bush Forever site and has very high conservation values.

This report investigates the various steps that will need to be taken for the Craigie Bushland Native Wildlife Sanctuary to come into effect. These steps include the removal of all cats and foxes from the enclosure, the gathering of baseline ecological data, the application for a licence from the Department of Environment and Conservation, the preparation of several plans, some related to the natural environment (e.g. fauna translocation proposals, kangaroo management plan, bushland management plan, fauna and flora monitoring plan), while others relate to the sanctuary's financial management and sustainability (e.g. preparation of a Business Plan, including applications for funding, identification of potential sponsors, appointment of qualified personnel to manage the project and the sanctuary).

A key component of the project will be a community engagement program and the establishment of partnerships with organisations that can contribute knowledge and expertise to the project. A list of key milestones and timelines is provided in the report.

The native mammal species that can be potentially translocated to the sanctuary include the quenda, brushtail possum, honey possum and pygmy-possum (stage 1 releases), while the woylie, western brush wallaby and tammar wallaby may be considered later under stage 2, subject to stage 1 releases being successful.

With the right amount of resources and dedication, the Craigie Bushland Native Wildlife Sanctuary has the potential to become a centre of excellence for wildlife management and community awareness and education about Australia's unique wildlife, and provide significant nature-based opportunities.

BACKGROUND

In 2005, the City of Joondalup commissioned a report to investigate the concept of creating a wildlife sanctuary at Craigie Bushland (2005). The report concluded that the bushland, a native vegetation reserve situated in the suburb of Craigie, “had the potential to become a sanctuary for Australian native wildlife and a centre of excellence for wildlife management, education and nature-based tourism in the Perth Metropolitan Area, attracting the local community as well as interstate and overseas visitors.” The report provided general guidelines and recommendations on how this concept could be turned into a fully-fledged proposal.

The City of Joondalup council passed a resolution in 2008 (Minutes of 28/10/2008 Council Meeting, City of Joondalup 2008) and decided to “progress the concept of the wildlife sanctuary” by:

- Tabling a report by the City of Joondalup’s Chief Executive Officer. This report outlined some legal requirements associated with the establishment of a sanctuary, described some initial public consultation that took place to gauge public support for the concept, and provided some preliminary five-year cost estimates of establishing and running the sanctuary;
- Commissioning a detailed “Feasibility Study and Management Plan that outlines all short and long-term planning issues and associated costs in line with Option 1 as detailed in Report CJ221-10/08 and [...] to investigate opportunities for potential partnerships in the development of the site”.

Two options were presented to Council for the development of the Craigie Bushland Native Wildlife Sanctuary (City of Joondalup 2008):

Option 1: Conservation Sanctuary with limited and controlled human interaction focusing on restoration

“The initial purpose of the sanctuary will be to return the local ecosystem to its highest levels by restoring or revegetating degraded natural bushland, reintroducing native animal species, and preventing further destruction or damage by feral animals and uncontrolled human activity.”

Option 2: Conservation Sanctuary with a focus on human experience and education

“The purpose of the sanctuary will be to create a place where visitors can ‘experience nature’ through a variety of activities in an area where the local ecosystem is preserved (or enhanced).”

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

“Similar to option 1, this option would also require the development of comprehensive short and long-term management plans with considerable support and advice from technical staff in the areas of flora and fauna management as well as the areas of business and marketing.”

Option 2 includes Option 1, but adds a sustained human experience and education dimension.

The creation of a 43.5 ha native wildlife sanctuary at Craigie Bushland containing an array of the Australian native mammal fauna that used to occur on Perth's Swan Coastal Plain has great significance. Although other sanctuaries in natural bushland settings exist further afield in the Perth Metropolitan Area (e.g. Whiteman Park's Woodland Reserve) and east of Perth (e.g. Australian Wildlife Conservancy's Karakamia Sanctuary), Craigie Bushland Native Wildlife Sanctuary would be the first area of native urban bushland to be set aside specifically as a wildlife sanctuary that is directly and easily accessible by public transport or car from Perth CBD and Joondalup city centre.

The sanctuary will provide a unique opportunity for Perth residents and visitors alike to view and have a first-hand experience of Australian native mammal fauna. The sanctuary will become a centre of excellence for community awareness and education about Australia's unique wildlife and its plight in the face of threats from introduced predators and habitat loss.

The sanctuary is surrounded by a 2.1 m high fence. At the time of writing this report (May 2010) the entry points and access gates along the sanctuary fence were still open, allowing visitors and wildlife to easily enter and leave the area. The fence will become predator-proof once all the entry points and gates have been closed. Many measures will need to be implemented before any mammal fauna translocations can occur into the sanctuary. This report describes how the Craigie Bushland Native Wildlife Sanctuary can be progressed to this next stage.

OBJECTIVES OF THIS REPORT

The objective of the present report is to present a detailed Feasibility Study and Management Plan for the proposed Craigie Bushland Native Wildlife Sanctuary. The report includes the following sections:

- An Executive Summary
- A description of the existing environment at Craigie Bushland
- A review of existing wildlife sanctuaries in the Perth region and the South-West of WA
- An outline of the benefits of a native wildlife sanctuary and associated issues

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

- A review of the environmental legislation and legal requirements applicable to the management of native fauna and fauna translocations
- A review of the native mammal species that can be potentially released at the sanctuary
- A sanctuary management plan presenting management recommendations and guidelines involving:
 - Wildlife and environmental management
 - Community engagement
 - Visitor management and tourism
 - Potential wildlife threats and risk analysis
 - Business management
 - Milestones and timelines
 - Indicative three year budget (2010 – 2013)
- A reference section.

This report concentrates on Option 1 of the Council 2008 resolution, but includes considerations on how Option 2 could be implemented in the future. This report mainly investigates the translocation of native mammals into the sanctuary, as they are the ones most likely to thrive inside a predator-proof fence, although the sanctuary could be a potential site for release of other fauna as well such as birds, reptiles and frogs.

SETTING THE SCENE

Native mammal fauna of Perth's Swan Coastal Plain: former and present

The original native mammal fauna of the Perth region¹ before European settlement comprised no less than 40 species (Burbidge & Start 1994). For the Swan Coastal Plain², Bancroft (2005) lists 37 native mammal species as having been recorded in historical times. The current number of native mammals in the Perth region is believed to have now dwindled to only 24 species (Burbidge & Start *op. cit.*).

How and Dell (2000) in a survey of urban bushland remnants in the Perth Metropolitan Area found that the native mammal fauna has gone through a catastrophic decline, with most native mammal

¹ Perth region defined here as approx. from Yanchep in the north to Jarrahdale and Mandurah in the south, and Mundaring and Walyunga in the east.

² The Swan Coastal Plain is defined in Bancroft (2005) as west of the Darling Scarp and between c. 31° S (Lancelin) and c. 33° S (just north of Bunbury).

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

species now extinct from urban bushland remnants and just a few species having survived in a small number of the remnants surveyed.

Species such as the boodie³ (burrowing bettong), bilby and banded hare-wallaby, all formerly present in the Perth region according to Burbidge and Start (1994), do not appear to have been found along Perth's Swan Coastal Plain (DEC undated-c; Maxwell *et al.* 1996). A similar situation exists with the western barred bandicoot described in Richards (2003) as present along the whole coastline of the Swan River colony, but not west of the Darling Ranges (Gould 1863).

The mala (rufous hare-wallaby) was found throughout inland Western Australia, but not in the Perth region *per se*. The woylie (brush-tailed bettong) was present along the Swan Coastal Plain 12,000 years ago according to subfossil records, at a time when vegetation and the position of the coastline would have been very different from the present. The numbat was still found on the Perth's Swan Coastal Plain up to the early 1980s (Perth Airport) and as late as 1986 (Jandakot) indicating that Perth's Swan Coastal Plain was a suitable habitat for the species. Due to the level of alienation of land on the Swan Coastal Plain it is now considered that numbats could not survive on the plain in the present day.

The current native mammal fauna of Perth's Swan Coastal Plain is limited to very few species (How & Dell 2000). The most frequently encountered ones include the western grey kangaroo, the brushtail possum and the quenda (southern brown bandicoot). Western brush wallabies have disappeared from almost all smaller remnants but are still found in good numbers at Whiteman Park, Harry Waring Marsupial Reserve and in low numbers at Thomsons Lake Nature Reserve. Honey possums and echidnas are only found in a handful of locations.

Introduced (i.e. non native) mammals on the Perth's Swan Coastal Plain include the fox, cat (domestic and feral), domestic dog, rabbit, black rat, brown or ship rat and house mouse. With the exception of the brown rat, these are all widespread throughout the region.

The scientific names and alternative common names of all species in this report are provided in Appendix 1.

Wildlife sanctuaries around Perth

Several wildlife sanctuaries have been established around Perth and the South-West of Western Australia. Various native fauna species have been reintroduced into these sanctuaries. These

³ See Annex 2 for scientific and alternative common names of all species cited in this report

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

sanctuaries are all surrounded by a feral proof fence, except for Paruna Sanctuary, which is bounded by a fence on one side and the Avon River on another (see next page).

Woodland Reserve (Whiteman Park)

The Woodland Reserve is a recently set-up 50 ha fenced wildlife sanctuary located a short walking distance from Whiteman Park's main precinct⁴, itself located about 18 km north of the Perth CBD. Several woylies have been translocated into a small 2.5 ha pen within the 50 ha main enclosure to monitor their capacity to survive in a coastal plain environment. Other species such as the tammar wallaby are being considered for release into the sanctuary. The quenda is naturally occurring in the sanctuary. A small number of western grey kangaroos also remain within the sanctuary at present. The reserve is managed by Whiteman Park and will be open to the public in the future.

Whiteman Park's Woodland Reserve has a similar environment to that of Craigie Bushland and encompasses various vegetation types of Perth's Swan Coastal Plain including *Banksia* woodland and shrubland. The western brush wallaby, western grey kangaroo, quenda, echidna and honey possum are all present in the bushland at Whiteman Park.

Karakamia Sanctuary (Australian Wildlife Conservancy)

Located near Chidlow on the Darling Scarp about 40 km east of Perth, the 270 ha fenced Karakamia Sanctuary⁵ is owned and managed by the AWC. The following species have been reintroduced into the sanctuary: woylie, quenda, tammar wallaby, quokka, western ringtail possum and numbat, all successfully apart from the latter. Western grey kangaroos, brushtail possums and western brush wallabies occurred naturally within the sanctuary and additional species such as the western pygmy-possum, chuditch (western quoll) and mardo (yellow-footed antechinus) have benefited from predator control by increasing in abundance. Guided nocturnal spotlighting tours can be organised through the Karakamia office.

Paruna Sanctuary (AWC)

Located along the lower Avon Valley about 40 km east of Perth, the 2,000 ha Paruna Sanctuary⁶, which is bordered by the Avon River on one side and a fence on another, is also owned and managed by AWC. The sanctuary provides a critical wildlife corridor between the Avon Valley and Walyunga National Parks and is regularly baited to control foxes. The following species have been reintroduced to the sanctuary: woylie, quenda, tammar wallaby and black-flanked rock-wallaby, with variable success due to the difficulty of controlling introduced predators. The sanctuary is open to the public

⁴ <http://www.whitemanpark.com.au/>

⁵ <http://www.australianwildlife.org/AWC-Sanctuaries/Karakamia-Sanctuary.aspx>

⁶ <http://www.australianwildlife.org/AWC-Sanctuaries/Paruna-Sanctuary.aspx>

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

(booking required) during the daytime in the autumn, winter and spring months (out of the high fire risk season) and a network of trails provides bushwalking opportunities.

Barna Mia Animal Sanctuary (Dryandra Woodland)

Barna Mia Animal Sanctuary⁷, managed by the Department of Environment and Conservation (DEC), is a 4 ha enclosure where a range of threatened species have been reintroduced: bilbies, boodies, mala, woylies, quenda and western barred bandicoots (Sprigg 2004). Guided nocturnal spotlight tours are organised with advance notice.

The 'Return to Dryandra' project involves two 10 ha enclosures set up for the purpose of breeding threatened species for release into the wild (Friend *et al.* 2004). These enclosures are not open to the public for wildlife viewing.

Both the Barna Mia Animal Sanctuary and the Return to Dryandra enclosures are located in Dryandra Woodland, 180 km south-east of Perth.

Private sanctuaries (Margaret River)

Two 40 ha sanctuaries are located near Margaret River 270 km south of Perth (Yelverton Brook Sanctuary, Herons Brook Sanctuary) and have a range of native mammals including woylies, quenda and western ringtail possums. Yelverton Brook Sanctuary is managed as an eco resort while Herons Brook Sanctuary is a private sanctuary not accessible to the public.

Wadderin Wildlife Sanctuary (Wheatbelt)

Located near Narembene (300 km east of Perth), the 520 ha Wadderin Wildlife Sanctuary is currently under development and involves the reintroduction of a range of native fauna. To date red-tailed phascogales and quenda have been translocated into the reserve and plans are in place to reintroduce tammar wallabies, woylies and brushtail possums (Short & Stone 2009).

Wildlife rehabilitation centres, breeding programs and wildlife parks

In addition to the above sanctuaries, several wildlife rehabilitation facilities exist in the Perth region, including:

- Native Animal Rescue (Malaga)
- Kanyana Wildlife Rehabilitation Centre (Gooseberry Hill, soon to move to Lesmurdie)
- Chidlow Marsupial Hospital (Chidlow)
- Malubillai Wildlife Carers Network (Victoria Park)

⁷ <http://www.dec.wa.gov.au/content/view/370/1044/1/1/>

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

- Kenwick Bird and Small Animal Rescue (Kenwick)
- Native Arc (Bibra Lake)
- Om-Shanti Marsupial Hospital (Wellard).

These facilities care for injured wildlife and often seek safe areas of bushland to release rehabilitated wildlife. Some of them hold threatened fauna, e.g. Kanyana Wildlife Rehabilitation Centre that have assisted DEC with threatened species captive breeding programs (e.g. bilbies) and the Native Animal Rescue wildlife rehabilitation centre which will be holding woylies as part of a recently commenced research program on a blood-borne parasitic disease in woylies.

The Perth Zoo has breeding programs for several threatened species for the purpose of wildlife translocation, including the numbat and the dibbler, both formerly present in the Perth region. The Caversham Wildlife Park houses native species, including woylies and echidnas, in enclosures for public display.

Management principles for Craigie Bushland Native Wildlife Sanctuary

The proposed goal of the Craigie Bushland Native Wildlife Sanctuary is:

To re-establish native fauna species in their natural environment in an urban bushland setting and provide the public with a wildlife viewing and educational experience without compromising the conservation values of the sanctuary.

Given the high conservation value of Craigie Bushland, there are strong grounds to support the concept that the sanctuary management should be ecosystem-based and underpinned by ecological sustainability principles, thus aimed at preserving ecosystem processes and biodiversity as much as focusing on individual fauna species. In other words, ecosystem processes should be allowed to take place with as little human intervention as possible and wildlife management should encompass all ecosystem levels rather than focus on single species.

