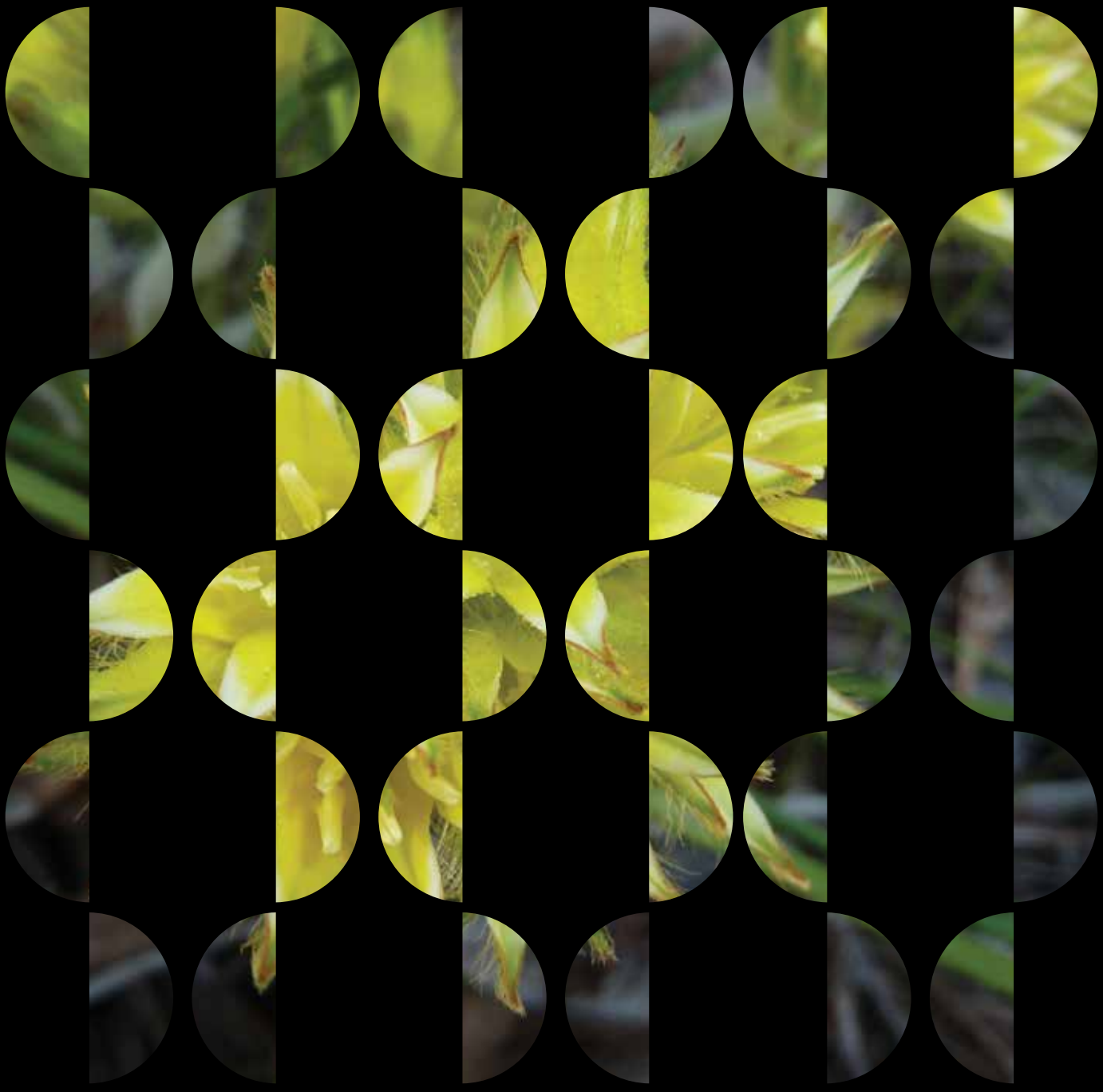
Local Biodiversity **Strategy**

A strategic plan for biodiversity conservation in the City of Canning over the next 20 years



Front Cover: *Conostylis bracteata.* Credit: S.Mawson

Inside Cover: Convict Fence on the Canning River
Credit: D. Graham

Banded Orb-weaver, *Argiope trifasiata.* Credit: S.Mawson

Contents

EXECUTIVE SUMMARY

Acacia applanata. Credit: S.Mawson

This local biodiversity strategy is prepared in accordance with the State endorsed methodology for local biodiversity conservation planning, developed through the Western Australian Local Government Association's Perth Biodiversity Project.

The local biodiversity strategy has the vision that:

Over the next 20 years, the diversity of indigenous species and ecosystems is conserved, resilient to threats, restored and valued by the local community.

The key objectives of the strategy are:

- To increase the protection status of significant biodiversity in the City, including on local government managed or owned lands, and on private land.
- To appropriately manage local natural areas to reduce threats to biodiversity.
- To increase the viability and resilience of natural areas by establishing buffers and ecological linkages; considering the impacts of climate change.
- To increase the distribution and abundance of fauna, including threatened fauna.
- To increase local community awareness and support for biodiversity conservation.

The local biodiversity strategy includes a comprehensive analysis of native vegetation and fauna in the City of Canning municipality. The City currently contains less than seven percent land coverage of native vegetation and many of these natural areas are small in size and fragmented. This represents a challenge for the City to ensure the ongoing viability of natural areas into the future. To address the high level of fragmentation, the local biodiversity strategy proposes to implement a revegetation program across the City, particularly in areas identified as local ecological linkages.

Despite the small area of remaining native vegetation, the City contains a large diversity of flora and fauna. In 2011 a study undertaken by Perth Biodiversity Project found an area of native vegetation on the Canning River foreshore recorded one of the highest numbers of ecological values across the Perth and Peel region. Over 738 species of flora and fauna occur in the five regionally significant vegetation complexes within the City. Specially protected flora and fauna occurs within these complexes including the Endangered Banksia Woodlands of the Swan Coastal Plain and the endangered Carnaby's Cockatoo and vulnerable Red-tailed Black Cockatoo.

The local biodiversity strategy also proposes mechanisms to protect existing native vegetation. This will be achieved by changing the land reservations of selected natural areas and the development of Local Planning Policies. Best practise management of the areas will be supported by reserve management plans and a bushland management strategy.

To measure the effectiveness of the proposed implementation measures, specific targets are defined for each of the strategy objectives.

Local Biodiversity Strategy Objective	Targets to be achieved by 2033	How to achieve them?
To increase the protection status of significant biodiversity in the City, including on local government managed or owned lands, and on private land.	1.1 Formally protect 250ha of native vegetation in the City (and achieve 5% of pre-European vegetation extent protected in the City)	Section 3.4.1 Table 10: • Change of selected reserve purpose (50ha) • Minimising impacts of future land use.
To appropriately manage local natural areas to reduce threats to biodiversity.	2.1 All local conservation reserves vested in the City are managed in accordance of the approved management plan 2.2 Conservation signage is installed at all conservation reserves 2.3 Continuous decrease in weed cover and feral animal distribution is recorded in all conservation reserves managed by the City 2.4 No new dieback infestations are recorded within the City's natural areas	Develop and adopt a bushland management strategy for all City vested Local Natural Areas – see section 4.2.
To increase the viability and resilience of natural areas by establishing buffers and ecological linkages; considering the impacts of climate change.	3.1 Each high conservation value natural area is connected to at least three other significant natural areas through a network of ecological linkages 3.2 Revegetate at least 250ha of degraded or cleared land using local species to increase the native vegetation cover in the City to at least 10% of its area. 3.3 At least 20% increase in locally native tree species in the City streets and parks.	Implementation of protection and restoration measures for natural areas and replanting of native vegetation within the regional and local ecological linkages – see Section 3.4.2 and 4.2.
To increase the distribution and abundance of fauna, including threatened fauna.	4.1 All viable natural areas will show current records of threatened and priority fauna where they would have occurred prior to fragmentation.	• See Section 4.2.
To increase local community awareness and support for biodiversity conservation.	5.1 All current community groups are actively participating in the management of natural areas in the City 5.2 At least 70% of native vegetation mapped on rural lands is retained 5.3 10% increase in participation in the City's environmental initiatives	• See Section 4.2.