Consequences of following ecosystem-based management principles are that:

- Whole-ecosystem considerations should be predominant when reintroducing any species into the sanctuary, in particular taking into account that any additional pressure on ecosystem resources can be sustained in the long term and that existing bushland conservation values are not diminished. Thus, given the limited size of the sanctuary (43.5 ha), it is likely that only a limited number of species may be released there.

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

- Artificial feeding of animals in the sanctuary should be avoided or kept to a minimum according to strict management criteria.
- Access to drinking water and provision of supplementary feeding for fauna should be managed in such a way so as to avoid artificially inflating the populations of animals within the sanctuary and not to make animals dependent on these additional resources.
- Wildlife management should take into account animal welfare so that no unnecessary hardship and suffering is inflicted on wildlife within the sanctuary, as per the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes* (NHMRC *et al.* 1990).
- A 'soft release' enclosure may be needed so that native mammals released into the sanctuary can be closely monitored in the first weeks. However, most research to date has indicated that there is little value in soft release strategies if the habitat in the release site is genuinely suitable.

Benefits of a native fauna sanctuary at Craigie Bushland

The concept of releasing a suite of native mammal species into an urban bushland setting has many benefits, both for natural ecosystems and people.

Benefits for bushland and ecological processes

Native mammals provide ecosystem services, many of which have been lost as various species have disappeared from the wild. Many mutually beneficial (symbiotic) relationships exist between fauna and ecosystems:

- Native mammals such as quendas and woylies aerate the soil through their diggings.
- Mammal dung is one of the ways in which organic matter is recycled into the soil.
- Woylies have a symbiotic relationship with mycorrhizal underground fungi and help spread the spores of these fungi in their dung, promoting germination after passing through the woylie digestive system.
- These mycorrhizal fungi have a symbiotic relationship with native trees and shrubs and contribute to the plants' nutrient uptake.
- Pollination services are provided by nectar-feeding native mammals such as honey possums and pygmy-possums.
- Herbivory can contribute to maintaining plant diversity in ecosystems.

The presence of some species may have a beneficial effect on bushland management and reduce management costs:

- Herbivores such as wallabies and kangaroos reduce ground cover density, particularly that of grasses, and thus help reduce fuel load and fire risk.

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

- Native mammals can reduce the incidence of grassy or bulbous weeds in the bushland, thus reducing the need for weed control.

Benefits for fauna and threatened species

Many potential benefits for fauna and threatened species conservation can arise from this project:

- Providing a safe haven for the relocation and release of native animals coming from wildlife rehabilitation centres, or for native wildlife for which relocation is the preferred option when habitat is lost due to development
- Raising public awareness, education and support for native fauna and threatened species conservation
- Providing an opportunity for the public to view native mammal species in their natural habitat
- Providing a potential source of native animals for reintroduction to the conservation estate or other sanctuaries.

Benefits for the local community

Benefits for the local community include:

- Hands-on involvement in a valuable and unique fauna conservation project (opportunities to participate in fauna translocations, wildlife monitoring, habitat restoration, school education projects, interpretation, guiding, etc.)
- Establishment of an ongoing partnership with the community around a high conservation value project with the potential for considerable recognition of community contribution to threatened species management through the actions of volunteers and community groups.
- Establishment of long-term partnerships with a range of government and non-government organisations, for the benefit of the wider community.

Issues and challenges

Releasing a suite of native mammals into an enclosed area of bushland poses certain ecological and management challenges that require careful planning and preparation. No matter the size of a sanctuary, a completely enclosed area requires ongoing and long-term management if ecological balance is to be maintained.

The translocation of fauna into an enclosed sanctuary raises issues that need to be carefully considered:

- The need for complete removal of introduced predators (cats and foxes)

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

- The need for removal of rabbits; this may need to be repeated annually if rabbit kittens can pass through the fence or under/around gate structures
- Selection of appropriate native species for translocation, given the relatively small size of the fenced area (43.5 ha)
- The source of animals to be translocated into the sanctuary
- A sound genetic stock for wildlife and the need for ongoing genetic renewal
- Quarantining of animals prior to their release and dealing with the potential spread of disease, parasites and weeds if there are reasons to believe that this may be required
- Population management of species translocated into the sanctuary and methods for managing excess animals
- Kangaroo management inside a fenced sanctuary
- Animal health and welfare considerations
- DEC licencing
- Fire and its potential threat to wildlife, infrastructure and public safety
- Vandalism, unwanted impacts from humans
- Level of public access allowed inside the sanctuary
- Dealing with domestic cats and dogs left inside the sanctuary when the fence is closed
- Establishing long-term partnerships with organisations with similar goals
- Securing long term funding through sponsorships and grants
- Consistency of translocation of each species with existing threatened species recovery plans, or overall conservation goals for the species.

Key ecological issues that need to be investigated include:

- The area of suitable habitat within the bushland required for each species (vegetation type and structure, breeding and resting sites, food resources)
- The carrying capacity of the sanctuary for each species to be translocated, beyond which overpopulation and overuse of the habitat is likely to occur
- Likely levels of competition between species, which will determine how many species can be translocated to the sanctuary
- Control of introduced (non-native) fauna, particularly rabbits and feral bees.

Other key financial and management issues to be considered include:

- Ensuring the long-term continuity and financial viability of the project. Once the translocation of wildlife has taken place, there will be a long-term requirement for ongoing wildlife management.

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

- Seeking appropriate expertise and advice to manage the sanctuary. Project coordination and day-to-day sanctuary management should be carried out by fully-qualified personnel and a technical reference group will be required to provide relevant guidance for the project.

The fauna release process may need to take place in two stages: 'soft release' into a smaller enclosure where animals can be closely monitored and provided with an opportunity to acclimatise to their new surroundings, followed by release into the larger 43.5 ha enclosure.

Key considerations must include whether additional feeding will be required, particularly during periods of drought, whether access to permanent water will be provided to translocated wildlife and what degree of public access will be allowed.

At all stages of the process, ecosystem-based conservation principles as well as animal welfare and ethics considerations should be the foundation of management decisions.

EXISTING ENVIRONMENT AT CRAIGIE BUSHLAND

Location, tenure, zoning, vesting

The Craigie Bushland Native Wildlife Sanctuary is located directly north of Whitfords Avenue and west of the Mitchell Freeway (see location map in Appendix 1). The sanctuary is in the residential suburb of Craigie within the City of Joondalup, approximately 20 km north of the Perth CBD and 6 km south of the Joondalup CBD.

The sanctuary covers an area of 43.5 ha of bushland within 53 ha of native vegetation known as Craigie Bushland (see aerial photo in Appendix 1). An area of approximately 9.5 ha of bushland surrounds the sanctuary, acting as a native vegetation buffer. To the north of the sanctuary and immediately adjacent to it lies the Water Corporation's Beenyup Water Treatment Site that contains approximately 40 ha of bushland in its eastern section, currently separated from Craigie Bushland by a predator-proof fence.

The sanctuary lies within Craigie Open Space (area 56.7 ha, see map in Appendix 2), which, in addition to the bushland, includes the Craigie Leisure Centre and associated facilities: car parks, access roads, etc. (Ecoscape 2005). The Craigie Leisure Centre is a thriving community facility that offers potential synergies with the Craigie Bushland Native Wildlife Sanctuary, including long opening hours seven days a week, ample parking space, a cafeteria and a service desk.

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

The Craigie Bushland Native Wildlife Sanctuary (Lot 8889) is Crown Land vested with the City of Joondalup, except for a water pipeline easement which is vested with the Water Corporation.

Lot 8889 is reserved 'Parks and Recreation' under the Metropolitan Region Scheme and the City of Joondalup District Planning Scheme.

Two management documents have been produced for Craigie Open Space: the first one is a draft management plan focused on the bushland environment (Anon. 1999), while the second is a study focused on the development potential and land use options of Craigie Open Space as a whole (Ecoscape 2005).

Bush Forever status

Craigie Bushland is part of the larger Bush Forever Site No. 303. This Bush Forever site has a total area of bushland of 139.5 ha (Department of Environmental Protection 2000b) forming a 5 km long north-south corridor interrupted by Whitfords Avenue, a major road link going in an east-west direction. In addition to Craigie Bushland, the other areas of bushland included in this Bush Forever site are Hepburn Heights Conservation Area, Pinnaroo Valley Memorial Park (that includes Pinnaroo Bushland) and the eastern part of the Water Corporation's Beenyup Water Treatment Site.

The inclusion of Craigie Bushland into Bush Forever Site 303 is based on the fact that it contains a regionally significant vegetation community, Karrakatta Central and South, that is rare (only 18% of that community's original area remaining) and poorly represented in the conservation system (6% currently reserved). Thus this site can be considered as important both locally and regionally and its preservation should be the objective of any management of the site. According to the Bush Forever Site description, more than 70 percent of this bushland was in 'Very good' to 'Excellent' condition at the time of the Bush Forever assessment.

Flora and fauna

Flora and fauna lists are provided in various management documents prepared for Craigie Open Space (Allen *et al.* 1994; Anon. 1999).

Flora (Allen *et al.* 1994; Anon. 1999; Department of Environmental Protection 2000b)

Native flora: 161 species.

Introduced flora and weeds: 72 species.

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

The Priority 4⁸ species *Jacksonia sericea* has now been split into two species: *Jacksonia sericea* (Priority 4) and *J. calicicola* (not currently priority listed).

Four species of banksias are common at Craigie Bushland and provide an important food source for native fauna. The flowering periods below are derived from George (1987):

- Bull banksia (*B. grandis*), flowering period mainly Oct. to Jan.
- Slender banksia (*B. attenuata*), flowering period mainly Oct. to Feb.
- Acorn banksia (*B. prionotes*), flowering period mainly Feb. to Aug.
- Firewood banksia (*B. menziesii*), flowering period mainly Feb. to Aug.

Three species of eucalypts are widespread at Craigie Bushland and provide an important food source and habitat (e.g. hollows) for native fauna:

- Tuart (*E. gomphocephala*)
- Jarrah (*E. marginata*)
- Marri (*Corymbia calophylla*)

Other plant species that provide important food and habitat for native fauna are:

- The grass tree (*Xanthorrhoea preissii*): flower spikes are an abundant source of nectar and grass tree skirts provide shelter and cover for native fauna, particularly woylies that use them for their nest during the day.
- The parrot bush (*Banksia sessilis*, formerly *Dryandra sessilis*): *Dryandra* flowers in early autumn provide a rich source of nectar, parrot bush thickets provide shelter where animals are safe from native predators.
- The honeypot dryandra (*Banksia nivea*, formerly *Dryandra nivea*): flowers are a rich source of nectar.
- Various species of hakeas (*Hakea lissocarpa*, *H. prostrata*) and grevilleas (*Grevillea crithmifolia*, *G. vestita*): flowers are a rich source of nectar.

Various *Lomandra* species are host for the graceful sun moth (see 'Fauna' section below).

Vegetation communities

Vegetation structure includes ground, shrub, medium and tall tree layers. Vegetation types include dense shrubland, *Banksia* woodland, *Banksia*-jarrah (*Eucalyptus marginata*) woodland and tall tuart (*Eucalyptus gomphocephala*) open forest. For a more detailed description of vegetation communities, see Bush Forever Site No. 303 description (Department of Environmental Protection 2000b).

⁸ For an explanation of the 'Priority 4' classification, please refer to p. 23.

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

A rapid inspection of vegetation condition at Craigie Bushland has confirmed the Bush Forever assessment rating of 'Very Good' to 'Excellent' (Department of Environmental Protection 2000b) for most of the bushland (scoring system used as per Keighery 1994).

The vegetation structure is mostly intact with all the vegetation strata present and a vegetation cover of more than 80% in most areas. Signs that hot fires have swept through the area are visible, but there does not appear to have been any substantial fire since 2005 (John Wood pers. comm.). The Craigie Bushland contains a significant vegetation community, Karrakatta Central and South (see Bush Forever section above).

Fauna

Fauna checklists for Craigie Bushland are patchy and many surveys date back to the 1990s (see 1999 Draft Management Plan, Anon. 1999).

A series of fauna surveys for various taxonomic groups (mammals, birds, reptiles, frogs, invertebrates) will be required to provide essential baseline data that can be used as a foundation for the future management of the sanctuary.

Mammals

Only one confirmed and three potential native mammal species are present:

- Western grey kangaroo: population size of 12 individuals estimated in 1999, current numbers unknown. One recent sighting and fresh pellets observed.
- Western brush wallaby (Priority 4 species): recorded in the 1999 Draft Management Plan, but current population status unknown
- Quenda (Priority 5 species): unconfirmed presence inferred from possible diggings (D. Pike pers. comm.)
- Brushtail possum: likely to occur at Craigie Bushland, but no confirmed record.

Introduced mammals in the Perth region include the fox, cat, black and brown rat, house mouse. They are all likely to be present in Craigie Bushland. Rabbits are present in the bushland at low density.

Birds

A total of 41 bird species were recorded by Birds Australia in a 2005-06 survey carried out for the Perth Biodiversity Project. Of these species, 11 are of conservation significance, including the splendid fairy wren (*Malurus splendens*), little eagle (*Hieraaetus morphnoides*), brown goshawk (*Accipiter fasciatus*) and the endangered Carnaby's cockatoo (*Calyptorhynchus latirostris*), which is

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

listed as 'Endangered' (*Environment Protection and Biodiversity Conservation Act 1999*) and as Fauna that is 'Rare or likely to become Extinct' (ranked 'Endangered'; WA *Wildlife Conservation Act 1950*).

Additional bird species of note present or expected to be present at Craigie Bushland are provided in the 'Predation' section below.

Bird species introduced to the Perth region and present at Craigie Bushland include rainbow lorikeets (*Trichoglossus haematodus*), long-billed and little corellas (resp. *Cacatua tenuirostris* and *C. sanguinea*) that all compete with native fauna for breeding hollows. DEC has undertaken an extensive control program of rainbow lorikeets in Perth since 2007, removing more than 23,000 birds from the local population. A much smaller amount of control effort has been directed at the introduced corella population.

Reptiles

Eleven reptile species, including the dugite (*Pseudonaja affinis*), were recorded in the 1999 Draft Management Plan. Another 14 species are expected to be present, including three species of monitors (*Varanus* spp.).

Frogs

No confirmed record, but the turtle frog (*Myobatrachus gouldii*) is likely to occur at Craigie Bushland.

Invertebrates

A total of 149 taxa were compiled by Allen *et al.* (1994).

The Graceful sun moth (*Synemon gratiosa*) occurs in Craigie Bushland west of the sanctuary's perimeter fence on the dune escarpment and may be found inside the sanctuary wherever its food source (*Lomandra hermaphrodita* and *L. maritima*) is present (D. Pike pers. comm.). The species is listed as 'Endangered' (*Environment Protection and Biodiversity Conservation Act 1999*) and as fauna that is 'Rare or likely to become Extinct' (ranked 'Endangered'; WA *Wildlife Conservation Act 1950*). See DEWHA⁹ and DEC¹⁰ information notes. The species requires targeted survey effort during the time when the species is most visible (Feb-April).