Table 1. Local Biodiversity Strategy Targets

Actions required to achieve the City's objectives for biodiversity can be divided in to six groups:

- Improved provisions for biodiversity in the City's local planning framework and their application in the future land use decisions
- Development of a strategic local reserve management plan
- Development of a plan for restoration of natural areas within regional and local ecological linkages
- Development of an incentive package to encourage vegetation retention and increased use of local plants in landscaping by developers and private landholders
- Continued support of community volunteers in bushland restoration activities
- Mainstreaming biodiversity consideration within all City business units and adopting a communication strategy that engages all government and community stakeholders.

Specific actions, their priority, responsibilities and key performance indicators are listed in the Action Plan.

Action Plan

Priority: High – complete by 2018-2019 | Medium – complete by 2019-2022 | Low – complete by 2033

	Action	Priority	Responsibility	Key Performance Indicator	Contributing to target (Table 1)
	Integration into the land use planning framework				
1	Integrate Local Biodiversity Strategy objectives, targets and mapping into the City's Local Planning Strategy	High	Canning Sustainable Development	WAPC endorses the City's local planning strategy with adequate provisions for local biodiversity (including mapping and targets)	1.1
2	Confirm the conservation values of the selected reserves with proposed change of purpose under the Land Administration Act 1997 or change of local reserve classification to Environmental Conservation in the local planning scheme.	High	Parks and Place Improvement Canning/ Land Utilisation	All reserves assessed and reserve purpose change made	1.1 and 2.1
3	Scheme Amendment to change the classification of selected high conservation value reserves vested in the City to Environmental Conservation	High	Canning Sustainable Development	All selected reserves with confirmed high conservation values classified for Environmental Conservation, contributing to the achievement of the target of 5% of pre-European vegetation extent protected in the City	1.1
4	Seek support from the relevant State Government agencies to change the classification of selected high conservation reserves vested in them	Medium		90% of selected reserves reserved for Conservation of Flora and Fauna, contributing to the achievement of the target of 5% of pre-European vegetation extent protected in the City	1.1
5	Develop and adopt Local Planning Policies addressing native vegetation retention in POS, development within ecological linkages, landscaping standards and tree preservation (see section 4.1.2)	High	Parks and Place Improvement Canning/ Canning Sustainable Development	Local Planning Policy adopted by the Council All new subdivisions and streetscape upgrades in accordance with the landscaping standards (minimum 20% of plants used are local species)	1.1, 3.1, 3.2, 5.2
6	Implement recommendations for vegetation retention and protection on lands that may be subject to future development (Appendix B).	Ongoing	Parks and Place Improvement Canning/ Canning Sustainable Development	Contribute to the achievement of 5% of pre-European vegetation extent protected and 10% native vegetation cover	1.1 and 3.2
	Local Government Natural Area Management				
7	Assess the ecological values, condition and management issues in all natural areas proposed to be managed for conservation	High	Engage adequately qualified consultant	All current and new natural areas assessed and prioritised according to ecological values and management issues	2.1
8	In consultation with interested community groups and other relevant stakeholders, prepare a strategic five year management plan addressing key issues across all natural areas and incorporating recommendations from existing updated reserve management plans	Medium	City to engage adequately qualified consultant or Parks and Place Improvement Canning	Strategic Management Plan adopted by the Council	2.1, 2.2, 2.3, 2.4
9	Update the Control and keeping of cats Local Law 2007	High	Parks and Place Improvement Canning	Updated Local Law enacted	2.3, 4.1
10	Develop and implement best-practice procedures for all City staff and contractors working and accessing natural areas and managing infrastructure assets	Medium-High	Parks and Place Improvement Canning	Best practice procedures part of induction of new staff and training for existing staff, part of contractual agreements for all works potentially within or near protected natural areas	2.3, 2.4
11	Implement the strategic reserve management plan	Ongoing	Parks and Place Improvement Canning	At least 80% of conservation reserves being actively managed by 2022	2.1, 2.2, 2.3, 2.4, 3.2
12	Undertake periodic fauna monitoring and keep records of all incidental fauna observations for all natural areas.	Ongoing	Parks and Place Improvement Canning	All viable natural areas will show current records of threatened and priority fauna where they would have occurred prior fragmentation	2.1, 4.1
13	Report any new fauna records to DBCA	Ongoing	Parks and Place Improvement Canning	DBCA records of fauna in the City are up-to-date	1.1, 2.1
14	Adopt a strategic and operational plan for restoration of degraded and cleared lands in local parks and other public lands within the regional and ecological linkages, considering priorities listed in Section 3.4.2	Medium	Parks and Place Improvement Canning	At least 90% of mapped degraded areas in conservation reserves are revegetated by 2033	3.1, 3.2
15	Adopt and implement a City wide landscaping program (including active public open space, compensation basins, drainage reserves, streets and other public lands) to increase the proportion of local native plants in landscaping	Medium	Parks and Place Improvement Canning/ Canning Sustainable Development	By 2033, at least 20% park trees and 10% of street trees are local species	3.1, 3.3

Australian Hobby, *Falco longipennis*. Credit: S.Mawson

	Action	Priority	Responsibility	Key Performance Indicator	Contributing to target (Table 1)
	Private landholder and community volunteers support				
16	Prepare and implement a private landholder incentives package to support biodiversity conservation on private rural lands.	Medium	City to engage adequately qualified consultant/ Parks and Place Improvement Canning	Private landholders incentive strategy adopted by the council At least 50% of native vegetation mapped on rural lands is retained in 2033	5.2, 5.3
17	Adopt a local plant subsidy scheme, targeting properties within ecological linkages	Medium	Parks and Place Improvement Canning	60% of land owners within each linkage actively participate in the scheme	5.2
18	Actively support local community groups interested in bushland and wetland management	Ongoing	Parks and Place Improvement Canning / CREEC	All current community groups are actively participating in the management of natural areas in the City	3.2, 3.3, 5.2, 5.3
19	Develop a range of activities that engage the community and raise awareness of biodiversity conservation issues in the City of Canning	Ongoing	Parks and Place Improvement Canning / CREEC	10% increase in participation in the City's environmental initiatives	5.3
	Communication and Local Government capacity building				
20	Integrate all Local Biodiversity Strategy mapping into the City's information system	High	Connect Canning	Mapping accessible to all City services	1.1, 3.1
21	Develop a new staff induction package that includes the Local Biodiversity Strategy objectives and actions, highlighting relevant responsibilities for each business unit	High	Connect Canning	All staff refer to the checklist prior commencing delivery of planned activities.	1.1, 3.1
22	For each business unit, develop a check list of activities that might impact biodiversity management in the City, including links to relevant staff within the Parks and Place Improvement that can provide advice or approval	High	Parks and Place Improvement Canning	All staff refer to the checklist prior to commencing delivery of planned activities.	1.1, 3.1
23	Develop and promote a sustainable landscaping information package for residential areas and verges (focusing on the use of local species) – linked to the local plant subsidy program	Medium	Parks and Place Improvement Canning / City to engage a qualified consultant	Landscaping information package available through the City's website and promoted annually	3.1, 3.3
24	Facilitate discussions with local Aboriginal leaders to investigate opportunities for their involvement in promoting the cultural values of natural areas in the City	Ongoing	Parks and Place Improvement Canning / CREEC	Cultural knowledge sought on projects, where relevant	2.1, 5.3
25	Develop a monitoring and reporting schedule for the Local Biodiversity Strategy	High	Parks and Place Improvement Canning	Annual report on progress with implementation of the Local Biodiversity Strategy and on the status of biodiversity in the City presented to Council	5.3
26	Undertake a review of the feasibility and effectiveness of the proposed implementation actions every 5 years.	Medium	Parks and Place Improvement Canning	Results of the review with recommendations on further actions presented to Council	1.1, 2.1, 3.3, 5.2, 5.3
27	Form partnerships with not-for-profit groups to facilitate reserve management and environmental education	Ongoing	Parks and Place Improvement Canning	At least one long-term (5 years) working partnership formed	2.1, 5.1, 5.2, 5.3

1 Context

1.1 What is Biodiversity and its Benefits

Biodiversity, or biological diversity, is a variety of all life forms. There are three levels of biodiversity (Natural Resource Management Council 2010), including:

- genetic diversity or the variety of genetic information contained in individual plants, animals and micro-organisms;
- species diversity or the variety of species;
- ecosystem diversity or the variety of habitats, ecological communities and ecological processes.

Conservation of biodiversity is critical to sustainable living which depends on maintenance of ecological services provided by a variety of ecosystems. Ecosystem services are divided into four main groups (TEEB 2011, Millenium Ecosystem Assessment, 2005):

- Provisioning services such as food, raw materials, fresh water, medicinal resources;
- Regulating services including microclimate, carbon sequestration and storage, moderation of extreme events, waste-water treatment, erosion prevention, pollination, biological control;
- Habitat or supporting services such as habitat for species, maintenance of genetic diversity;
- Cultural services such as education, recreation, mental and physical health, tourism, aesthetic appreciation and inspiration for culture, art and design, spiritual experience and sense of place.