⁹ http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66757

¹⁰ <http://www.dec.wa.gov.au/content/view/5695/1808/>

Predation

Natural predators are likely to play an important role in maintaining a suite of self-sustaining mammal species in Craigie Bushland. Predators apply selective pressure on natural prey populations, removing sick and injured individuals, thus maintaining a healthy population and a well-adapted gene pool.

The presence of predators should be kept in mind when releasing captive-bred individuals or individuals that have been rehabilitated in a wildlife care facility. The following list of predators with their preferred prey size are found or likely to be found at Craigie Bushland.

Raptors

Australian kestrel (*Falco cenchroides*): feeds mainly on mice (10 to 25 g) and small mammals, also insects, small birds, reptiles.

Brown goshawk (*Accipiter fasciatus*): feeds mainly on rabbits (25% of total prey numbers, 54% of total prey biomass), also birds, insects, reptiles.

Collared sparrowhawk (*Accipiter cirrhocephalus*): feeds mainly on small birds, rarely mammals. Observed by the author at Craigie Bushland in May 2010.

Black-shouldered kite (*Elanus axillaris*): feeds mainly on mice or mouse-sized mammals (90% of diet).

Australian hobby (*Falco longipennis*): feeds on large flying insects, day-flying moths, mammals, bats and small birds up to its own weight of 200 to 300 g.

Peregrine falcon (*Falco peregrinus*): feeds mainly on birds, such as doves, pigeons, parrots, more rarely on mammals.

Little eagle (*Hieraaetus morphnoides*): feeds mainly on rabbits (90% of diet; 1.0 to 2.2 kg size prey).

Wedge-tailed eagle (*Aquila audax*): rabbits, wallabies (up to 10 kg) and small kangaroos, also carrion. Preferred prey > 500 g. One pair breeds at Whiteman Park and could potentially visit Craigie Bushland.

Barn owl (*Tyto alba*): feeds mainly on mice, also small rabbits and rats (100 to 340 g).

Boobook (*Ninox connivens*): feeds on mice, insects (moths), also frogs.

Reptiles

Monitors (*Varanus* spp.): opportunistic feeders, diurnal. Feed on insects, reptiles, mice, carrion.

Dugite (*Pseudonaja affinis*): feeds on mice, lizards, snakes, birds.

Carpet python (*Morelia spilota*): feeds mainly on birds and mammals (up to medium-sized species of 500 g and 3.5 kg for adult female pythons), mainly nocturnal.

LEGAL FRAMEWORK

Wildlife Conservation Act 1950 (Western Australia)

All Australian native fauna is ‘protected’ under the WA *Wildlife Conservation Act 1950*. It is an offence to ‘take’ protected or threatened fauna unless a licence has been granted by DEC.

The definition of “take” includes “to capture, disturb or molest” and also includes attempts to take fauna and assisting another person to take fauna. The definition of fauna includes not only the animal, but any part thereof, including eggs, fur, feathers, etc.

Under the WA *Wildlife Conservation Act 1950* all Australian native fauna in Western Australia belongs to the Crown, including animals temporarily held by wildlife rehabilitation centres and in some cases private wildlife sanctuaries, depending on the origins of the animals. Thus they are regulated by the same legislation as animals in the wild.

Licencing process for fauna translocations¹¹

A ‘Regulation 16’ licence (‘Licence to keep fauna for educational or public purposes’) will be required from DEC by the City of Joondalup to translocate and manage native fauna species within the confines of the sanctuary. Application forms are available from the DEC website¹².

The licence application will need to include, but not be limited to, the list of species that may be released into the sanctuary and their suitability, the general management and monitoring procedures and general information about feral animal control and habitat management.

All fauna translocations into the sanctuary require DEC’s prior written approval. This is normally achieved following the preparation and approval of a translocation proposal in accordance with the guidelines set out in DEC Policy Statement No. 29.

A translocation proposal must include:

- The source of individual animals to be translocated
- A description of the predator-proof fence and predator control programs for foxes and cats
- An assessment of the suitability of the habitat for the particular species
- Issues to do with existing or potential animal disease

¹¹ Note: The following section has been derived from information provided by DEC’s Species and Communities Branch (Nature Conservation Division).

¹² http://www.dec.wa.gov.au/index.php?option=com_content&task=view&id=864&Itemid=1992

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

- Details of post-translocation monitoring and management of released animals
- Animal welfare considerations
- An assessment of the genetic diversity of the population to be translocated and its potential long-term genetic viability
- Conservation benefits of the program and its contribution to any existing species recovery plans
- Animal ethics issues
- Evidence of long-term financial support for the sanctuary.

If a state or federal recovery plan exists for the species, the translocation plan must be in accordance with the goals and objectives of the recovery plan(s). Assessment of a translocation proposal by DEC can take several weeks depending on the complexity of the translocation proposal.

In addition to the above requirements for a licence and translocation proposals, any movement of native animal or animals will require DEC's approval on each occasion.

Licencing of fauna and flora survey activities

Research within the sanctuary such as surveys of fauna and flora (including fungi) may require a licence from DEC. Fauna surveys involving the capture or trapping of animals will require a 'Regulation 17' licence ('Licence to take fauna For scientific purposes'), under the *Wildlife Conservation Regulations 1970*. Similarly, any collection of plant specimens will require a 'Regulation 23' licence ('Licence to take flora for scientific purposes').

As a condition of the licence, the licensee is required to submit an annual return detailing the species and numbers that were captured for fauna, and details of specimens collected for identification purposes for flora.

Bush Forever

Under the clearing regulations of the *Environmental Protection Act 1984*, Bush Forever areas are recognised as environmentally sensitive areas.

The classification of the Craigie Bushland as a Bush Forever site limits the range of management options for the Craigie Bushland Native Wildlife Sanctuary. Management decisions will need to be compatible with the Bush Forever's goals and policies (Department of Environmental Protection 2000a) and the newly adopted State Planning Policy for Bushland in the Perth Metropolitan Region (SPP 2.8), which has been in a draft form since 2004 and was adopted by the State Government earlier this year (Government of Western Australia 2010). SPP 2.8 sets out a process (SPP 2.8 Fig. 2 &

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

Appendix 1) and criteria (SPP 2.8 Appendix 2) for the assessment of activities or decisions that have the potential to cause an environmental impact on a Bush Forever site. Craigie Bushland as Bush Forever Site 303 falls under the category ‘Bush Forever Reserve’ (SPP 2.8 section 5.1.2.1).

The *Metropolitan Region Scheme (MRS) Amendment 1082/33 - Bush Forever and Related Lands* is currently being considered by the State Parliament after a period of public submissions.

Covenancing

Nature conservation covenants are legally binding voluntary agreements used to protect bushland conservation values by restricting potentially damaging activities. Nature conservation covenants provide legal protection in perpetuity.

The City of Joondalup may wish to investigate the covenancing of Craigie Bushland Native Wildlife Sanctuary. Two agencies offer conservation covenancing in Western Australia: the Department of Environment and Conservation and the National Trust of Australia (WA). Assistance may be provided, in the form of best practice advice, to manage the sanctuary if the bushland is covenanted.

Commonwealth legislation

The translocation of threatened species listed under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* does not require a referral to the federal Minister for Environment, Water, Heritage and the Arts.

REVIEW OF NATIVE MAMMAL SPECIES WITH POTENTIAL FOR TRANSLOCATION INTO THE SANCTUARY

Native mammal species considered as suitable or potentially suitable for release into the sanctuary include:

Species considered suitable for Stage 1 release into the sanctuary	Species considered potentially suitable for Stage 2 release into the sanctuary
Quenda (Southern Brown Bandicoot)	Woylie
Brushtail Possum	Tammar wallaby
Honey possum	Western brush wallaby
Western pygmy-possum	

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

Ecological notes are derived from Cronin (1991) and Van Dyke & Strahan (2008) unless otherwise specified. Biological, ecological, distributional and photographic information can be found in DEC's Fauna Species Profiles¹³ (DEC undated-c). The scientific names and alternative common names of all fauna species are provided in Appendix 3.

Note on threatened and priority species categories in Western Australia

The various threatened and priority species categories in Western Australia are as follows:

- **Threatened species:** Species listed as 'Rare or likely to become extinct' under the WA *Wildlife Conservation Act 1950* (as per Government Gazette of 23/02/2010). These species are given a ranking ('Endangered' or 'Vulnerable') according to IUCN's international criteria.
- **Priority species:** This category applies to species that are not listed as 'Rare or likely to become extinct' under the WA *Wildlife Conservation Act 1950*, but require special protection because they are rare or have declined significantly. Only Priority 4 and 5 species are mentioned in this report:
 - **Priority 4 listing:** species that are considered to be adequately surveyed, or for which sufficient knowledge is available and are not currently threatened, but need monitoring.
 - **Priority 5 listing:** species that are not threatened, but are in need of monitoring, that is subject to a specific conservation program, which if ceased would result in the species becoming threatened within five years.

The Priority 1, 2 and 3 categories are not mentioned in this report and not described here.

Species considered as suitable for Stage 1 release into the sanctuary

Quenda (Southern Brown Bandicoot)

Distribution: Widespread, but extinct from the Wheatbelt and declining in the South-West of Western Australia. Also found in the Eastern States, though as a different subspecies. Still widespread, but has declined in abundance in bushland across the Perth Metropolitan Area and in the jarrah forest on the Darling Scarp. The species was until recently found in Craigie Bushland and may still occur there (D. Pike pers. comm.).

Threatened species status: Priority 5 as per the DEC listing dated 19/10/09. See Conservation Statement by Courtenay (1995a).

Ecological notes: Nocturnal. Omnivorous, consuming a wide variety of foods including earthworms, insects, fruiting bodies of underground fungi. Woodland and shrubland with thick understorey cover, suburban backyards and parks. Home range for males up to 7 ha, females up to 2 ha. Males are

¹³ <http://www.dec.wa.gov.au/content/view/3432/1999/1/2/>

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

territorial and aggressive towards each other. Characteristic conical diggings in the ground. Size: 400 g to 3.2 kg.

Prospect for translocation to Craigie Bushland: Good candidate for release into Craigie Bushland, as the species may still be present in the sanctuary and the habitat is suitable. Monitoring will be required to ensure that numbers do not exceed the carrying capacity of the sanctuary, although young quenda may be able to move through the fence. Prior to any translocation taking place, the absence of the species from Craigie Bushland Native Wildlife Sanctuary would need to be established.

Potential sources of animals for translocation: Wildlife rehabilitation facilities, sites earmarked for development where wildlife trapping and relocation is taking place for conservation purposes, other wildlife sanctuaries.

Brushtail Possum

Distribution: Widespread in forest, woodland as well as suburban parks and gardens. Common across the South-West of Western Australia, including the Perth region.

Threatened species status: Not threatened.

Ecological notes: Nocturnal. Arboreal, agile. Feeds on eucalypt leaves. Home range size: 2 ha (females) and 10 ha (males) (Statham & Statham 1997). Population density 0.2 to 4 individuals/ha (Van Dyke & Strahan 2008). Territorial males show aggression towards each other. Competition with less dominant ringtail possum for tree hollows where the species occur together. Size: 1.5 to 4 kg.

Prospect for translocation to Craigie Bushland: likely to have been found at Craigie Bushland in the recent past, and may still be present.

Potential sources of animals for translocation: Wildlife rehabilitation facilities, sites earmarked for development where wildlife trapping and relocation is taking place for conservation purposes, other wildlife sanctuaries.

Other mammal species

Both the honey possum and the western pygmy-possum occur on Perth's Swan Coastal Plain in similar habitats to those found in Craigie Bushland and would be suitable for translocation into the sanctuary. However they would not be able to be contained within the enclosure because of their ability to easily move through the fence due to their small size. The honey possum feeds exclusively on nectar and pollen. The Proteaceae species found at Craigie Bushland are likely to provide an adequate food source for the species (see 'Flora' section under 'Existing environment' in this report).

The following species used to occur or still occur on Perth's Swan Coastal Plain and could be potential candidates for translocation: western bush rat, yellow-footed antechinus or mardo, ash-grey mouse and various species of dunnarts. They are all small and would not be able to be contained within the enclosure.

Species considered as potentially suitable for Stage 2 release into the sanctuary

All the species below will require a substantial level of management if translocated into the sanctuary, including the need to remove excess individuals as populations increase.

Woylie

Distribution: Various populations in forested parts of the South-West of WA. Successful species recovery in the 1980-90s (Start *et al.* 1995) has been followed by a sharp decline over most of its range for reasons still unknown, but likely to include predation by foxes and feral cats and possibly disease. No historical records of the species on Perth's Swan Coastal Plain positively identified (subfossil records on Perth's Swan Coastal Plain 12,000 years old). Translocated to Karakamia Sanctuary and Woodland Reserve in Whiteman Park.

Threatened species status: Listed as 'Rare or likely to become extinct' (ranked 'Endangered') under the *Wildlife Conservation Act 1950* and 'Endangered' under the *Environment Protection and Biodiversity Conservation Act 1999*. The existing Recovery Plan (Start *et al.* 1995) is under review (Interim Recovery Plan currently in preparation).

Ecological notes: Nocturnal. Inhabits forest/woodland/shrubland with dense understorey and open grassy areas. Feeds mainly on fruiting bodies of underground fungi, supplemented by bulbs, tubers, seeds, insects. Overlapping home range of 20 ha or more. Karakamia Sanctuary has an estimated population of about 400 woylies in an area of 270 ha (ave. 1.5 woylies/ ha; Manda Page, pers. comm., AWC). Woylies help spread spores of underground fungi contained in their dung pellets. Many of these fungi are mycorrhizal fungi which have a symbiotic relationship with native trees and shrubs by facilitating the uptake of soil nutrients from the plant root system (Orsini 1999). Size: 1.1 to 1.6 kg.

Prospect for translocation to Craigie Bushland: A trial release has taken place at Whiteman Park into a wildlife sanctuary similar to the one proposed at Craigie Bushland (similar vegetation types and geographic location on Perth's Swan Coastal Plain). Depending on the results of this trial, woylies may be considered for release into Craigie Bushland Native Wildlife Sanctuary. However the population would need to be closely managed, as the estimated 60 or so woylies that Craigie Bushland could hold could be rapidly exceeded, as the species has a rapid breeding rate (2-3 young/year, sexual maturity at 5-6 months). The Karakamia woylie population increased from 30 animals in 1998 to 400 in 2010, with 600 removed from Karakamia and released at various sites in the intervening period. Karakamia could be a potential source of individuals for release into Craigie Bushland Native Wildlife Sanctuary subject to prior agreement from DEC and AWC.

Potential sources of animals for translocation: Wildlife rehabilitation facilities, other wildlife sanctuaries in Western Australia, DEC-managed conservation estate, sites where woylies are held for the purpose of research (eg. the Native Animal Rescue wildlife rehabilitation centre in Malaga).

Tammar wallaby

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

Distribution: Localised populations in the South-West of WA, common on Garden Island. Also found in Southern Australia. Not found on Perth's Swan Coastal Plain, but abundant on Garden Island, thus would have been found on Perth's Swan Coastal Plain less than 5,000 years ago when Garden Island was connected to the mainland. Translocation at Karakamia Sanctuary successful with an estimated 150 individuals on 270 ha (M. Page, pers. comm., AWC).

Threatened species status: Priority 5 as per the DEC listing dated 19/10/09.

Ecological notes: Nocturnal. Eats grasses and leaves of shrubs. Overlapping home ranges of up to 30 ha. Lives up to 11 years. Produces a single young at the same time every year. Size: 4 to 10 kg.

Prospect for translocation to Craigie Bushland: A trial release of the species may occur at Whiteman Park's Woodland Reserve soon. Depending on the results of this trial, tammar wallabies may be considered for release into Craigie Bushland Native Wildlife Sanctuary. A breeding population is only suitable for such a small sanctuary if a specific management regime is implemented to prevent increase above the sanctuary's carrying capacity.

Potential sources of animals for translocation: Wildlife rehabilitation facilities, other wildlife sanctuaries in Western Australia, DEC-managed conservation estate.

Western brush wallaby

Distribution: Endemic to the SW of WA, where it is widespread, but declining across the region. Isolated populations in larger bushland areas in the Perth Metropolitan Area, such as Whiteman Park and on the Darling Scarp. Used to be present on the Edith Cowan University campus at Joondalup, and still occurs in the Yellagonga Regional Park (R. Davis, pers. comm.). Unlikely to be found currently in Craigie Bushland (D. Pike pers. comm.).

Ecological notes: Nocturnal. Inhabits open forest or woodland areas with dense understorey in patches. Usually solitary or in pairs. Habitat overlaps with that of the western grey kangaroo. Extinction in the wild increases as bushland size decreases. With a large home range of 30 ha or more, extinction rates are high in reserves of less than 100 ha (Courtenay 1995b). Size: 7 to 9 kg.

Threatened species status: Priority 4 as per the DEC listing dated 19/10/09. See Conservation Statement by Courtney (1995b).

Prospect for translocation to Craigie Bushland: A breeding population may not be suitable for such a small sanctuary. Further translocation from the wild is generally not desirable, as the species is difficult to capture, very sensitive to stress and has been known to die in cage traps. However, trapping and translocation may be an option from sites earmarked for development where the species' habitat will be cleared. Release of rehabilitated animals from a wildlife care facility may be suitable. If the species are released into the sanctuary, not more than 4 or 5 individuals in total should be released and fertility control would be desirable (see section below on kangaroo fertility control). Prior to any translocation taking place, the absence of the species from Craigie Bushland Native Wildlife Sanctuary would need to be confirmed.

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

Potential sources of animals for translocation: Wildlife rehabilitation facilities, sites earmarked for development where wildlife trapping and relocation is taking place for conservation purposes. Species deemed as not suitable for translocation from the wild in normal circumstances because of its sensitivity to stress when trapped and risk of injury or death in the process.

Species considered as unsuitable for release into the sanctuary

Western Ringtail Possum

Distribution: Endemic to the South-West of WA. Coastal peppermint and tuart woodland from Busselton to Bunbury and Yalgorup National Park, and possibly Darling Scarp (Jarrahdale). Also scattered populations across the South-West in jarrah/marri/wandoo forest. Translocated to Karakamia Sanctuary but limited population increase probably due to limited habitat and inter-specific competition with brushtail possums (M. Page, pers. comm., AWC).

Threatened species status: Listed as 'Rare or likely to become extinct' (ranked 'Vulnerable') under the *Wildlife Conservation Act 1950* and 'Vulnerable' under the *Environment Protection and Biodiversity Conservation Act 1999*. Recovery plans by both federal (DEWHA) and Western Australian (DEC) environmental agencies (Anon. 2009; Burbidge & de Tores 1998).

Ecological notes: Nocturnal. Feeds mainly on Myrtaceae leaves, also flowers and fruits. Competition with more aggressive brushtail possum for tree hollows in the jarrah forest, which can result in ringtail possums using sub-optimal habitat. Inhabits dense, coastal peppermint forest, home ranges are 0.5 hectares to 1.5 hectares and in eucalypt forests about 2.5 hectares. In contrast, in the northern jarrah forests, home ranges have been recorded up to 5.6 hectares. Size: 660 g to 1.1 kg.

Prospect for translocation to Craigie Bushland: Unlikely to be suitable for release into Craigie Bushland, as the species has a limited tolerance to the heat levels that occur in summer in the Perth region (appears to suffer in temperatures above 30°C and deaths occur in temperatures above 36°C). The species currently does not occur along the coast north of Yalgorup National Park between Bunbury and Mandurah. Lack of peppermint trees may not be a key obstacle for translocation at Craigie Bushland, as the species used to be found up to Dongara along the coast and is found inland in the jarrah forest.

Quokka

Distribution: Endemic to the South-West of WA where localised populations are found. In the Perth region, only known population in Jarrahdale. Translocated to Karakamia Sanctuary where it is present in small numbers in limited suitable habitat (M. Page, pers. comm., AWC).

Threatened species status: not classified as Threatened, but very localised and declining over its range in the South-West of WA.

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

Ecological notes: Nocturnal. Eats grasses and leaves of shrubs and trees. Inhabits thick swamp and riparian vegetation on the mainland and dry shrubland on Rottnest Island, with only seasonal access to freshwater. Males highly territorial during breeding and around fresh water sources. Size: 2.4 to 3.6 kg.

Prospect for translocation to Craigie Bushland: Species not suitable for such a small sanctuary (unless an intensive management regime is implemented): likely to overgraze habitat and breed up in excess of carrying capacity of bushland. Mainland habitat of dense swamp vegetation absent from Craigie Bushland.

Numbat

Distribution: Only found in the South-West of WA. Originally found across Australia.

Threatened species status: Listed as 'Rare or likely to become extinct' (ranked 'Vulnerable') under the *Wildlife Conservation Act 1950* and 'Vulnerable' under the *Environment Protection and Biodiversity Conservation Act 1999*.

Ecological notes: Diurnal. Feed only on termites. Inhabits shrubland/woodland and open wandoo and jarrah forest/woodland with hollow logs on the ground for nesting. Home ranges of 20 to 50 ha can overlap. Last recorded on Perth's Swan Coastal Plain at Perth Airport in the early 1980s. Size: 280 to 550 g. Unsuccessful translocation to Karakamia Sanctuary, possibly due to small size of the sanctuary and lack of food resources.

Prospect for translocation to Craigie Bushland: Species not suitable for such a small sanctuary (unless an intensive management regime is implemented): each individual requires 20,000 live termites per day and has a home range of up to 50 ha. To be able to maintain numbats within the sanctuary, a daily supplementary feeding program would have to be put into place representing a costly and long-term undertaking and requiring dedicated staff.

Short-beaked echidna

Distribution: Found across Australia.

Threatened species status: Not threatened.

Ecological notes: Diurnal. Wide range of habitats. Eats termites and ants, also other invertebrates (grubs, larvae and worms). Generally solitary. Most active early in morning and late afternoon during summer, and during the day in winter. Overlapping home ranges 800 m across. Can go easily unnoticed. Size: 2 to 7 kg.

Prospect for translocation to Craigie Bushland: Species not suitable for a small sanctuary, requires an extensive home range. Species likely to attempt to leave the sanctuary, risking damage to the fence in the process with its powerful claws.

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

Chuditch and brush-tailed phascogale: Species not suitable for such a small sanctuary as they have a very large home range. In addition, these species are extremely mobile and would easily escape from the enclosure.

Other mammal species

There is no direct evidence that boodies, bilbies, banded hare-wallabies and dighters were present on Perth's Swan Coastal Plain in historical times. They are unlikely to be approved for translocation by DEC due to the fact that there is no evidence they belong to the original fauna of the region, the small size of the sanctuary, their threatened status and the difficulty to source these species for translocation.

Sourcing native mammals for translocation

Four main sources exist to seek native mammals for translocation:

- Wildlife rehabilitation facilities and wildlife carers
- Sites earmarked for development where wildlife trapping and relocation is taking place for conservation purposes
- Privately managed wildlife sanctuaries (e.g. AWC)
- DEC-managed conservation estate.

Each fauna translocation, regardless of the source, requires approval from DEC's Nature Conservation Division.

SANCTUARY MANAGEMENT

Update of 1999 Draft Management Plan

The 1999 Craigie Open Space Management Plan (Anon. 1999) is still in a draft stage and has still not been adopted by the Joondalup Council. Most of the fauna and flora information available on Craigie Bushland dates back to the 1990s and needs to be updated.

A review and update of the 1999 Craigie Bushland Draft Management Plan in the context of the new Craigie Bushland Native Wildlife Sanctuary would be desirable in order to implement an effective bushland management program. As part of this review a comprehensive fauna and flora survey will need to be conducted. Providing detailed guidance on bushland management for the Craigie Bushland Native Wildlife Sanctuary is outside the scope of this plan.

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

Recommendation

- To review, update and finalise the 1999 Craigie Open Space Draft Management Plan, incorporating the Craigie Bushland Native Wildlife Sanctuary Management Plan's key recommendations and requirements related to future fauna translocations, and that the revised Management Plan be adopted by the Joondalup Council.

Baseline surveys

Prior to translocating any mammal species into the sanctuary, it is essential to carry out a 'state of the environment' assessment inside the bushland. Baseline surveys will be required for:

- Vegetation
 - Composition and structure, including weed species
 - Bushland condition
 - Fungi
- Fauna:
 - Mammals (both native and introduced)
 - Birds
 - Reptiles
 - Frogs
 - Invertebrates

A variety of techniques may be required to record species presence, abundance and distribution within the bushland: opportunistic observations, pitfall traps, Elliott traps, cage traps, sand pads (baited, unbaited), hair tubes, spotlighting, infrared camera traps. For each fauna group a survey methodology will need to be prepared, with sampling techniques (in time and space), timelines, number of staff required and budget.

Community volunteers, school, TAFE or university students may be able to contribute to survey activities.

Fauna surveys are best carried out in spring (Sept.-Oct.) for mammals and birds, autumn and spring for reptiles and autumn/winter for frogs. Vegetation and habitat surveys can be carried out at any time of the year, but flowering plants are best identified in spring.

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

After the closure of the perimeter fence and prior to translocating any native mammals, it is recommended to retain small exclusion fenced plots that will remain inaccessible to released fauna ('controls') to assess the impact of released fauna on the ecosystem ('treatments').

Monitoring program

A general habitat monitoring program will need to be put in place that includes:

- Monitoring of possible cat and fox incursions through regular checks of the perimeter fence, as well as using sand pads (baited and unbaited), direct observations (scats, dens, prey remains, etc.) and infrared camera traps
- Habitat condition monitoring before and after translocations: vegetation condition mapping, indicator species, leaf litter accumulation, fauna species distribution and abundance, weed species.

The monitoring of translocated animals will include the following:

- Releasing animals first into a 'soft release' enclosure where they can be closely monitored in the first days/weeks post-translocation for those animals that may require it
- Trapping all translocated fauna regularly (1-2 times annually) to monitor the animals' health and body condition, reproductive status, presence of pouch young, etc. and provide an opportunity to notice any signs of population stress or disease. There may also be the need to monitor intensively for 2-4 weeks immediately post-release using radio-telemetry.

A monitoring plan will need to be prepared indicating the goals of the monitoring program, the species and communities (flora and fauna) that will be monitored, the timing and frequency of monitoring and the methods used.

Carrying capacity, dealing with excess animals

The carrying capacity of a species is defined as the number of individuals of a particular species that can be sustained for a particular set of environmental conditions. Although this definition implies that the carrying capacity is constant, it is in reality a variable number that depends on climatic variability, competition from other species for food and habitat, predation levels, etc.

This concept can be useful to determine how many animals of a particular species the sanctuary can sustain in the long term based on current available habitat.

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

A breeding population inside a fenced enclosure, no matter the size of the enclosed area, will increase in excess of the species' carrying capacity if new recruitment exceeds natural mortality and predation, because there is no emigration possible.

Some marsupial species adjust their fertility to the availability of resources in the environment through mechanisms like embryonic diapause, where species cease breeding for a period of time, usually over the drier summer months (Van Dyke & Strahan 2008).

Providing access to permanent water and supplementary feeding is likely to artificially increase animal numbers within the sanctuary and should be avoided as much as possible.

Capture of surplus breeding animals and release into appropriate areas, such as nature reserves, national parks and wildlife sanctuaries will be required at various times, both to alleviate pressure within the enclosure and to maintain genetic diversity within the populations. The detail of how many animals need to be captured and where these animals will be released will be specified in the translocation proposals required for each species by DEC.

Indicators of overpopulation may include specific changes to native vegetation, litter or soil, territorial fighting between males, increased incidence of disease or a loss of condition by particular animals.

Fauna habitat management

Once a detailed habitat assessment has been carried out for the range of fauna species proposed for translocation to the sanctuary, a fauna habitat management plan will need to be developed.

This may include habitat enhancements such as:

- Placement of additional tree hollows and hollow logs, e.g. for numbats
- Placement of piles of dead wood on the ground to enhance wildlife habitat, e.g. for invertebrates, reptiles, birds and mammals)
- Creation of a seasonal wetland in the south-west corner of the sanctuary.

Wetland creation program

A sump in the south-west corner of the sanctuary collects runoff water from the surrounding built-up areas. This represents an ideal site for the creation of a new seasonal wetland and associated fauna (e.g. frogs, invertebrates) habitat.

The following **wetland creation activities** are suggested:

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

- Soften two of the three steep sides of the sump to a low gradient using machinery equipped with wheels (not tracks) to minimise ground disturbance
- Retain one steep side of the sump for fauna habitat (e.g. rainbow bee-eaters, monitor lizards)
- Plant wetland vegetation to create a gradient of habitats, from sedges at the water's edge to dense shrubs species further upslope.

Recommendation

- That a seasonal wetland be established where the current sump in the south-west corner of the sanctuary is using native species plantings of local provenance.

Weed control

Weed control programs will need to be modified to fit in with fauna management requirements. Generally, the routine use of chemicals and herbicides should be phased out from the sanctuary, to avoid any potential effect on wildlife. The 2010 spring season is to be used for intensive control of highly invasive weeds such as *Lachenalia* that cannot be controlled by other means than herbicides. Hand removal or spot spraying of invasive weeds are recommended after translocations have started to proceed.

Attention is required to the introduction of new weed species during the translocation of mammals, particularly herbivorous species that may have ingested weed species, which may then be released within dung at the translocation site.

Kangaroo management

A small but unknown number of western grey kangaroos are present within Craigie Bushland and some kangaroos are likely to remain inside the perimeter fence when the enclosure is sealed off. Western grey kangaroos are a natural part of Perth's Swan Coastal Plain environment and it may be seen as desirable to retain a small population within Craigie Bushland Native Wildlife Sanctuary.

The first course of action is to determine how many kangaroos are currently in Craigie Bushland and what their patterns of movements are. The chosen kangaroo management strategy for Craigie Bushland Native Wildlife Sanctuary will depend largely on the result of that kangaroo survey.