Other benefits of keeping green spaces in urban areas include positive effects on property values. It has been estimated that property values increase about 10% in streets with large trees. Other recorded benefits include increased profits in tree-lined retail areas, greater acceptance of higher density residential developments near good quality green spaces, up to 25% reduction in energy consumption in buildings shaded by trees, reduced impacts on storm water management, reduced air pollution, noise impacts and improved human health (reduction in heat-related illnesses), sense of place and identity, increased outdoor activity and reduced infrastructure damage due to UV radiation exposure (Brown at al 2013, Pandit 2013, Matusik Property Insight 2006).

The importance of natural areas to residents of the City of Canning can be demonstrated through the results of a community survey conducted in 2007-2008. As part of a wider study involving four other Local Governments in the Perth Metropolitan Region, residents within 500 metres from three natural areas in the City were surveyed (Perth Biodiversity Project 2008). The selected natural areas included Queens Park Bush Forever Area, Lambertia Creek Conservation Area and the Prendwick Botanical Park.

One hundred percent of respondents living near Lambertia Creek stated it was important to have some natural bushland in the local area, and in the other two surveyed areas, over 90% of residents stated the same (CATALYSE 2007). 53% of all respondents in the City of Canning stated that they use their local reserve daily or at least once a week, with most common activities including walking, exercising pets and nature watching.

More recently the City of Canning undertook a community wellbeing survey or scorecard. Residents mainly like living in the City of Canning because of excellent parks and open spaces, proximity and access to the river (CATALYSE 2017).

Canning River. Credit: Darren Graham

1.2 What is a Local Biodiversity Strategy?

A local biodiversity strategy:

- Provides an overview of biodiversity assets retained in a local government area and identifies conservation priorities, focusing on 'Local Natural Areas';
- Summarises legislative and policy requirements for biodiversity conservation;
- Reviews existing provisions in the local planning framework for biodiversity conservation;
- Recommends a set of actions to improve the current status of biodiversity conservation in Local Natural Areas;
- Facilitates engagement of relevant stakeholders.

Local Natural Areas are defined as natural areas that exist outside Bush Forever Areas, Regional Parks and lands managed by the Department of Biodiversity Conservation and Attractions (Del Marco et al. 2004). Natural areas are areas that contain native species or communities in a relatively natural state and hence contain biodiversity. Natural areas can be areas of native vegetation, vegetated or open water bodies, waterways, springs, rock outcrops, bare ground, caves, costal dunes or cliffs. Parkland cleared areas, isolated trees in cleared settings, oval and turfed area are not included in the definition of natural areas (Del Marco et al. 2004).

This document is prepared in accordance with the Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region (Del Marco et al 2004) that outline the framework for local biodiversity conservation planning. The adopted methodology has been endorsed by the State Government (EPA 2008, WAPC 2011).

1.3 Definition of Conservation, Protection and Retention

The Local Biodiversity Strategy aims to conserve the diversity of natural areas and associated ecosystems in the City of Canning. In the context of this Strategy, conservation, protection and retention of natural areas are defined as follows:

Conservation: In relation to biodiversity, conservation is the protection, maintenance, management, sustainable use, restoration and improvement of the natural environment (Australian Government 2010).

Protection: Protected areas are those natural areas that are secured for conservation either as:

- Public lands vested for a biodiversity conservation purpose (e.g. nature conservation)
- Indigenous Protected Areas
- Private and public lands where the biodiversity values are secure for conservation under planning scheme provisions, or covenanting
- Shared management reserves (Australian Government 2010).

Retention: is all the processes ensuring natural areas are retained but not necessarily afforded protection to ensure their continued existence and viability (Del Marco et al. 2004).

1.4 Legislative and Policy Framework

Biodiversity conservation requires a multi-level approach including Commonwealth, State, local government, industry and non-government groups, private individuals and the community, all contributing to biodiversity conservation at appropriate levels. Development and implementation of a local biodiversity strategy provides an effective mechanism for meeting legislative requirements and strategic objectives at the local government level.

At the national level, Australia's Biodiversity Conservation Strategy 2010-2030 (NRMMC 2010) provides the overarching guiding national framework for biodiversity conservation. Australia, as the signatory to the international Convention on Biological Diversity, adopted a target of 17% of each of its bio-regions being protected in its National Reserve System **(http://www.environment.gov.au/land/nrs/about-nrs/requirements**). Priority actions towards meeting this target are identified in the Australia's National Reserve System Strategy 2009-2030 (Australian Government 2010) which was prepared in collaboration with all States.

Table 2 gives an overview of key legislation and statutory mechanism available at each level of Government in Australia to protect biodiversity. The Environmental Protection Authority and the Western Australian Planning Commission provide guidance on how to address environmental issues in land use planning via guidance statements, environmental and state planning policies.

At the State level, there is recognition for protection of 'locally significant natural areas' or natural areas that have not been recognised through processes focusing on regionally significant natural areas such as Bush Forever Areas or Regional Parks (Government of Western Australia 2000a, WAPC 2010). The Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region (Del Marco et al. 2004) provide guidance on how to assess, prioritise and protect locally significant natural areas. The State Government has prepared the draft Perth and Peel Green Growth Plan for 3.5 Million. This proposes improved protection and management of Bush Forever sites in the region.

At the local government level, provisions for biodiversity in a local planning strategy and scheme provide the most effective mechanisms for meeting the legislative requirements and integrating local biodiversity conservation objectives (State of Western Australia 2011). The local planning scheme provides the statutory mechanisms for the control of land use and development. However, the local planning strategy guides the way the scheme changes over time and provides justification for land use categories in the scheme. Thus it is critical that biodiversity is adequately considered early in the land use planning process through the preparation of the local planning strategy.

To provide further guidance on specific matters of the scheme, local planning policies can be prepared by local government. Adoption and implementation of this local biodiversity strategy will provide the adequate background information on biodiversity to inform the City's local planning strategy.

The following section provides an overview of the City of Canning's strategic objectives for biodiversity conservation and describes the current planning framework.

Banksia Peacock Spider, *Maratus mungaich.* Credit: S.Mawson

Statutory and Legislative Mechanisms	Key strategic and policy documents
Commonwealth	
Environmental Protection and Biodiversity Conservation Act 1999	• Australia's Biodiversity Conservation Strategy 2010-2030 • National Wildlife Corridors Plan (2012)
Western Australia	
Environmental Protection Act 1986 and the related Environmental Protection (Clearing of Native Vegetation) Regulations 2004 Biodiversity Conservation Act 2016 Biosecurity and Agriculture Management Act 2007 Swan and Canning Rivers Management Act 2006 Conservation and Land Management Act 1984	• EPA Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia (EPA, 2000) • Environmental Protection Bulletin No 20: Protection of naturally vegetated areas through planning and development (EPA, 2013) • EPA Guidance Statement No. 33: Environmental Guidance for Planning and Development (EPA, 2008) • Environmental Protection Swan Coastal Plain Lakes Policy 1992 • EPA Position Statement No.4: Environmental Protection of Wetlands • Environmental Protection Bulletin No. 1 – Environmental Offsets-Biodiversity • Draft Perth and Peel Green Growth Plan for 3.5 million
Planning and Development Act 2005 And Planning and Development (Local Planning Schemes) Regulations 2015	• Statement of Planning Policy No. 2: Environment and Natural Resources Policy (SPP2) (WAPC 2003) • Statement of Planning Policy No. 2.3: Jandakot Groundwater Protection Policy (WAPC 1998, under review) • Statement of Planning Policy No 2.8: Bushland Policy for the Perth Metropolitan Region (WAPC 2010) • Statement of Planning Policy No. 2.10: Swan-Canning River System (WAPC 2006)
City of Canning	
Town Planning Scheme No 40, 21 & 17 Draft Local Planning Scheme No 42	• Strategic Community Plan 2017 • Environment Management Strategy 2014 • Water Management Strategy 2014 • Public Open Space Strategy 2015

Table 2. Statutory and Legislative Mechanisms

1.5 Local Strategic and Planning Context

The City adopted its Community Strategic Plan, Our City: Our Future in 2017. Many of the community aspirations to the natural environment remain similar to those of the 2013 Strategic Community Plan.