Few long-term studies exist of kangaroo populations in Western Australia. One such study in the Wheatbelt suggests that kangaroo populations living in remnant bushland surrounded by paddocks are relatively stable (Arnold *et al.* 1991a; Arnold *et al.* 1991b). Based on Arnold's density estimates of 0.05 to 0.2 kangaroos per ha (op. cit.), the carrying capacity of a 40 ha remnant would be between 2

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

and 8 animals. The average density of western grey kangaroos in jarrah forest in the south-west of WA is at the lower end of that range (0.08 kangaroos per ha).

Kangaroos are known to reach high numbers when there is permanent access to food and water, e.g. around lakes, golf courses and parkland. Predation by foxes on young joeys is a limiting population factor (e.g. Marangaroo Golf Course, C. Mayberry pers. comm.). High number of kangaroos can become a management issue, damaging fences and overgrazing native bushland.

Kangaroo populations seldom remain stable in some small fenced-off bushland reserves. In the 20 ha Hepburn Conservation Reserve within the City of Joondalup, a small number of kangaroos has subsisted for over 20 years at about the same level. This population does not have access to permanent water or grassy areas, thus needs to rely on the limited resources that native bushland provides, contrary to the large number of kangaroos living around the lakes and lawns of Pinnaroo Valley Memorial Park, which have reached plague proportions.

If current kangaroo numbers within Craigie Bushland are small (less than 10 to 12), a possible option is to retain those kangaroos and closely monitor their numbers over the ensuing two years. If kangaroo numbers remain stable, no action will be required in the short term.

If kangaroo numbers increase, a decision can then be made whether to:

- Retain kangaroos within the enclosure in combination with fertility control
- Remove some or all kangaroos from the sanctuary and translocate them to another bushland site.

Culling at Craigie Bushland is unlikely to be acceptable given current community attitudes and the fact that the sanctuary is surrounded by human habitation.

All fertility control techniques (Herbert 2004) involve some element of surgical procedures. These techniques include male vasectomy, male castration, female sterilisation and female contraception. The effectiveness of female kangaroo contraception is at least 12 months (C. Herbert, pers. comm.) and this option requires the capture of all females inside the sanctuary every year. All the fertility control options involve kangaroo capture and anaesthesia by darting.

All the population control options will require a Kangaroo Management Plan approved by DEC. This plan should be prepared by a qualified kangaroo expert. For more information on kangaroo management, see DEC Wildlife Management Notes (DEC undated-a, b).

Feral animal control

Several species may potentially be present within the sanctuary at the time of fence closure: cats, foxes, rabbits and feral bees, as well as several introduced birds (rainbow lorikeets, little and long-billed corella). It is also possible that domestic dogs and domestic cats may find themselves inside the enclosure at the time the perimeter fence is closed. These pets will need to be located, captured and returned to their owners where possible.

Cats (domestic or feral) and foxes represent the biggest threat to native fauna because of their remarkable effectiveness as predators. Foxes and cats will need to be completely removed from the sanctuary before any translocation of native wildlife can take place. Further, cats can also transmit diseases to native wildlife such as toxoplasmosis and sarcosporidiosis. For a recent review of cat ecology and management strategies in Australia, see Denny and Dickman (2010).

Rabbits are present in low numbers inside the perimeter fence. They represent a potential threat to bushland, native fauna habitat and fence stability.

Bees occupy hollows that could be used by native fauna. They will require ongoing control as there is no method to keep them from reinvading the sanctuary. There are a number of effective methods to control rainbow lorikeets and corellas residing and breeding within the sanctuary.

Perimeter fence design

The perimeter fence at Craigie Bushland Native Wildlife Sanctuary has been designed to prevent foxes and cats from entering the sanctuary. Its characteristics are as follows:

- 2.1 m tall fence constructed of 30 mm chain link mesh and 600 mm overhang towards the outside at 55°
- A horizontal chain link mesh apron on inside and outside of fence that is 300 mm below ground and extends 450 mm on each side of fence, with crushed limestone rock on top of apron on the outside of the fence
- No electric wire on either the top or along the sides of the fence.

The following table presents results of an experimental study of the efficacy of various fence designs to prevent feral cats and foxes from breaching a variety of fence types (Robley *et al.* 2006) compared with the existing fence at Craigie Bushland. Fence types in the study varied in height, presence/absence of a mesh apron on the outside and presence/absence of electrified wiring.

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

Experimental study (Robley <i>et al.</i> 2006)	Craigie Bushland Native Wildlife Sanctuary fence
A fox could get over a floppy top fence of 1.2 m high that does not have electric wiring, but a 1.8 m high fence without electric wiring was not breached by foxes during the experiment.	The 2.1 m fence with overhang at the Craigie Bushland Native Wildlife Sanctuary is likely to prevent foxes from breaching the fence.
Foxes managed to dig under a shallow mesh apron a number of times during the experiment.	The current fence design with crushed limestone rock on the outside of the fence should prevent foxes and rabbits from digging under the fence.
A fox managed to repeatedly chew through the lower mesh of the fence.	It is at least highly unlikely that a fox could chew through the mesh at Craigie Bushland Native Wildlife Sanctuary, as the chain link mesh is particularly strong.
There were increased numbers of contacts by feral cats with the overhang as the electric wires were moved higher <i>or removed altogether</i> .	This suggests that the absence of electric wires will increase the chances of a cat trying to get to the top of the fence.

Recommendation

- Floppy chain link mesh to be added to the overhang on the outside of the fence to stop foxes and feral cats from climbing over the top of the fence. A trial period will be necessary to ensure the effectiveness of the fence design at keeping feral predators out.

Removal of cats from sanctuary

The potential exists for domestic and feral cats to remain inside the wildlife sanctuary upon closure of the fence.

The use of baited cage traps is a method to remove cats from the sanctuary that can be effective (Sharp & Saunders undated). Trapping should be done in such a way that the capture of non-target animals in traps is avoided at all times. Leg hold traps can also be used if cage trapping is unsuccessful.

Trapped domestic cats can be returned to their owners if the cat has a collar or is microchipped. If the owner cannot be identified, the cat can be housed in a cat shelter pending further claims by potential owners, and, after a set amount of time, put out for adoption. Feral cats can be taken away and euthanased in a humane manner.

Removal of foxes from sanctuary

The use of foothold traps is the recommended method to remove foxes from an urban bushland area and usually results in a 100% removal rate (M. Butcher, pers. comm.). The use of cage traps is not recommended as foxes can become wary of the traps and become very difficult to capture. Given the low density of rabbits inside Craigie Bushland it is unlikely that there may be more than a few foxes in the bushland. The various methods of controlling foxes is reviewed in various field notes (Butcher undated; DAWA 2005).

Control of rabbits

Control methods for rabbits are reviewed in Department of Agriculture field notes (DAFWA 2007; DAWA 2001). The recommended control method for rabbits is warren destruction and fumigation. Grain poisoned with 1080 is the recommended option in fenced urban bushland as it poses not risk to the native bird and mammal species. It is essential to avoid baiting with anti-coagulant poisons such as Pindone which kills quenda and western grey kangaroos.

Control of feral bees

Destroying feral bee swarms inside tree hollows requires accessing the hollow with a ladder or ropes and killing the swarm with an insecticide. This needs to be done in early spring and autumn. DEC has developed an efficient bee control method that does not require hives to be located or trees climbed. This method is still under a research permit, but will hopefully be available for wider use in the near future.

General remarks

Culling cats, foxes or rabbits using firearms can be carried out in a small reserve surrounded by human habitation, if conducted by experienced operators with the appropriate firearms, but may be opposed by a section of the community on animal welfare grounds.

Farm notes about the safe use of 1080 poison have been produced by Department of Agriculture and Food Western Australia (DAFWA 2007, 2009). 1080 meat baits would need to be tethered to a stake and buried underground to avoid the risk of them being carried outside the perimeter fence by scavenging birds. 1080 grain baits should be scattered rather than laid in furrows to minimise risk to non-target species and prevent trails from being eaten out by kangaroos and granivorous birds. Neighbouring residents would need to be advised of the baiting program through a community information campaign.

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

The removal of all cats and foxes from the sanctuary may extend over several months. It is a prerequisite to the release of any native mammal into the sanctuary. The removal of cats and foxes from the sanctuary will need to be carried out by professional and qualified contractors.

Feral animal control should be done humanely at all times and in accordance with existing legislation (*Animal Welfare Act 2002, Dog Act 1976, Agriculture and Related Resources Protection Traps Regulations 1982* and common law).

Fire control

The Fire and Emergency Services Authority of WA (FESA) is the statutory authority in charge of firefighting in Western Australia. Fire management is an essential component in the management of Craigie Bushland Native Wildlife Sanctuary.

Fire has the potential to have catastrophic consequences on fauna species inside the perimeter fence, as fire may sweep through most of the bushland trapping fauna inside the fence. Preventing fire should be the primary goal of any fire strategy.

The second goal should be to put out any fire that may have started within the bushland as a matter of the highest priority. Emergency procedures with clear lines of responsibility and ongoing liaison between FESA and City of Joondalup should be in place and accessible to staff at all times.

Recommendations

- That the City of Joondalup liaise with FESA to develop a Fire Management Plan for the whole of Craigie Bushland that emphasises the high natural and wildlife values of the bushland and the sanctuary, with clear response times and priorities allocated to any emergency. The Fire Management Plan should include the provision of appropriate firebreaks within and surrounding the sanctuary, access gates should fire control be necessary, and monitoring and management of fuel loads within the sanctuary at appropriate times of year.
- That a fire hazard and risk assessment plan be prepared by the City of Joondalup.

Fire risk assessment

Arson is a substantial fire risk for Craigie Bushland Native Wildlife Sanctuary. Fire may originate inside the sanctuary or outside the perimeter fence. These risks can be minimised by implementing an early warning system based on community vigilance during high fire risk periods and by carrying out

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

an active local community engagement program, so that the local community becomes an active stakeholder in the management of the sanctuary.

The high asset value of the wildlife that will be translocated into the sanctuary and the high conservation significance of the bushland require a very high priority rating for fire prevention and control.

Depending on weather conditions and other parameters, small ground fires are likely to be tackled by ground crews using small 4WD vehicles with 1000 litre water storage, while larger fires would require an aerial fighting capability (e.g. FESA's Helitac helicopters).

Recommendations

- That the City of Joondalup prepares in consultation with FESA a Fire Risk Management Plan
- That the City of Joondalup ensures that up-to-date aerial photos of Craigie Bushland and maps showing emergency gates into Craigie Bushland Native Wildlife Sanctuary are available and that master keys to all gates are passed on to both FESA and the Duncraig Fire Brigade.
- That the City of Joondalup conveys to FESA and the Duncraig Fire Brigade the high significance of the Craigie Bushland Native Wildlife Sanctuary as far as fire fighting priority is concerned.

Emergency gates

Keys to the nine emergency gates need to be held by FESA personnel at all times. Signage within the sanctuary needs to point to the nearest emergency exit(s). A map of the sanctuary featuring emergency exits and tracks needs to be provided to all visitors.

Phytophthora management

The root fungus *Phytophthora nicotianae* has been identified in several areas of Craigie Bushland. A dieback control plan needs to be put in place to avoid the spread of the disease that includes an updated map of current infestations and likely areas of spread (e.g. drainage lines).

Technical reference panel

To ensure that the best relevant expertise is available during the various stages of the project, a group of technical experts will be required to provide advice and guidance to the City of Joondalup and the sanctuary management team in the fields of fauna and flora ecology and management, wildlife translocations, environmental management, landscaping, veterinary science and wildlife care.

Recommendation

- That a Technical Reference Panel be formed representing various agencies and fields of expertise as required.

COMMUNITY ENGAGEMENT

Community Engagement Plan

Community engagement and support is an essential component of developing a successful sanctuary at Craigie Bushland. The community is a key stakeholder in the project and community support, participation and partnership will not only contribute to successfully fulfilling project goals and outcomes, but also to ensure that the community is fully involved throughout the various stages of the project.

In order to actively engage the community along with the project, a Community Engagement Plan needs to be developed that includes a detailed budget and timetable for implementation. That plan may include the following:

- Leaflets, posters and information panels at the Craigie Leisure Centre and at council offices
- Distribution of information pamphlets in letterboxes of neighbouring residents
- Articles and advertisements in community newspapers
- Holding public open days at the sanctuary before and after perimeter fence closure
- Using the 'fence closure' event as an opportunity to hold an official launch of the sanctuary to mark the occasion with appropriate media coverage
- Development of a school education program
- Assistance with the creation of the sanctuary Friends group

An informal Friends of Craigie Bushland group exists at present and meets on an irregular basis.

Recommendation

- That a Community Engagement Plan be prepared for the Craigie Bushland Native Wildlife Sanctuary.

Community Stakeholder Group

The formation of a Community Stakeholder Group will help promote and facilitate the circulation of information between the City of Joondalup and the community.

Recommendation

- That a Community Stakeholder Group be formed representing key community interests to help developing an effective community relations and communication process.

VISITOR MANAGEMENT AND TOURISM

Public access

Current uses of the bushland include bushwalking, people walking their dogs, nature appreciation (wildflowers, birds, invertebrates). Current users include visitors from the local neighbourhood and further afield.

People who have been using the bushland for recreation and nature appreciation are likely to have developed a strong attachment for the area and its values. They may wish to retain access to the bushland. Others, such as dog walkers, may be reluctant to relinquish their ability to freely access the bushland, which may result in vandalism and breach of the integrity of the perimeter fence.

The integrity and success of the sanctuary will rely on its public acceptance, in particular its acceptance by the local community and current users of the bushland. Community acceptance of the sanctuary will depend on the level of public access allowed without compromising the sanctuary values. The values of the sanctuary need to be communicated effectively to the community.

As part of the community engagement program for Craigie Bushland Native Wildlife Sanctuary, some level of public access will be desirable to maintain community goodwill towards the project and to promote community involvement in the project.

Several options can be investigated:

1. Allow public access through guided tours only. Set times can be offered and trained community volunteers could guide visitors. A similar model operates at the Perth Zoo and at Seal Beach on Kangaroo Island (South Australia). Visitor numbers at Craigie Bushland Native Wildlife Sanctuary may not be high enough for this model to be effective at least during the first years of sanctuary operation.
2. Access be limited to members of the public with prior registration including:
 - Date and approximate duration of visit and name of accompanying visitors, and a mobile contact number during the visit. This system has clear benefits to enhance visitor safety in case of fire.

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

- Visitor registration to be handled at the Craigie Leisure Centre.
- Electronic entry system at the various entry points using a swipe card or keypads with a PIN number, with visitor times of entry and exit automatically recorded, information which could provide additional safety in the event of a fire (handing out of keys will likely result in keys not being returned or copies of the keys being made).
- Regular visitors may require multiple entry permits.
- Condition of access to be specified at the point of registration, e.g. no dogs allowed, no smoking, children supervised at all times.

Interpretation, signage

A network of trails already exists within Craigie Bushland. Interpretative signage will enhance visitor experience by providing information about the sanctuary and its fauna and flora.

Visitor centre

A visitor centre at or near the main sanctuary entrance with interpretative displays and material would complement signage inside the sanctuary and assist in contributing towards site security with a staff presence onsite. It will be a necessary addition if nature-based tourism operations are to be set up to cater for guided tours and visitors. This centre may also be able to generate revenue for the sanctuary through the sale of souvenirs and other items, and potentially snacks and beverages.