To achieve the adopted vision, the Strategic Plan sets out specific goals for the natural environment:

- Natural areas are preserved and enjoyed
- Resources are managed sustainably
- The community is environmentally aware

In April 2014, the City adopted the Local Environmental Management Strategy (Essential Environmental 2014a). In August 2014, the City adopted its Water Management Strategy (Essential Environmental 2014b) which outlines the City's objectives for improved water management and to inform local land use planning.

Preparation of this Local Biodiversity Strategy is consistent with the recommendations of the Environmental Management Strategy (Essential Environmental 2014a). The Water Management Strategy and the Public Open Space Strategy have also been considered in the preparation of this document.

In October 2017, the Western Australian Planning Commission endorsed the Local Planning Strategy that sets out the City's objectives for future planning and development. In July 2017, the Draft Local Planning Scheme No. 42 was adopted for advertising and, when endorsed it will replace the City's Town Planning Scheme No. 40.

The City adopted several local policies with provisions for biodiversity conservation, see Table 3. City of Canning Policies with Provisions for Biodiversity Conservation.

Policy ID	Policy Title	Policy purpose
Administrative Policies		
ET520	Conservation of flora and fauna	To conserve natural flora and fauna.
ET521	Subdivision and Developments - Environment	To assess environmental issues.
ET525	Trees in Streets, thoroughfares and parks	To enhance the City's parks and streetscapes by the protection and maintenance of existing trees and the implementation of tree planting programs.
ET526	Subdivision - Landscaping	To provide an acceptable standard of reserve to be handed over to the City.
ET527	Urban revegetation and greening	To improve the urban revegetation and greening of the City.
Local Planning Policy		
SRS221(04)	Town Planning Schemes Landscape Plan	To assist with the enhancement of streetscape appearance within the City and other objectives as set out in this Policy. Objective 1.2: Provide protection for existing vegetation.
LP.09	Tree Retention and Planting Development	To facilitate acceptable tree preservation and provision as part of development in order to deliver healthy, vibrant and ecologically sustainable communities.

Table 3, City of Canning Policies with Provisions for Biodiversity Conservation

The Planning and Development (Local Planning Schemes) Regulations 2015 set out the role of local planning policies in decisions: "In making a determination under this Scheme the local government must have regard to each relevant local planning policy to the extent that the policy is consistent with this Scheme." (Schedule 2 Clause 2.4 (2)). However, if the Policy is inconsistent with the Scheme provisions, the Scheme prevails. In the current Town Planning Scheme No. 40, protection or retention of native vegetation is not included as an objective for any of the zones or local reserves.

It is recommended that the City includes specific provisions in the revised Local Planning Scheme No.42, with specific provisions for protection of significant local natural areas (4.1.2 Local Planning Scheme and Local Planning Policy).

Purple Flag, *Patersonia occidentalis*. Credit: S. Mawson

Western Bearded Dragon, *Pogona minor*. Credit: S.Mawson

2 Biodiversity Assets

2.1 Regional Context

The City of Canning is within an internationally recognised hotspot for biodiversity conservation, the South West of Western Australia. Hotspots identify regions with high levels of biological diversity and endemism that are under threat (Myers et al 2000, Conservation International 2011).

The regional conservation significance of most native vegetation in the City has been recognised as part of the Bush Forever initiative (State of Western Australia 2000). Bush Forever, a whole government initiative aims to protect at least 10% of the pre-European extent of representative vegetation complexes on the Swan Coastal Plain portion of the Perth Metropolitan Region.

Of the remaining vegetation in the City, 74% is within lands classified as Bush Forever Areas. Table 4 lists the Bush Forever Areas in the City of Canning and identifies the overlaying land use classifications. For each MRS land use category specific implementation mechanisms are proposed for achieving the Bush Forever initiative objectives. They are outlined in the State Planning Policy 2.8: Bushland Policy for the Perth Metropolitan Region (2010) and in Bush Forever Volume 3, Appendix 3 (State of Western Australia 2000).

Bush Forever Area (BFA)	BFA area (ha)	2014 Native vegetation extent within the BFA (ha)	Land use classification in the MRS	Land use classification in the TPS No 40*
BFA 224 – Canning River Regional Park and adjacent bushland (Bannister Creek)	285.5ha	140ha	Parks and Recreation/ Urban (Bannister Creek)	Regional Parks and Recreation, Local Park and Recreation Area and Public Purposes
BFA 283 – Queens Park bushland	40ha	18ha	Parks and Recreation	Regional Parks and Recreation
BFA 424 McDowell Street Bushland, Welshpool	9.9ha	7ha	Parks and Recreation	Regional Parks and Recreation and Local Parks and Recreation Area
BFA 338 (portion only)- Yagan Wetland and adjacent bushland	5.7ha	4.2ha	Parks and Recreation	Regional Parks and Recreation
BFA 388 (portion only) Jandakot Airport	28ha	17.4ha	Rural/Railways	Local Parks and Recreation Area
BFA 389 (portion only) Acourt Road bushland	140ha	129ha	Parks and Recreation	Regional Parks and Recreation
BFA 333 (portion only) Canning River Foreshore Salter Point to Wilson	0.8ha	0.6ha	Parks and Recreation	N/A

Table 4, Bush Forever Areas in the City of Canning

2.2 Geology, Landforms and Soils

The City of Canning is spread over a range of alluvial and aeolian deposits of the Swan Coastal Plain, quaternary deposits building the low relief of the Coastal Plain.

The alluvial deposits, characteristic of the eastern parts of the Swan Coastal Plain extend into the City within the localities of East Cannington, Queens Park, Cannington and Wilson. They are represented by the Guildford Unit, characterised by duplex soils and the Cannington Unit which has free lime in the sub-soil that occasionally form small lime mounds (Churchward and McArthur 1980).

The Swan unit which follows the present stream courses, including the Canning River, is developed in sediments that are younger than those of the Guildford unit.

The aeolian deposits are arranged in three systems of dunes of different ages. The oldest, the Bassendean dune system cover the remainder of the City of Canning and are represented by two units; the Bassendean unit and the Southern River Unit differing in the nature of associated swamps. The Southern River unit occurs where sand was blown over the alluvial soils and the swamps often have a clay base while in the Bassendean unit, peaty soils developed in the swamps (Churchward and McArthur 1980).

2.3 Vegetation

For this Strategy, native vegetation mapping is used as a surrogate to describe the variety of ecosystems in the City. Biodiversity conservation priorities at the regional or biogeographic region scale and local scale are based on the levels of retention and protection of native vegetation. One of the key principles of biodiversity conservation is to prevent loss of species and ecosystems by retaining at least 30% of the pre-European settlement extent of each ecological community (EPA 2000, Del Marco et al 2004). In constraint areas, the Environmental Protection Authority (EPA) seeks to protect at least 10% of the pre-European extent, a threshold for identifying threatened ecological communities (EPA 2000).

At the national level, the Australian Government adopted a new target for protections of Australia's biodiversity (**http://www.environment.gov.au/land/nrs/about-nrs/requirements**). Australia, as the signatory to the international Convention on Biological Diversity, seeks to protect at least 17% of each of its bio-regions in the National Reserve System, through implementation of priority actions identified in the Australia's National Reserve System Strategy 2009-2030 (Australian Government 2010) which was prepared in collaboration with all States.

Under Bush Forever, one of the adopted policy measures for implementation includes an assumption against clearing of threatened ecological communities or vegetation complexes with less than 10% remaining on the Swan Coastal Plain portion of the Perth Metropolitan Region, generally involving vegetation complexes of the eastern side of the Swan Coastal Plain (State of Western Australia 2000). A portion of remaining native vegetation in the City of Canning qualifies to these criteria (vegetation representative of Swan, Guildford and Cannington complexes).

Less than 7% of the City of Canning area is covered in native vegetation (see Table 5). Of the remaining 6.6% vegetation, nearly one third is classified as Local Natural Areas, or natural areas outside lands managed by the Department of Biodiversity Conservation and Attractions (DBCA), Bush Forever and Regional Parks. Local Natural Areas are the focus of this Local Biodiversity Strategy and include freehold land and land vested in or managed by Local Government and other State Government agencies for purposes other than conservation.

	Area	% of current extent
Pre-European vegetation extent	6428.6ha	
2018 native vegetation extent	428.5ha	100%
Portion of the current extent in Bush Forever Areas (and not on DPAW managed lands)	253.5ha	59%
Portion of current extent in Local Natural Areas	112.5ha	26%
Portion formally protected (on DPAW lands)	62.5ha	14%
Total protected locally*	**66.8ha**	**15%**

Table 5. Overview of native vegetation and protection status in the City of Canning

*Locally protected natural areas include lands reserved for conservation on DBCA managed lands and other reserves with conservation purpose.

White-banded Grass-dart, *Taractrocera papyria agraulia*. Credit: S.Mawson

2.3.1 Diversity of vegetation

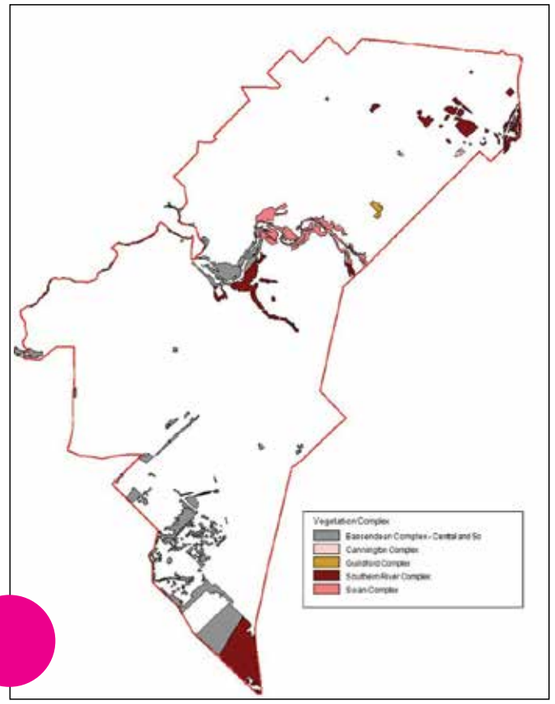


Figure 1. Vegetation Complexes in the City of Canning

Five vegetation complexes (Heddle et al 1980) occur in the City of Canning, with two dominating the City's area. Very little remains of the Cannington complex which was the third most common vegetation type in the City's area before clearing.

2.3.1.1 The most common vegetation complexes in the City

More than half of the City area was covered in vegetation representative of the Bassendean Central and South vegetation complex and it still remains the most represented vegetation complex in the City. The second most common vegetation complex in the City was and remains the Southern River complex. In 2018, less than 10% of the pre-European extent remained in the City of these two vegetation complexes.

Bassendean Central and South vegetation complex ranges from woodland of *Eucalyptus marginata – Allocasuarina fraseriana – Banksia spp.* to low woodland of *Melaleuca spp.* and sedgelands on the moister sites. This area includes the transition of *Eucalyptus marginata* to *Eucalyptus todtiana* in the vicinity of Perth. *Banksia attenuata*, *Banksia grandis* and *Banksia menziesii* are common on the upper slopes; *Banksia littoralis* and *Melaleuca preissiana* are common in the low-lying moister soils, where marri replaces jarrah in dominance. Other plant species include *Kunzea vestita*, *Hypocalymma angustifolium, Adenanthos obovatus* and *Verticordia spp.*

An example of vegetation representative of the Bassendean Central and South vegetation complex is reserved in the Caladenia Grove Wetland Reserve (R48617) in Canning Vale. The reserve is approximately 5 hectares and includes several plant communities (ATA Environmental 2004):

- *Melaleuca preissiana* Low Open Woodland covers the wetland portions of the reserve and is surrounded by a *Regelia inops* Open Heath and *Regelia inops* Tall Shrubland with *Melaleuca scabra* and *Melaleuca thymoides*, over a Low Shrubland of *Scholtzia involucrata*, *Dasypogon bromeliifolius*, *Patersonia occidentalis* and *Hypolaena exsulca*.
- The upland parts of the reserve are dominated by mixed *Banksia attenuata/B. menziesii/B. ilicifolia* woodland over S*choltzia involucrata*, *Calytrix flavescens* and *Beaufortia elegans*.

The Southern River complex is represented by open woodland of *Corymbia calophylla – Eucalyptus marginata* – Banksia spp. on elevated areas with fringing woodland of *Eucalyptus rudis – Melaleuca rhaphiophylla* along the streams. In the City of Canning, examples of this vegetation complex are retained in Bush Forever Area 283 and 424, including the community of *Corymbia calophylla - Kingia australis* woodlands on heavy soils, a threatened ecological community (see section 2.4 Threatened Species and Ecological Communities).

Mangles kangaroo paw, *Anigozanthos manglesii*. Credit: S.Mawson

2.3.1.2 The most threatened vegetation complexes

The third most common vegetation complex in the City was the Cannington complex. Of the 430.2 hectares mapped as pre-European extent in the City, only 1.6 hectares remained in 2018. While the Cannington complex is a mosaic of vegetation from the adjacent vegetation complexes, it has a distinctive feature associated with the mounds of spring limestone of the Cannington soil-landscape unit (Heddle et al 1980). These mounds of spring limestone support pockets of tuart (*Eucalyptus gomphocephala*) within woodlands of jarrah-banksia with varying understorey. The low lying areas support vegetation ranging from woodlands of *Eucalyptus rudis-Melaleuca rhaphiophylla* along the streams, to a closed scrub of *Melaleuca spp.* on the less well-drained depressions.

In the regional context, distribution of the Cannington complex in the City of Canning and the adjoining City of Gosnells represents only 3.6% of the extent on the Swan Coastal Plain, with majority mapped within the Shires of Murray, Waroona and Harvey. With less than 1 hectare remaining in the City of Gosnells, the 1.6 hectares in the City of Canning are the last remaining examples of this vegetation complex in the Perth Metropolitan Region.

Of the 1.6 hectares remaining in the City of Canning, 0.47 hectares is retained in a public recreation purpose reserve R49104, managed by the City under a Management Order. The remaining approximately 1 hectare of vegetation representative of the Cannington complex is located on private properties adjoining the reserve.

The second vegetation complex most affected by clearing in the City is the Guildford complex. Of the 305 hectares mapped as pre-European extent in the City, only 6.2 hectares remained in 2018. All remaining vegetation representative of the Guildford vegetation complex forms components of a Threatened Ecological Community (see more information in section 2.4) and are spread over several freehold properties between Grose Avenue and Bent Street in Cannington. Woodman Environmental (2005) described five plant communities within the last remaining patch of native vegetation representative of the Guildford complex in the City, also referred to as Grose Avenue bushland or Carousel wetland:

- low woodland of *Casuarina obesa* over a disturbed understorey dominated by *Cyathochaeta avenacea*, *Cynodon dactylon** and *Patersonia occidentalis* on sandy clay-loam,
- Seasonally inundated degraded shrubland of *Viminaria juncea* and *Melaleuca lateritia* over a herb layer dominated by weed species and sedges on grey sandy clay,
- Shrubland of *Viminaria juncea* over scattered shrubs including *Verticordia densiflora, Xanthorrhoea brunonis* and *Pericalymma ellipticum var. floridum* on brown clay,
- Heath dominated by *Verticordia densiflora, Patersonia occidentalis, Cyathochaeta avenacea* and *Centrolepis aristata* in a seasonally inundated area on clay-loam,
- Heath dominated by *Melaleuca lateritia* over mixed species including *Meeboldina cana*, *Chorizandra enodis* and *Astartea affinis* in a seasonally inundated area on clay-loam.

Two Priority 4, Priority 2 (in 2015 listed as Priority 3) and Threatened flora have been recorded within the Grose Avenue bushland (Woodman Environmental 2005, Environmental Planning Tool August 2014).