Fence closure

Closing the perimeter fence will require a particular sequence of events to take place before removal of feral cats and foxes from the sanctuary can commence:

- Prior warning of the local community of the exact day and time when all the gates are to be closed (newspaper advertisements, letterbox drops, public notices on site)
- The day and time of closure needs to be chosen carefully to minimise public disruption and avoid as much as possible domestic dogs or cats finding themselves inside the sanctuary at the time of closure
- A contingency plan needs to be put in place if domestic cats and dogs are inside the enclosure after gates have been closed.

Nature-based tourism potential

Wildlife tours and more generally ecotourism operations are part of Option 2 as per Joondalup Council 2008 Resolution (City of Joondalup 2008). This option would become available once the

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

sanctuary has been successfully established, possibly up to two years from the removal of introduced predators and reintroduction of native fauna. It is unlikely that the sanctuary would provide enough income from ecotourism operations to cover its running and infrastructure costs.

The future Craigie Bushland Native Wildlife Sanctuary would fit in well with other nature-based activities within the City of Joondalup, such as walk trails, cycling paths and linkages with community activities along the coast.

Large-scale wildlife tourism operations associated with wildlife sanctuaries generally require a substantial amount of infrastructure development: visitor centre with information displays, merchandise, food and beverage outlets, staffing seven days a week, etc.

Outside the City of Joondalup boundaries, the potential clientele or target audience for the sanctuary would include Western Australian and interstate tourists, as well as overseas visitors. For the sanctuary to be developed as a successful tourism attraction, a marketing strategy and promotion plan would be required.

As most native mammal species inside the sanctuary are nocturnal, viewing of animals would require night visits. Two options exist for visitors to view wildlife: spotlighting can yield reliable wildlife sightings if the density of animals is sufficient. This is the option used successfully at Karakamia Sanctuary.

The alternative is to view wildlife at feeding stations: this is the most reliable option for visitors to view wildlife as animals are habituated to receive food in this manner (e.g. Barna Mia Animal Sanctuary, Sprigg 2004). However, sound wildlife management principles require that any amount of feeding represents a small proportion of each species' daily food requirements, so that the majority of each animal's requirements is obtained from the natural environment.

A limit on the number of people that can participate in night tours will need to be set to restrict disturbance to wildlife caused by the presence of humans. Barna Mia Wildlife Sanctuary in Dryandra Woodland National Park has a restriction of two groups of 20 people per night and four times a week.

POTENTIAL WILDLIFE THREATS AND RISK ANALYSIS

Fire, vandalism, introduction of diseases and weeds, failure to commit to the sanctuary's long-term management, and lack of sufficient financial backing are all issues that may jeopardise the long term viability of the Craigie Bushland Native Wildlife Sanctuary.

Threat	Consequence	Mitigation actions required	Consequence
Large crown fire burning out of control	Habitat gravely damaged. Many native animals killed and injured	Rapid fire emergency response in place and activated. Open sanctuary gates to allow native animals to escape into surrounding bushland	Extreme
Small localised ground fire	Habitat slightly damaged. Very few native mammals affected	Rapid fire emergency response in place and activated	Medium to high
Breach of perimeter fence integrity due to falling trees or tree branches, or from vandalism (hole in fence or fence collapse)	Foxes, cats and dogs entering sanctuary and potentially killing or injuring native mammals. Native mammals escaping outside perimeter fence	Remove all introduced predators from sanctuary that have entered the perimeter fence, trap and retrieve native mammal fauna that may have escaped from sanctuary. Frequent monitoring for possible incursions by feral or domestic animals.	Very high
Vandalism directed towards wildlife, eg. deliberate introduction of dogs or domestic cats chasing/attacking/injuring wildlife	Disturbance and ensuing stress to wildlife, animals injured, killed	Frequent monitoring for possible intrusions by unwanted animals. Capture and removal from sanctuary	High
Wildlife disturbance by human visitors inside sanctuary, including disturbance to young	Disturbance and ensuing stress to wildlife, young separated from female, impact on behaviour	Visitor education program in place and sanctuary rules publicised to all visitors and observed	High
Vandalism directed towards bushland vegetation, trees, and facilities (signage, fence and other infrastructure)	Damage to infrastructure	Clean up or replace damaged infrastructure	Medium
Introduction of disease or parasites into the sanctuary	The release of excess animals into other protected areas cannot take place, leading to a potential management issue	Quarantine all animals prior to releasing them into the sanctuary and carry out a comprehensive veterinary health check just before translocation	High
Lack of sufficient financial backing for the sanctuary	Many key management actions cannot take place, putting wildlife and habitat at risk	Secure long-term financial backing for the sanctuary	Very high
Failure by the Joondalup Council to commit to the sanctuary's long-term management and funding	Funding discontinued, failure to carry out necessary management tasks, fauna put at risk	Joondalup Council making a long term financial commitment towards sanctuary, e.g. funding the preparation of and endorsing a long term Business Plan	Very high

BUSINESS MANAGEMENT

Financial viability

The financial viability of the Craigie Bushland Native Wildlife Sanctuary needs to be underpinned by a detailed Business Plan outlining potential sources of income and expenditure, staffing requirements, and potential capital costs of a new building to house sanctuary management staff and visitor interpretation needs. The Business Plan would include potential in-kind contributions by various organisations, partners, community involvement and volunteers.

As mentioned in the Minutes and Resolutions of Council meeting of 28/10/2009 (City of Joondalup 2008), the City of Joondalup does not have the resources nor the expertise to conduct a project such as the Craigie Bushland Native Wildlife Sanctuary without external assistance. This assistance can include partnerships with key organisations, grants and funding, sponsorships, involvement of external wildlife experts, and the participation of the local schools, universities and community in the form of volunteer time, fund raising and other in-kind contributions.

Recommendation

- That a fully itemised and costed Business Plan be developed for the Craigie Bushland Native Wildlife Sanctuary.

Personnel requirements

The sourcing and appointment of suitable and qualified personnel will need to be carefully considered. These activities range from day-to-day management tasks to project coordination and development and scientific guidance. Similar sanctuaries such as Whiteman Park's Woodland Reserve and AWC's Karakamia Sanctuary operate with two to three full-time equivalent (FTE) technical, management and scientific staff.

In its initial year of operation (2010-11), the sanctuary will require ongoing feral control, as well as project coordination and scientific input if wildlife translocations are to start in the first half of the 2011-12 financial year (first six months of 2012). Licence and translocation applications, the development of a sanctuary Business Plan, baseline surveys and active community engagement will require dedicated personnel.

In its operational phase the sanctuary will require at least two part-time positions with different skills and qualifications:

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

- A sanctuary manager with applied bushland and fauna management skills
- A senior managerial position with wildlife and project management qualifications in a project coordination, development and scientific role.

The first position can be filled by a council staff member recruited for this purpose. This staff member will ensure that daily tasks are performed in a timely manner and according to an established operational plan: monitoring for the possible presence of feral predators, fence inspections and maintenance, monitoring of fauna and flora, baseline surveys, weed control and habitat restoration.

The second position will involve licence and fauna translocation applications and liaising with DEC, negotiations with potential sponsors, covenanting of the bushland, establishment of partnerships, development and implementation of a community engagement program, liaison with the Community Stakeholders Group and the Technical Reference Panel, development of a science and monitoring program. Consideration should be given by the City of Joondalup to tender for consulting services to perform these tasks.

Partnerships

Establishing partnerships with key stakeholders and organisations will enable the City of Joondalup and the sanctuary management team to benefit from synergies with these organisations and stay up-to-date with the latest developments in the field of conservation, fauna management and translocations.

Key partners may include:

- Various scientific and educational organisations such as the WA Museum, Perth Zoo and academic institutions
- Wildlife sanctuary managers (e.g. Australian Wildlife Conservancy, Whiteman Park)
- Fauna rehabilitation centres (e.g. Kanyana Wildlife Rehabilitation Centre, Native Animal Rescue-Malaga)
- Colleges, schools, universities and other education organisations
- Veterinary practices specialising in native wildlife (e.g. Murdoch University School of Veterinary Sciences, private vet surgeries)
- Nearby land managers (e.g. Water Corporation, Main Roads, Metropolitan Cemetery Board/Pinnaroo Valley Memorial Park)
- Earth Carers networks, Earthwatch Australia, Birds Australia Western Australia, Western Australian Naturalists' Club, Wildflower Society of Western Australia and other active community groups.

Sponsorships

For the success of the project it is essential for the City of Joondalup to secure major industry and/or government sponsors to provide financial and in-kind support to the project. The securing of key sponsors may also be seen by DEC as an important part in the licencing process, ensuring that the Craigie Bushland Native Wildlife Sanctuary has a secure long-term future.

To maximise mutual benefits to all parties, it would be an advantage if potential sponsors have a clear and positive environmental strategy and an interest in threatened species management and conservation. In return the City of Joondalup can provide sponsor recognition on signage, displays and information material.

Potential major industry sponsors may include companies such as Chevron, Woodside, ALCOA, Ti West, Wesfarmers and companies in the banking sector such a Macquarie Bank and BankWest. More local sponsors can be approached in the Joondalup community such as nurseries, retail stores, etc.

Major government sponsors could include agencies such the Water Corporation (which already has an association with the sanctuary project as a neighbouring land manager and because of its involvement with the provision of wooden walkways along the Craigie Bushland escarpment), Western Power and Alinta.

Other organisations which may be involved in this project could include non-governmental organisations such as WWF-Australia, Greening Australia, Australian Wildlife Conservancy and universities.

Recommendations

- That a **sponsorship strategy** be developed by the City of Joondalup with clear short and long-term goals and objectives.
- That major sponsors be invited to enter into a **Memorandum of Understanding (MOU)** with the City of Joondalup stating the MOU's objectives, the responsibilities of both parties, the long-term nature of the engagement taken (recommended time three to five years) that is commensurate with the long-term management responsibilities required in relation to the management of a wildlife sanctuary.

As the City of Joondalup does not have a tax-deductible status, there may be some difficulties for the City to attract sponsors to donate funds for the project. An option could be that the sanctuary be

Craigie Bushland Native Wildlife Sanctuary Feasibility Study and Management Plan

administered and managed by a non-profit organisation (e.g. a trust or an incorporated non-governmental organisation) with a tax deductible status.

Recommendations

- That the sanctuary Business Plan investigate financial models that could best attract sponsors and donors to the project.

Grants, funding

Various grants and other sources of funding may be available to support the Craigie Bushland Native Wildlife Sanctuary. These grants may include Commonwealth grant programs ('Caring for Our Country' channeled through the Perth Region NRM and Community Action grants) and state funding programs (DEC's Environmental Community Grants, State NRM Community Grants Program and LotteryWest funding program).

MILESTONES AND TIMELINES

Key milestones and timelines for the development of the Craigie Bushland Native Wildlife Sanctuary are suggested below:

Timing	Key milestones
Jul. 2010 – Jun. 2011	<ol style="list-style-type: none"> 1. Baseline flora and fauna surveys and habitat assessment under way 2. Community engagement program in place 3. Floppy top mesh added to fence 4. Licence application and translocation proposals for Stage 1 species submitted to DEC 5. Search for major sponsors for the sanctuary 6. Negotiation of agreement with key partners 7. Sanctuary Business Plan, Sponsorship Plan completed
Jul. 2011 – Jun. 2012	<ol style="list-style-type: none"> 1. Project coordinator and sanctuary manager positions advertised and appointments effected. 2. Sanctuary operations plan prepared 3. Kangaroo management program in place 4. Native fauna and habitat monitoring program in place 5. Perimeter fence closed 6. All foxes and cats removed from sanctuary 7. Feral monitoring program in place 8. Control program for rabbits, feral bees in place 9. Review of 1999 Craigie Bushland Draft Management Plan completed 10. Long-term major sponsor for the sanctuary secured and partnerships in place 11. Translocation of Stage 1 species into sanctuary under way (subject to licencing and translocation approvals being granted)
July 2012 – Jun. 2013	<ol style="list-style-type: none"> 1. Evaluation of 2011-2012 Stage 1 translocations 2. Translocation of Stage 2 species into sanctuary under way: woylie, tammar wallaby, western brush wallaby (subject to evaluation of Stage 1 translocations completed)
July 2013 – Jun. 2014	<ol style="list-style-type: none"> 1. Native fauna and habitat monitoring continuing 2. Project review of first three years of operations completed 3. 2014-2017 operations plan and budget completed

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

THREE-YEAR INDICATIVE BUDGET 2011 – 2014

‘X’ indicates activities for year 2010–11 that may be potentially accommodated under the existing City of Joondalup 2010-11 budget.

‘*’ Activities marked with an asterisk in year 2011–12 may be brought forward **into the 2010–11 City of Joondalup budget** if they are funds available. This would provide an opportunity to move forward important milestones (DEC licence application, fauna/flora surveys, community engagement, preparation of various plans) leading to the first species translocations potentially taking place at the end of 2010 or early 2011.