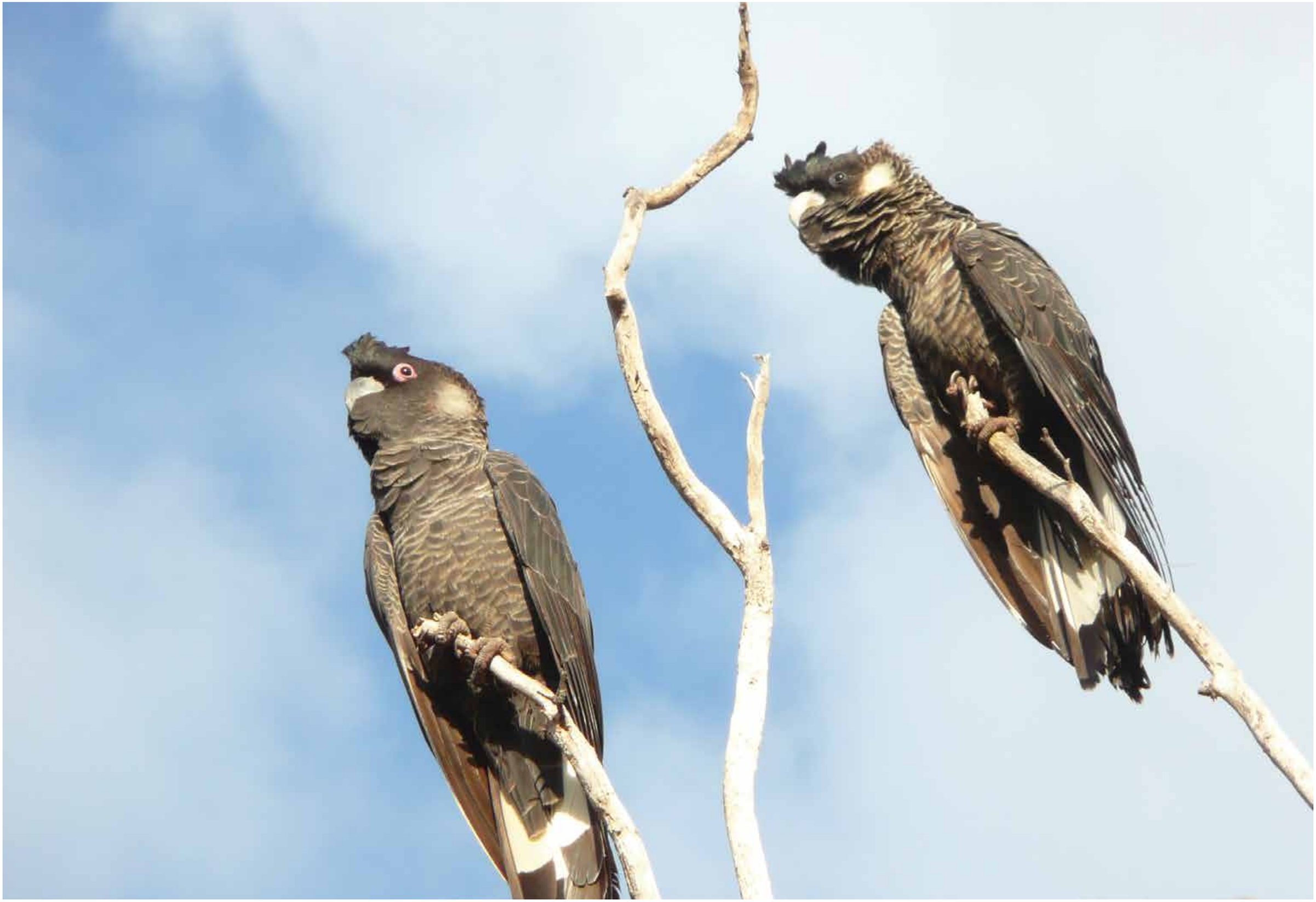
2.3.1.3 The most retained vegetation complex in the City

The best retained vegetation complex in the City is the Swan complex, with 24% of its pre-European extent remaining in the City. The Swan complex consists of plant communities developed on alluvial deposits along the Canning River and is dominated by woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla* with localised occurrence of low open forest of *Casuarina obesa* and *Melaleuca cuticularis*. Other plants that are present include species of *Leptocarpus, Juncus, Cyperus, Schoenus and Scirpus*.

This vegetation was subject to early disturbances associated with settlement of the south-west of Western Australia, therefore there are only a few remnant undisturbed areas. The best examples of estuarine habitat found along the Swan and Canning Rivers on the Swan Coastal Plain occur within the City of Canning between Riverton Bridge and Kent Street (CALM 1997), providing a reason for the establishment of the Canning River Regional Park.

A vegetation survey of the Park identified numerous plant communities (CALM 1997):

- The salt-marsh and shore-rush communities (likely to meet the criteria of the Subtropical and temperate coastal saltmarsh threatened ecological community listed under the EPBC Act as Vulnerable (Commonwealth of Australia 2013a):
  - The Samphire community dominated by *Sarcocornia quinqueflora*
  - The Shrubby Samphire community dominated by *Tecticornia* species
  - The Club-rush community consisting of a single native species, *Bolboschoenus caldwellii*. This community is replacing the original samphire community where freshwater flushing from storm water drains occurs.
- Three fringing forest communities:
  - The Saltwater Sheoak-Paperbark community (*Casuarina obesa* and *Melaleuca rhaphiophylla*)
  - The Paperbark community (*Melaleuca rhaphiophylla*)
  - The Paperbark-Flooded Gum community (*Melaleuca rhaphiophylla* and *Eucalyptus rudis*).
- Two bulrush communities (one the native rush (*Typha domingensis*) and one with the introduced *Typha orientalis*), and possibly a hybrid variety (Jenni Andrews, personal comment).
- The Flooded Gum community (*Eucalyptus rudis*) of which only two small patches remain in the suburb of Ferndale.
- Aquatic flora – its distribution is dependent on the salinity tolerance of each species.



Carnaby's Cockatoo, *Calyptorhynchus latirostris*. Credit: S.Mawson

2.3.2 Protection status of vegetation

While over 70% of the remaining vegetation in the City is within lands providing some level of protection through provisions of the Bush Forever policy (SPP 2.8, WAPC 2010), this represents only 5% of the pre-European extent of vegetation in the City. Just over 1% of the pre-European extent of vegetation in the City is in Crown reserves vested for conservation, including 62.5 hectares managed by DBCA within the Canning River Regional Park and 4.2 hectares in a reserve managed by the City of Canning (Yagan Park).

It is not possible to achieve the minimum recommended target of 10% of the pre-European extent of vegetation as less than 10% of native vegetation remains in the City. Therefore formalising the protection status for all Bush Forever Areas and other high conservation value local natural areas should be the highest priority to improve the current protection status of remaining vegetation.

The most feasible options for increasing the protection level of natural areas in the City of Canning include:

- Changing or extending a reserve purpose to conservation under the Land Administration Act 1997 provisions;
- Securing vegetation on freehold land via land use provisions (as part of Public Open Space), purchase or land swap, ceding the secured land to the Crown and reserving it for conservation;
- Introducing a Local Environmental Conservation reserve classification into the City's Local Planning Scheme (see section 4.1).

Due to the smaller lot size of privately owned rural zoned lands in the City of Canning, protection of vegetation via a conservation covenant, a voluntary but legally binding agreement between a landholder and a covenanting agency to conserve vegetation is an unlikely option. However, support to landowners via a Stewardship Program (see section 4.2.3 of this document) will assist with long-term vegetation retention and maintenance of biodiversity values.

Daviesia physodes. Credit: S.Mawson

2.4 Threatened Species and Ecological Communities

2.4.1 An overview and significant flora

The State's Biodiversity Conservation Act 2016 aims to protect all flora and fauna in the state. Those species that are considered critically endangered, vulnerable, extinct or extinct in the wild are listed in the Threatened Flora -Rare Flora Notice and the Threatened Fauna - Specially Protected Fauna Notice published in the Government Gazette. The latest lists were released in January 2018 **(https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities)**

The Biodiversity Conservation Act 2016 introduces provisions to list threatened ecological communities as critically endangered, endangered, vulnerable or collapsed (destroyed). Threatened ecological communities are listed as 'Environmentally Sensitive Areas' which are declared in the Environmental Protection (Environmentally Sensitive Areas) Notice 55 under section 51B of the Environmental Protection Act 1986. Exemptions to vegetation clearing listed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply in Environmentally Sensitive Areas, so these areas cannot be cleared without approval.

Numerous threatened species and ecological communities listed by the State are also listed under the Commonwealth's Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act). Under the EPBC Act species and ecological communities are ranked into four categories: extinct in the wild, critically endangered, endangered and vulnerable.

A search of the State's database NatureMap identified 738 species of native flora and fauna and 156 naturalised species (NatureMap visited in January 2015) recorded in the City. Naturalised species are non-native species that have spread into natural areas and their reproduction is sufficient to maintain a population, such as Perennial Veldt Grass (*Ehrharta calycina*) or Black rat (*Rattus rattus*). Threatened and Priority species protected under the State and Commonwealth legislation are listed in Table 6.

The Commonwealth Department of Environment's on-line Protected Matters Search Tool **(http://www.environment.gov.au/epbc/protected-matters-search-tool)** lists 46 threatened species and 24 migratory species, including several species or their habitat that may occur in the City of Canning. Table 6 lists Specially Protected Flora and Fauna occurring in the City of Canning. Any proposed activities that may have significant impact on one or more listed matters of national environmental significance should consider the Administrative Guidelines on Significance available via **http://www.environment.gov.au/epbc/publications/significant-impact-guidelines-11-matters-national-environmental-significance**

Eastern Great Egret, *Ardea modesta*. Credit: P Walker.

SPECIALLY PROTECTED FAUNA	Conservation code
Actitis hypoleucos (Common sandpiper)	IA
Ardea modesta (Eastern Great Egret)	IA
Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)	T
Calyptorhynchus baudinii (Baudin's Cockatoo)	T
Calyptorhynchus latirostris (Carnaby's Black Cockatoo)	T
Dasyurus geoffroii (Chuditch or Western Quoll*)*	T
Falco peregrinus (Peregrine Falcon)	S
Falco peregrinus subsp. macropus (Australian Peregrine Falcon)	S
Hydromys chrysogaster (Water-rat)	P4
Isoodon obelus subsp. fusciventer (Quenda, Southern Brown Bandicoot)	P5
Leioproctus douglasiellus (a short-tongued bee)	T
Lerista lineata (Perth Slider, Lined Skink)	P3
Merops ornatus (Rainbow Bee-eater)	IA
Neelaps calonotus (Black-striped snake)	P3
Neopasiphae simplicior (bee)	T
Phascogale tapoatafa subsp. tapoatafa (Southern Brush-tailed Phascogale)	T
Plegadis falcinellus (Glossy Ibis)	IA
Tringa nebularia (Common Greebshank)	IA
THREATENED AND PRIORITY FLORA	**Conservation code**
Andersonia gracilis	T
Anthotium junciforme	P4
Aponogeton hexatepalus (Stalked Water Ribbons)	P4
Baeckea sp. Perth Region (R.J. Cranfield 444)	P3
Boronia tenuis (Blue Boronia)	P4
Byblis gigantea (Rainbow Plant)	P3
Caladenia huegelii (Grand Spider Orchid)	T
Conospermum undulatum	T
Diuris purdiei (Purdie's Donkey Orchid)	T
Drakea elastica (Glossy-leaved Hammer Orchid)	T
Drakea micrantha	T
Drosera occidentalis subsp. occidentalis	P4
Eremophila glabra subsp. chlorella	T
Grevillea thelemanniana subsp. thelemanniana (Spider Net Grevillea)	P2
Haloragis scoparia	P1
Macarthuria keigheryi	T
Meeboldina decipiens subsp. decipiens	P3
Ptilotus sericostachyus subsp. roseus	P1

THREATENED AND PRIORITY FLORA	Conservation code
Schoenus benthamii	P3
Schoenus natans (Floating Bog-rush)	P4
Schoenus pennisetis	P3
Stylidium paludicola	P3
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T
Tetraria australiensis	T
Tripterococcus paniculatus	P4
Verticordia lindleyi subsp. lindleyi	P4

Conservation Codes

T - Rare or likely to become extinct

X - Presumed extinct

P1-P4 – Priority 1-4

IA - Protected under international agreement

S - Other specially protected fauna

Table 6, Specially Protected Flora and Fauna in the City of Canning

Castiarina subcincta. Credit: S Mawson.

In addition to the conservation significance flora listed in Table 6, the presence of the tuart (*Eucalyptus gomphocephala*) in the City should be noted as significant. While tuart does not appear on the list of recorded species generated by NatureMap (January 2015), Powell (DEC 2009) mentions the presence of tuart in Riverton (near High Road) as an example of tuart extending beyond the coastal strip inland along watercourses. Stands of tuart are also occurring within the grounds of Lynwood Senior High School (Fisher 1999).

Tuarts, the largest trees on the Swan Coastal Plain, are restricted to a 5-10km wide coastal strip between Jurien Bay and Sabina River east of Busselton. It is estimated that only about 35% of the pre-European extent of tuart communities remain (DPAW 2014).

Remaining tuart woodlands have been disturbed by grazing, adjoining urban development, altered fire regimes, past timber harvesting and since the 1990s, a severe dieback, including instances of sudden mass collapse of tuarts in a large area south of Mandurah has been observed. Research into causes of tuart decline considered a range of potential triggers, including effects of a plant pathogen *Phytophthora multivora* (Scott et al 2011). Considering the high conservation significance of tuart, its health decline within some protected areas, and the fact that 67 percent of the remaining tuarts are on private land, re-establishing tuart in reserves in areas where it used to occur should be a high priority.

2.4.2 Fauna

Quenda, *Isoodon obesulus*. Credit P Walker

This section discusses the possibilities of threatened and priority fauna recorded as occurring in the City persisting in the remaining natural areas.

Until 2010 and 2012, when chuditch or Western Quoll (*Dasyurus geoffroii*) were trapped during fauna surveys in the southern suburbs of the Perth Metropolitan Region (Chambers, 2014), it had not been recorded in Perth on the Swan Coastal Plain for over seventy years (Department of Environment and Conservation, 2012a). The chuditch is listed as Vulnerable under the EPBC Act and the Biodiversity Conservation Act 2016. This species used to inhabit about 70% of the Australian continent. Its current extent is limited to the South West of Western Australia, representing only about 5% of the former range.

Chuditch, the largest carnivorous marsupial occurring in Western Australia, are solitary animals with males occupying over 15 km², often overlapping with other individuals including a core area of about 4 km² that does not overlap with other chuditch (Department of Environment and Conservation, 2012a). The ability of chuditch to return to the well vegetated sections of the City will be dependent on the establishment of effective ecological linkages between the known populations in the Jarrah Forest and other large areas of native vegetation on the Swan Coastal Plain and an effective fox control and feral cat program across the region.

The Brush-tailed Phascogale (*Phascogale tapoatafa subsp. tapoatafa*) was formerly widespread in eastern and south-western Australia. In Western Australia it now occurs in the south west between Perth and Albany with the highest densities recorded in the Perup/Kingston area, Collie River valley and near Margaret River and Busselton. It occurs in lower densities in the Northern Jarrah forest (Department of Environment and Conservation, 2012b). Its former occurrence has been reduced by 50% (Commonwealth of Australia, 2015) and it is listed on Schedule 1 (Fauna that is of special conservation need as conservation dependent fauna). Considering that female brush-tailed phascogales cover 20-70 hectares of forest and open woodlands with abundant hollow-bearing trees and the distance to the nearest current populations, any chance of re-establishing the species in the City will be dependent on the same actions as for chuditch, establishing linkages, controlling foxes and retaining hollow-bearing trees not only in the City but also within the adjoining Local Governments.

Of the six other threatened fauna recorded in the City, five have recovery plans or conservation advice with recommended priority actions (see the highlighted species in Table 6). Recommendations in this document are consistent with the proposed recovery action for these threatened species.

The three black cockatoos are endemic to the south west of Western Australia. Carnaby's black cockatoo is listed as Endangered, Forest red-tailed cockatoo and Baudin's cockatoo are listed as Vulnerable under the EPBC Act. Carnaby's and Baudin's cockatoo are listed as Endangered Birds under Division 2 published under Schedule 2 of the Threatened Fauna - Specially Protected Fauna Notice. The Forest red-tailed cockatoo is is listed as Vulnerable Birds under Division 2.

All remaining vegetation in the City of Canning is mapped as potential feeding habitat for Carnaby's black cockatoos, with the majority within buffers of several known roosting sites (Glossop et al, 2010). Due to the proximity of this vegetation to open water in the numerous natural and artificial wetlands in the City, all native vegetation, including single trees known to be utilised by Carnaby's cockatoos are considered significant and should be protected and degraded areas restored. A list of plant species known to be utilised by all three threatened species of black cockatoos is available through the EPBC Act referral guidelines for the three threatened black cockatoo species (Commonwealth of Australia, 2012).

The two native bees *(Leioproctus douglasiellus and Neopasiphae simplicior*) recorded in the City are endemic to the Perth Metropolitan Region and have very limited known range, with the current extent of occurrence of *Leioproctus douglasiellus* being 24.3 km² and the area of occupancy 0.2 km². Both species are listed as Critically Endangered under the EPBC Act and listed on Division 5, Endangered Invertebrates published in the Threatened Fauna - Specially Protected Fauna Notice.

Black Swan and cygnets, *Cynus atratus*. Credit P Walker.

Specimens of *Leioproctus douglasiellus* have been collected on two plants: *Goodenia filiformis* (Priority 3) and *Anthotium junciforme* (Priority 4) (Commonwealth of Australia, 2013). Specimens of *Neopasiphae simplicior* were only collected from four plants: *Goodenia filiformis*, *Lobelia tenulor, Angianthus preissianus* (males only) and *Velleia sp.* (Commonwealth of Australia, 2008). *Goodenia filiformis* is not listed as occurring in the City of Canning on a list of species generated via NatureMap. However, there is a historical record of collection of this species from the locality of Cannington and it has also been observed in the Canning River Regional Park (Jenni Andrews, personal comment). It is recommended to seek expert advice on the suitability of selecting this species for revegetation projects aiming to improve the extent of habitat for the native bees.