Operating expenses	Year 2010-11	Year 2011-12	Year 2012-13	Year 2013-14	Three year total
<u>Personnel - Project coordination, sanctuary management</u>					
Senior manager (project coordination/supervision)		\$80,000*	\$80,000	\$80,000	\$240,000
Sanctuary manager (0.5FTE)		\$40,000	\$40,000	\$40,000	\$120,000
Subtotal		\$120,000	\$120,000	\$120,000	\$360,000
<u>Wildlife, bushland mgt plans and business plan</u>					
Preparation of Community Engagement Plan		\$8,000*			\$8,000
Submission of DEC licence application and translocation proposals		\$8,000*	\$5,000	\$5,000	\$18,000
Preparation of 2011-2014 Business Plan		\$20,000 *			\$20,000
Preparation of 2011-2014 Sponsorship Plan		\$4,000 *			\$4,000
Preparation of Fire Risk Management Plan	X				
Preparation of Kangaroo Management Plan		\$3,000			\$3,000
Review of 1999 Craigie Bushland Management Plan		\$30,000			\$30,000
Preparation of 2011-14 operations plan	X				
Year 3 project review and preparation of 2014-2017 operations plan				\$15,000	\$15,000
Subtotal		\$73,000	\$5,000	\$20,000	\$98,000
<u>Feral control/Kangaroo Management Plan</u>					
Kangaroo management program	X	\$5,000	\$2,000	\$2,000	\$2,000
Fox and cat control/eradication	X	\$1,500	\$1,500	\$1,500	\$4,500
Feral bee control	X	\$1,500	\$1,500	\$1,500	\$4,500
Subtotal		\$8,000	\$5,000	\$5,000	\$11,000
<u>Fauna/flora surveys</u>					
Flora/habitat surveys		\$5,000*	\$5,000	\$5,000	\$15,000
Fauna surveys		\$15,000*	\$5,000	\$5,000	\$20,000
Subtotal		\$20,000	\$10,000	\$10,000	\$35,000
<u>Species translocation</u>					
Cages for transporting animals		\$2,000			\$2,000
Radio collars, radio tracking equipment		\$15,000			\$15,000
Infrared camera traps, survey equipment, etc.		\$12,000			\$12,000
Purchase of small equipment		\$5,000	\$5,000	\$5,000	\$15,000
Veterinary checks before release, regular vet checks		\$8,000	\$8,000	\$8,000	\$24,000
Travel expenses		\$1,500	\$1,500	\$1,500	\$4,500
Subtotal		\$43,500	\$14,500	\$14,500	\$72,500

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

<u>Community awareness/engagement program</u>					
Design and production of display boards/brochures/leaflets		\$8,000 *	\$1,500	\$1,000	\$10,500
Fixed information display at Craigie Leisure Centre and mobile display		\$15,000 *			\$15,000
<i>Subtotal</i>		<i>\$23,000</i>	<i>\$1,500</i>	<i>\$1,000</i>	<i>\$25,500</i>
<u>Fire prevention, management of public access</u>					
Emergency signage in bushland		\$5,000			\$5,000
Public access to entry gates (electronic tags/key)		\$5,000 *			\$5,000
<i>Subtotal</i>		<i>\$10,000</i>			<i>\$10,000</i>
<u>Establishment of partnerships</u>					
Functions, catering, promotion	X	\$5,000	\$1,000	\$1,000	\$7,000
Exchange of resources with partner organisations		\$15,000	\$15,000	\$15,000	\$45,000
<i>Subtotal</i>		<i>\$20,000</i>	<i>\$16,000</i>	<i>\$16,000</i>	<i>\$52,000</i>
<u>Infrastructure maintenance</u>					
Trail upgrades and signage	X	\$4,000			\$4,000
Wetland creation program	X				
Habitat enhancement	X	\$3,000	\$3,000	\$3,000	\$9,000
Additional mesh to existing fence					
Fence maintenance/repairs	X	\$3,000	\$3,000	\$3,000	\$9,000
Fencing for soft release of wildlife	X				
<i>Subtotal</i>		<i>\$10,000</i>	<i>\$6,000</i>	<i>\$6,000</i>	<i>\$22,000</i>
Total - Operating expenses		\$327,500	\$178,000	\$192,500	\$686,000
Capital expenses	Year 2010-11	Year 2011-12	Year 2012-13	Year 2013-14	Three year total
<u>New visitor centre, research and management facility</u>					
Construction of visitor centre, research facility		\$150,000	\$150,000		\$300,000
Visitor centre: furnishings and fittings		\$20,000	\$20,000	\$20,000	\$60,000
Total - Capital expenses		\$170,000	\$170,000	\$20,000	\$360,000
Summary budget 2011-2014	Year 2010-11	Year 2011-12	Year 2012-13	Year 2013-14	Three year total
Personnel - Project coordination, sanctuary management		\$120,000	\$120,000	\$120,000	\$360,000
Translocation proposals, Kangaroo Management Plan, Bushland Management Plan, Sponsorship and Business Plan		\$30,000	\$25,000	\$20,000	\$75,000
Fauna/flora surveys		\$20,000	\$10,000	\$10,000	\$35,000
Feral control/kangaroo management program		\$8,000	\$3,000	\$3,000	\$9,000
Species translocation		\$43,500	\$14,500	\$14,500	\$72,500
Community awareness/engagement program		\$23,000	\$1,500		\$25,500
Fire prevention, management of public access		\$10,000			\$10,000
Establishment of partnerships		\$20,000	\$16,000	\$16,000	\$52,000
Infrastructure maintenance		\$23,000	\$8,000	\$6,000	\$37,000
Total - Operating expenses		\$327,500	\$178,000	\$192,500	\$686,000
Total - Capital expenses		\$170,000	\$170,000	\$20,000	\$360,000
Total – All expenses		\$497,500	\$348,000	\$212,500	\$1,046,000

REFERENCES

- Allen M., Mahoney C., Morald T., Ogden G., Pastega A. & Stuart-Street A. (1994) Craigie Open Space Urban Bushland Management Plan. Unpublished report submitted for assessment as SCI 3451 Environmental Management Project. Edith Cowan University, Western Australia, Joondalup.
- Anon. (1999) Craigie Open Space Draft Management Plan. City of Joondalup.
- Anon. (2009) Background Paper to EPBC Act Policy Statement 3.10 – Nationally Threatened Species and Ecological Communities. Significant impact guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, Western Australia. Department of the Environment, Water, Heritage and the Arts, Canberra.
- Arnold G. W., Grassia A., Steven D. E. & Weeldenburg J. R. (1991a) Population ecology of western grey kangaroos living in a remnant of wandoo woodland at Baker's Hill, southern Western Australia. *Wildlife Research* 18: 561-575.
- Arnold G. W., Steven D. E. & Weeldenburg J. R. (1991b) Distribution and abundance of two species of kangaroos living in remnants of native vegetation in the central Wheatbelt of Western Australia and the role of native vegetation along road verges and fencelines as linkages. In: *Nature Conservation 2: the Role of Corridors* (eds. D. A. Saunders & R. J. Hobbs) pp. 273-280. Surrey Beatty and Sons, Chipping Norton.
- Bancroft W. (2005) Reintroduction of locally extinct mammals into a feral-proof enclosure at Whiteman Park: initial project outline and review. Report prepared for Whiteman Park by Wes Bancroft, Kalamunda, Western Australia.
- Burbidge A. & de Tores P. (1998) Western Ringtail Possum (*Pseudocheirus occidentalis*) Interim Recovery Plan 1997-1999. Western Australian Department of Conservation and Land Management, Wanneroo, Western Australia.
- Burbidge A. & Start T. (1994) Mammals in the garden. *Landscape Magazine* 10 (Spring 1994): 18-24.
- Butcher M. (undated) Fox trapping using cage traps. Animal Pest Management Services. Unit 3 Hewdon Rd, Australind, Western Australia.

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

City of Joondalup (2008) CJ221-10/08 Craigie Bushland – Proposed conservation sanctuary development – [44236]. Council minutes ordinary meeting of council of Tuesday 28 October 2008 pp. 24-32.

Courtenay J. (1995a) Status and conservation of the quenda (*Isoodon obesulus fusciventer*). Conservation statement prepared for the Conservation Council of Western Australia. Department of Environmental Management, Edith Cowan University, Perth.

Courtenay J. (1995b) Status and conservation of the western brush wallaby (*Macropus irma*). Conservation statement prepared for the Conservation Council of Western Australia. Department of Environmental Management, Edith Cowan University, Perth.

Cronin L. (1991) *Key guide to Australian mammals*. Reed Book, Balgowlah, New South Wales.

DAFWA (2007) Rabbit control in urban and semi-urban areas. Farmnote 341. Department of Agriculture and Food Western Australia.

DAFWA (2009) Guide to the safe use of 1080 poison. Farmnote 381. Department of Agriculture and Food Western Australia.

DAWA (2001) Options for rabbit control. Farmnote 89/2001. Department of Agriculture Western Australia.

DAWA (2005) Options for fox control. Farmnote 91/2001 [reviewed July 2005]. Department of Agriculture Western Australia.

DEC (undated-a) Fauna Note No. 29. Western grey kangaroo. Western Australian Department of Environment and Conservation.

DEC (undated-b) Fauna Note No. 30. Western grey kangaroo management plan. Western Australian Department of Environment and Conservation.

DEC (undated-c) Fauna species profiles - Marsupials and monotremes. Western Australian Department of Environment and Conservation.

Denny E. A. & Dickman C. R. (2010) Review of cat ecology and management strategies in Australia. Invasive Animals CRC, Canberra.

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

Department of Environmental Protection (2000a) Bush Forever. Vol. 1 Policies, Principles and Processes. Published by the Western Australian Planning Commission. Government of Western Australia.

Department of Environmental Protection (2000b) Bush Forever. Vol. 2. Directory of Bush Forever sites. Published by the Western Australian Planning Commission Government of Western Australia.

Ecoscape (2005) Craigie Open Space Study. Prepared for the City of Joondalup by Ecoscape (Australia) Pty Ltd and Planning Solutions (Australia) Pty Ltd. . City of Joondalup.

Friend T., Anthony C. & Thomas N. (2004) Return to Dryandra. *Landscape Magazine* 16 (Winter 2001).

George A. S. (1987) *The Banksia Book*. Kangaroo Press, Kenhurst, New South Wales.

Gould J. (1863) *The Mammals of Australia*. The Author, London.

Government of Western Australia (2010) Bushland Policy for the Perth Metropolitan Region. State Planning Policy 2.8 *Government Gazette, WA* 2743-2764.

Herbert C. A. (2004) Long-acting contraceptives: a new tool to manage overabundant kangaroo populations in nature reserves and urban areas. *Australian Mammalogy* 26: 67-74.

How R. A. & Dell J. (2000) Ground vertebrate fauna of Perth's vegetation remnants: impact of 170 years of urbanisation. *Pacific Conservation Biology* 6: 198-217.

J.-P. Orsini and Associates (2005) A preliminary investigation into the concept of a wildlife sanctuary at Craigie Bushland Reserve. A report prepared for the City of Joondalup by Jean-Paul Orsini and Associates, Environmental Consultancy. May 2005. City of Joondalup.

Keighery B. J. (1994) Bushland Plant Survey. A guide to plant community survey for the community. Wildflower Society of WA (Inc.), PO Box 64, Nedlands WA 6008, Nedlands, Western Australia.

Maxwell S., Burbidge A. A. & Morris K. (1996) The 1996 Action Plan for Australian Marsupials and Monotremes. Wildlife Australia, Canberra.

Craigie Bushland Native Wildlife Sanctuary
Feasibility Study and Management Plan

NHMRC, CSIRO & AAG (1990) Australian code of practice for the care and use of animals for scientific purposes. The National Health and Medical Research Council, the Commonwealth Scientific and Industrial Research Organisation and the Australian Agricultural Council. Canberra, ACT.

Orsini J.-P. (1999) 'Bugs, Beasts and Biodiversity - an environmental education package on the biodiversity of the South-West of Western Australia for secondary schools'. Australian Association for Environmental Education, Perth.

Richards J. D. (2003) Report on Threatened Shark Bay Marsupials, Western Barred Bandicoot *Perameles bougainville bougainville*, Burrowing Bettong *Bettongia lesueur lesueur*, Banded Hare-wallaby *Lagostrophus fasciatus fasciatus*, and Rufous Hare-wallabies *Lagorchestes hirsutus bernieri* and *Lagorchestes hirsutus dorrae*. Prepared for the Department of Environment and Heritage, Canberra. CSIRO Sustainable Ecosystems, Wembley, Western Australia.

Robley A., Purdey D., Johnston M., Lindeman M. & Busana F. (2006) Experimental trials to determine effective feral cat and fox exclusion fence designs. A report for the Australian Government Department of the Environment and Heritage. Arthur Rylah Institute for Environmental Research, Department of Sustainability and Environment, Heidelberg, Melbourne and Department of Primary Industries, Frankston, Victoria.

Sharp T. & Saunders G. (undated) Trapping of feral cats using cage traps. Humane pest animal control CAT002. Prepared for the NSW Department of Primary Industries.

Short J. & Stone M. (2009) Farmers befriend Phascogale. *Landscape Magazine* 25 (Summer 2009-10): 22-28.

Sprigg T. (2004) Barna Mia: wildlife home. *Landscape Magazine* 20 (Spring 2004): 52-58.

Start T., Burbidge A. & Armstrong D. (1995) Woylie Recovery Plan. Wildlife Management Program No 16. Western Australian Department of Conservation and Land Management.

Statham M. & Statham H. L. (1997) Movements and habits of brushtail possums (*Trichosurus vulpecula* Kerr) in an urban area. *Wildlife Research* 24: 715-726.

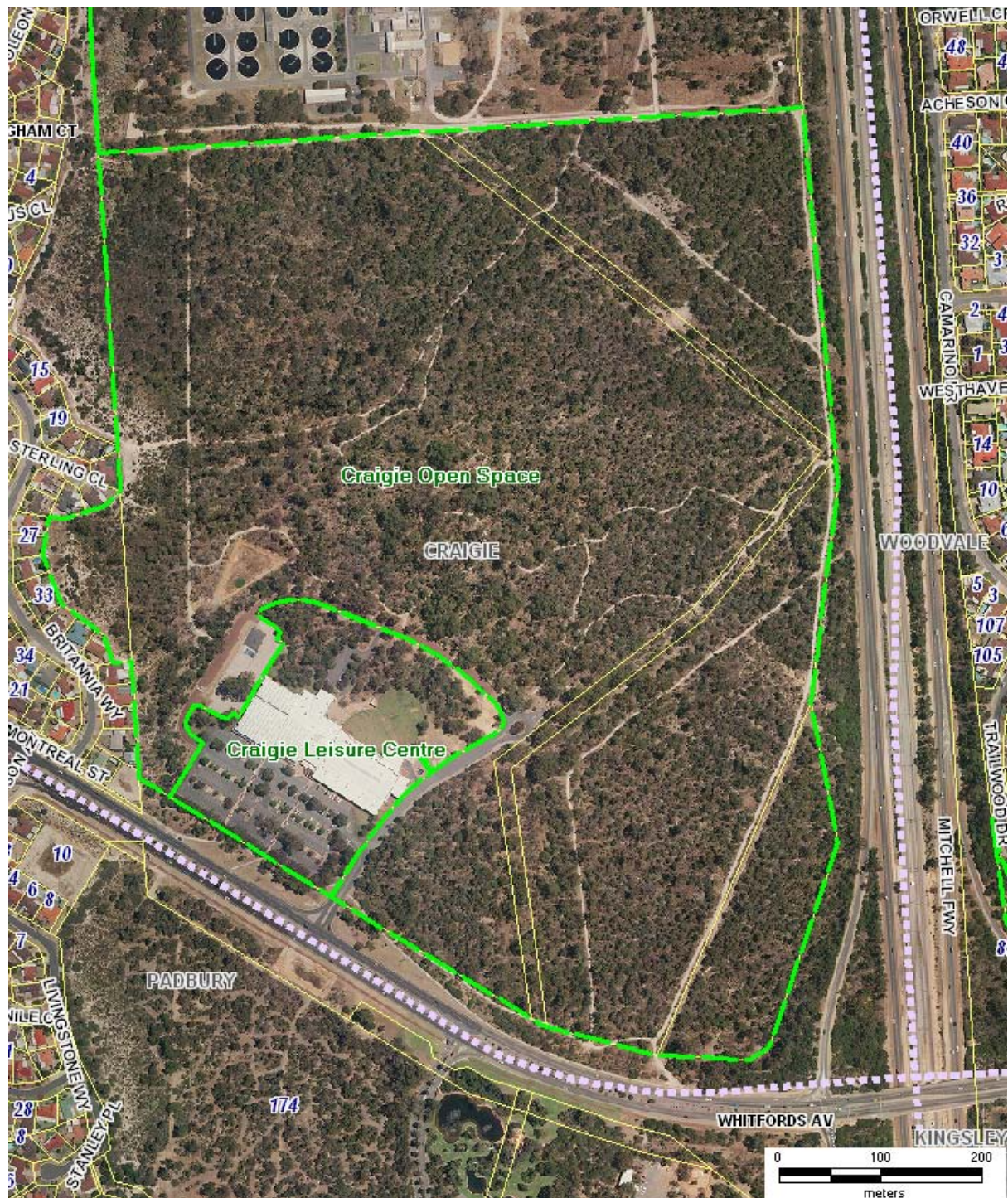
Van Dyke S. & Strahan R. eds. (2008) *The Mammals of Australia*. Reed New Holland, Sydney, New South Wales.

APPENDIX 1: CRAIGIE OPEN SPACE AND BUSHLAND LOCATION MAP



Craigie Bushland Native Animal Sanctuary Location Map

APPENDIX 2: CRAIGIE BUSHLAND NATIVE WILDLIFE SANCTUARY LOCATION MAP



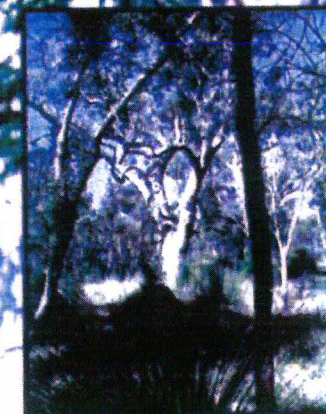
APPENDIX 3: COMMON AND SCIENTIFIC NAMES OF MAMMAL SPECIES CITED IN THIS REPORT

Native mammal species

Common name	Other names	Scientific name
Ash-grey mouse	Noodji	<i>Pseudomys albocinereus</i>
Banded Hare-wallaby	Mernine or munine	<i>Lagostrophus fasciatus</i>
Bilby	Dalgyte, rabbit-eared bandicoot, Ninu	<i>Macrotis lagotis</i>
Black-flanked rock-wallaby	Warru	<i>Petrogale lateralis</i>
Boodie	Burrowing bettong	<i>Bettongia lesueur</i>
Brushtail possum		<i>Trichosurus vulpecula</i>
Brush-tailed phascogale	Wambenger	<i>Phascogale tapoatafa</i>
Chuditch	Western quoll	<i>Dasyurus geoffroii</i>
Dibbler		<i>Parantechinus apicalis</i>
Dunnart		<i>Sminthopsis</i> spp.
Echidna		<i>Tachyglossus aculeatus</i>
Honey possum	Noolbenger	<i>Tarsipes rostratus</i>
Mala	Rufous Hare-wallaby	<i>Lagorchestes hirsutus</i>
Mardo	Yellow-footed antechinus	<i>Antechinus flavipes</i>
Numbat	Walpurti	<i>Myrmecobius fasciatus</i>
Quenda	Southern brown bandicoot	<i>Isodon obesulus</i>
Quokka		<i>Setonix brachyurus</i>
Red-tailed phascogale	Kenngoor	<i>Phascogale calura</i>
Tammar wallaby		<i>Macropus eugenii</i>
Western barred bandicoot	Marl	<i>Perameles bougainville</i>
Western brush wallaby	Black-gloved wallaby, kwoora	<i>Macropus irma</i>
Western bush rat		<i>Rattus fuscipes</i>
Western grey kangaroo		<i>Macropus fuliginosus</i>
Western pygmy-possum	Pygmy-possum, mundarda	<i>Cercartetus concinnus</i>
Western ringtail possum	Ringtail possum, western ringtail	<i>Pseudocheirus occidentalis</i>
Woylie	Brush-tailed bettong	<i>Bettongia penicillata</i>

Introduced and feral mammal species

Common name	Scientific name
Black rat	<i>Rattus rattus</i>
Brown rat	<i>Rattus norvegicus</i>
Domestic dog	<i>Canis lupus</i>
Domestic or feral cat	<i>Felis catus</i>
Feral (European) honey bee	<i>Apis mellifera</i>
House mouse	<i>Mus musculus</i>
European rabbit	<i>Oryctolagus cuniculus</i>
Red fox	<i>Vulpes vulpes</i>



CRAIGIE OPEN SPACE MANAGEMENT PLAN



CRAIGIE PUBLIC OPEN SPACE

DRAFT MANAGEMENT PLAN

NOVEMBER 1999

SUMMARY

Craigie Open Space covers an area of approximately 56.7ha and is situated 20 km north of the CBD, in the residential suburb of Craigie. Craigie Open Space is a continuation of the recognised classified area of Hepburn Heights-Pinnaroo Park-CALM Woodvale and Hepburn Heights Conservation Reserve (Perth's Bushplan 1998).

Settlement and subsequent clearing of bush and heath land for urbanisation resulted in the loss of fauna habitats and ecosystems. These remaining pockets of isolated bush and heath land although not pristine, do provide natural habitats for fauna of the area.

Craigie Open Space has been subjected to human disturbance through actions such as rubbish dumping, arson, digging to install underground telephone cables, and digging to install sewerage pipes that follow the easement lines through the area. The latter activity left accessible wide sandy tracks which has resulted in the illegal use by motor cycles and four wheel drive vehicles, in turn resulting in the loss of large areas of vegetation.

The Bushland is generally in good condition and contains an excellent example of the Tuart-Jarraah-Banksia woodland and vegetation community, and also an area of Quindalup Sands Dunes with its Acacia-Conifer-Allocasuarina-Quondong, and heath vegetation community. Both area types have been largely lost to urban development in the Perth area.

To date approximately 163 native plant species (Appendix 1) have been found within the bushland as well as at least 42 bird species (Appendix 2), diverse reptile and mammal populations (Appendix 3). The bushland's strategic location as part of the northern bushland corridor make the area important as a habitat for bird and mammal species which move around these large bush and heath land areas.

Craigie Open Space management plan outlines specific strategies and recommendations in the areas of weed control, fire control, bushland restoration, access management, interpretation and research. The underlying aim of the Bushland's management is to conserve and enhance the area's biological values and ecological functions.

Natural regeneration is to be assisted where possible by removing the restraints and disturbance factors currently acting, such as weed invasion.

A concept plan has been drawn which illustrates the current bushland condition and developments proposed for the area. Any upgrading of the bushland is to be based on preserving the ecological integrity of the area while providing public access through an integrated system of walking paths.

To implement the strategies recommended in this management plan, a works program has been developed with a three year timetable to complete all major developments such as pathway construction.

Involvement of the community, including local learning institutions, clubs, adjacent residents of the bushland and the Friends of Craigie Bushland in the restoration of the area is imperative to the successful outcome of the management plan.

RECOMMENDATIONS

Weed Control

1. The City of Joondalup develops a detailed weed control implementation program. This program should be developed in conjunction with trained bush regeneration volunteers willing to undertake weed control programs at Craigie Bushland.
2. Train community volunteers and members of The Friends group in bush regeneration techniques so that they can contribute to effective weed control, particularly through hand weeding and other non toxic methods.
3. Notify the public prior to spraying of weeds in the bushland with the use of appropriate signage.
4. Notify adjacent residents and the public of the impacts and illegality of dumping garden refuse in the Bushland.
5. Ensure weed control contractors have adequate training and experience in working in bushland areas.
6. Establish a herbarium of all weed species found within the Bushland.

Fire Control

1. Retain the existing perimeter firebreak on the eastern, and northern perimeter and the fire break on the lower western area at the base of the escarpment. This firebreak in the south-west corner of the bushland adjoins the rear car park of the Craigie Leisure Centre and has a chained access point to allow for vehicle access. Also retain the existing perimeter firebreak on the western perimeter of the dunes area adjacent to housing which has access points at Unicorn Place (Hydrant) and Warrandyte Reserve. (Figure 2).
2. Continue method of creating the fire breaks which alleviate the need for annual cultivation.
3. Use the pathways in fire emergencies with access available from the Craigie Leisure Centre carparks as indicated in the Concept Plan. Maintain trafficable vegetation for one metre either side of the pathways for access by emergency fire fighting vehicles.

4. Monitor fuel loads in fire threat areas so that if existing or future fuel loads increase above an accepted level, manual fuel reduction measures be undertaken, or small (less than 400m²) mosaic prescribed burns be carried out in autumn. Care should be undertaken so that the burn frequency does not impact on the ecological values of the flora and fauna.
5. Devise and implement a Craigie Bushland-Firewatch program through liaison with users, neighbours of the area and staff of the Craigie Leisure Centre that details notification procedures in the advent of a wild fire.
6. Aim to suppress any spot fires at Craigie Bushland as quickly as possible to confine them to as small an area as possible.
7. Carry out a detailed assessment of fire threat areas (ie. adjoining property and life) at Craigie Bushland.
8. The City of Joondalup in consultation with the WA Fire and Rescue will formulate a fire management plan for the Craigie Bushland.
9. Keep records of cause, date, time, and duration of all fires at Craigie Bushland and map their extent. Record also names of all personnel attending.
10. Locate and record position of all fire hydrants around the perimeter of Craigie Open Space.
11. During extreme hot weather conditions, when fire risk is very high, access may be restricted. Signs to indicate access restrictions should be placed at all entrances to the Bushland.

Disease Control

1. All vehicles entering Craigie Bushland should be washed down if they have been "off road" outside Craigie Bushland.
2. Only vehicles and machinery essential for management, fire suppression operators & Beenyup Water Treatment inspectors who will need to inspect pipes within easements, be allowed access to Craigie Open Space.
3. All plant seedlings grown for revegetation within the Bushland should come from nurseries accredited as being dieback free and using methods of plant propagation that minimise the likelihood of dieback infection, or from supervised pupils of learning institutions.
4. All material imported for pathways should be dieback free and only come from dieback free areas.

5. Include disease protection specifications in any contract documentation for contractual work within Craigie Open Space.

Feral Animal Control

1. Continue to remove all rubbish including waste from the area especially perimeter housing fences to discourage feral rodents.
2. Do not allow horses within the bushland. Advisory signs prohibiting horse access should be placed at major entrances.
3. Dogs should be kept under control within the bushland using the perimeter paths to protect the fauna.
4. Have Council Rangers patrol Craigie Open Space to enforce these recommendations.

Access

1. Construct pathway system as shown in Figure 2.
2. Retain the firebreaks as access points.
3. Close and rehabilitate all other informal paths.
4. Consult the Water Authority as to the treatment of the areas surrounding the sewage easement that passes within Craigie Open Space. Liaise with the Water Authority in relation to creating access from Lot 1024, which abuts Craigie Open Space.
5. Maintain access for emergency fire suppression vehicles along the sealed pathways by keeping the vegetation one metre on either side of the path to below one metre in height, paths should curve gently where necessary so fire fighting vehicles can drive along them in safety.
6. Cyclists should only use perimeter pathways and with controlled speed and care.
7. Dogs should be kept under control at all times using the perimeter pathways to protect the fauna.
8. Monitor the use of the sealed pathway system particularly with regards to conflict between pedestrians, disabled users and riders of bicycles.

Bushland Restoration

1. A detailed bushland restoration implementation plan that sets out plant numbers, species and techniques for each of the restoration zones shown in Figure 3 be developed.
2. Involve The Friends Group, community volunteers, and teachers and pupils of local learning institutions in the restoration process.
3. Encourage the attendance of interested Friends Group members and Community volunteers in bush regeneration courses.
4. All revegetation programs within Craigie Open Space should use local seed or propagation material.
5. Contract specialist revegetation nurseries (which are accredited dieback free) to grow seedlings needed in revegetation programs. Encourage teachers and supervised pupils of local learning institutions to grow seedlings needed in revegetation programs.
6. Avoid artificial watering, staking plants, and direct or indirect application of fertiliser.

Interpretation and Education

1. Develop high quality interpretive displays at Craigie Open Space using pupils of local learning institutions, local artists and designers
2. Develop a brochure that outlines the physical and biological values of the bushland and the management strategies being implemented.
3. Restrict signage within the bushland area as it detracts from the natural landscape.
4. Develop a brochure that details some of the area's plant species, eg. along a botanical trail, without the installation of individual plant labels.
5. Through Liaison with teachers and pupils of local learning institutions, develop an environmental education program specifically tailored to experience based learning at Craigie Open Space.

Research and Monitoring

1. Compile a reference and field herbarium of both native and exotic flora found at Craigie Open Space
2. Continue an annual flora survey during the spring months.
3. Survey the reptile, mammal, amphibian and invertebrate fauna through an appropriate pit trapping program.
4. Establish several permanent vegetation monitoring quadrants covering 10m x 10m. These quadrants should be sited in areas where assisted natural regeneration and reconstruction programs are being developed. The plant species and their relative abundance should be documented and photographic records taken from a set location at a set height, (ie. diagonally from the northern corner looking south).
5. Annual monitoring programs should be established for the following:-
 - a) The number of fires, their intensity and the effectiveness of the fire control programs;
 - b) Populations of feral animals in the park and the effectiveness of any control programs;
 - c) Assessing the impact of park users on the biological and physical environment;
 - d) Assessing the requirements of park users including the effectiveness of interpretation material.

Instigate a monitoring program that will determine the effectiveness of weed control programs and enable further refinement of these programs based upon fixed vegetation quadrants.

Monitor the area for signs of plant fungal including *Phytophthora sp* and *Armillaria* and if infection is suspected, carry out soil testing to confirm.

Monitor the area for the presence of feral animals; cats, foxes and rabbits.

**A PRELIMINARY INVESTIGATION INTO THE CONCEPT OF A
WILDLIFE SANCTUARY AT CRAIGIE BUSHLAND RESERVE**

**A report prepared for the City of Joondalup
by Jean-Paul Orsini and Associates**

April 2005

***Jean-Paul Orsini & Associates
Environmental & Community Consultancy
15 Hooley Street - Swanbourne WA 6010
Phone/fax: (08) 9384 3756, mob 0405 006 720
Email: jporsini@bigpond.net.au***

Executive summary

Craigie Bushland is a precious and scenic bushland reserve located at the heart of Perth's northern suburbs and managed by the City of Joondalup¹. Craigie Bushland, with its 53 ha area of well-preserved tuart/jarrah/banksias woodland of outstanding conservation value, has long been recognised as an important community asset, as demonstrated by its inclusion into the State Government's Bush Forever plan².

With the potential reintroduction into the Craigie Bushland of various species of native marsupials that have become rare or extinct in the Perth region, the reserve has the potential to become a sanctuary for Australian native wildlife and a centre of excellence for wildlife management, education and nature-based tourism in the Perth Metropolitan Area, attracting the local community as well as interstate and overseas visitors.

However, for the creation of a future Craigie Bushland Wildlife Sanctuary to be successful, a number of steps would be required:

- establishing adequate partnerships/linkages with various stakeholders and interested parties: wildlife authorities and other government organisations, community groups, indigenous custodians, private enterprise as well as teaching and research institutions.
- preparing a feasibility study and strategic business plan for the project based on existing expertise and knowledge and including a time table for the project.
- providing the adequate capital works, expertise, personnel and support to carry the project through in the long term.
- sourcing adequate funding and resources for all stages of the project.

The project would be well placed as part of the City of Joondalup's Strategic Plan and Tourism Development Plan to provide significant benefits for the local community and Perth visitors alike, while enhancing the image of the City of Joondalup as an innovative and eco-friendly destination.

Pedestrian Access Gate – Craigie Bushland



CRAIGIE BUSHLAND ACCESS GATE LOCATIONS