Loss of habitat due to clearing, inappropriate fire regimes which can result in replacement of their habitat with weeds and competition with introduced honeybees are the main threats to these species (Commonwealth of Australia 2013b & 2008). The approved conservation advice for the two native bee species lists a range of actions including:

- Protection of known habitat,
- Adoption of adequate fire management strategies for this habitat,
- Management of weeds with minimising impacts of herbicides on the native bees,
- Investigations of options for linking, enhancing or establishing additional populations of bees
- Feral honey bee control program to reduce competition for limited resources (Houston 2000).

Implementation of this Local Biodiversity Strategy will directly contribute to the above actions.

The revised Yagan Wetland Reserve Management Plan (Brooker and Rigo 2000) notes the importance of the reserve to rare species of insect and lizard that do not appear on the list generated via NatureMap.

The Yagan Wetland Management Plan identifies the reserve as the only location on the Swan Coastal Plain where the largest dragonfly in Western Australia, *Petalura hesperia*, has been recorded and its small population is believed to be stable (Brooker and Rigo 2000). The Atlas of Living Australia, an on-line national database of all the known species in Australia, shows one record from the City of Canning collected in 1957 and another record on the northern extent of the Swan Coastal Plain (collected in 1966). Considering the rarity of this species, it is recommended to seek an update of the State databases of records for this species.

The second species identified in the Yagan Wetland Reserve Management Plan is a skink, *Egernia luctuosa*. It is considered significant (Government of Western Australia 2000b) as the Perth region is the northern limit of its geographic range (Bush et al. 1995).

Nearly all remaining vegetation in the City of Canning has been identified as potential habitat for Quenda, Priority 5 species that is endemic to the south west Western Australia. Survey of quendas or Southern brown bandicoots, conducted by WWF-Australia and the Department of Parks and Wildlife between 2012 and 2013, and demonstrated that despite the growing development in the Perth region, quendas persist in many urban bushland areas. In the City of Canning, 26 sightings of Quenda were reported from the suburb of Canning Vale, 4 sightings from Willetton and one from Welshpool (Howard et al. 2014). Lack of sightings from other parts of the City with remnant vegetation should not be interpreted as quenda not persisting in those areas but might be more a reflection of uneven distribution of community participants in the survey, for example a population is also known to occur in Wilson even though no formal records are listed for the locality on the NatureMap (Jenni Andrews, personal comment).

The 2012 Quenda survey identified the following causes of death of quenda (Howard et al. 2014):

44% - vehicle strikes

30% - predation (foxes, cats and dogs)

16% - drowning (in swimming pools and backyard ponds)

8% - unknown cause

1% - poison.

Clearing of habitat, drying of wetlands and lack of connectivity between fragmented remaining vegetation were listed as main contributors to the significant decline of Quenda populations in the Perth Region. Howard et al. (2014) list a range of recommendations on how to integrate considerations for quenda habitat and quenda dispersal into land use planning and how to manage remaining habitat and the main identified causes of Quenda deaths.

Rakali or Water rat, also known as Moytj or Ngurju (Southwest Australia Noongar names), (*Hydromys chrysogaster*), a Priority 4 species is a large amphibious native rodent whose populations declined in the southwest Western Australia due to trapping in the 1930s and 1940s, river and wetland habitat degradation and drowning in illegal fish traps. Rakali are considered to be an indicator of good river health. Rakali were observed in the City of Canning within the Canning River Regional Park (Storer et al. 2013). Protection and restoration of riparian vegetation, prevention of use of illegal fish and marron traps, feral animal control and water quality control are key recommendations on improving habitat for the Water rat (DEC 2012c).

Waterways and wetlands support a large number of birds, reptiles, insects and aquatic fauna. The varied ecosystems of the Canning River Regional Park support a wide diversity of species. About half of the bird species occurring on the Swan Coastal Plain can be found in the Regional Park. Past studies listed 97 species of birds in the Park, including 44 waterbirds, 41 forest and woodland birds and 12 common species found in urban areas (Department of Conservation and Land Management 1997). The Canning River Regional Park Volunteers biannual bird survey recorded 101 species in 2015.

Many of the birds use the Park for breeding, feeding or refuge, including several migratory species protected by international treaties such as the Japan-Australia Migratory Birds Agreement and the China-Australia Migratory Birds Agreement. A list of migratory bird species protected by these agreements and recorded in the City of Canning is in Table 6.

The Rainbow bee-eater migrates annually from the north of Australia to the southwest to breed during the summer months (September and April). These conservation significance migratory birds set up their nests in the ground in sandridges, sandpits, riverbanks, beaches and dunes but also road cuttings or golf courses. It is important to raise awareness of these species and plan any development or infrastructure maintenance with consideration for these species. Fox control in locations known to be used by Rainbow bee-eaters for breeding should also be a priority.

Black swan (*Cygnus atratus*), the official bird emblem of Western Australia, are most commonly found in areas of shallow, vegetated foreshores in the Swan Canning Riverpark. For nesting they require adequate water levels, materials for building nests, proximity to feeding areas and access to fresh water (Swan River Trust 2012). However, due to encroaching residential development, the number of sheltered, vegetated sites, with no risk of disturbance by dogs, cats, foxes and people is limited. Stopping the practice of feeding bread and other food scraps is an important measure towards ensuring long-term viability of this iconic species on the Canning River and other water features in the City and the region.

In addition to the Water rat and Quenda, the Brush-tail possum (*Trichosurus vulpecula*) has also been recorded in the Canning River Regional Park and in the Bannister Creek Park (Department of Conservation and Land Management 1997; SERCUL 2014); and the Western brush wallaby (*Macropus Irma*) is also reported occurring in the City (Jenni Andrews, personal comment), yet they are not listed in the NatureMap generated species records. The distribution of these species in the City needs to be formally recorded to allow future monitoring of the effectiveness of natural area management to maintain adequate habitat in the City.

One of the two priority reptile species recorded in the City, *Neelaps calonotus* (Black-striped snake), is endemic to the Swan Coastal Plain. Records of *Lerista lineata* (Perth slider) have also been limited to the southern parts of the Swan Coastal Plain, Rottnest and Garden Islands, until it was recorded east of Shark Bay (Bush et al. 1995). Other larger reptiles include Long-necked tortoise (*Chelodina colliei*), Dugite (*Pseudonaja affinis affinis*), Western tiger snake (*Notechis scutatus occidentalis*) and the Western bearded dragon (*Pogona minor minor*).

The most abundant fish recorded in the Canning River was the Perth Herring (Department of Conservation and Land Management 1997). A more recent study of the Canning River recorded 30 different species of aquatic fauna, including four endemic freshwater finfish and two endemic crayfish. The native freshwater fish include Freshwater cobbler, Western minnow, Western pygmy perch and the Nightfish. Out of the 30 species, 5 species of finfish (Mosquitofish, One-spot livebearer, Goldfish, Koi and Spangled perch); one crayfish (Yabbie) and one tortoise (Murray River tortoise) were introduced species. Nearly 30 different species of aquatic macroinvertebrates were recorded (Storer et al. 2013).

The Kent Street Weir acts as a barrier between the estuarine waters of the Canning River and the Kent Street Weir Pool. Annual migration of some estuarine fish into the freshwater occurs and two spawning beds exist upstream of the Weir (Ian Vaughn, personal comment, 6 July 2015). The Department of Water and Environmental Regulation intend to install a fish way in 2017 at the same time the Kent Street Weir is upgraded. The upgrade will install higher weir boards to prevent salt water tidal intrusions.

A local friends group, the Friends of Queens Park Bushland are building an on-line community resource by recording all flora and fauna observed in bushland comprising Bush Forever Area 283 and 424, including brief descriptions and photos. The webpages documenting the animals and insects can be found on **http://www.friendsofqueensparkbushland.org.au/category/animals**. A number of fauna species documented on the website will be found in other bushland and wetland areas in the City.

'Birds of the Canning River' website, created by Bill Lambe, also provides a useful resource for identifying birds using the Canning River and its foreshore areas: **http://www.canningriverbirds.com**. The Canning River Regional Park Volunteers have recorded birds in the Canning River Regional Park annually since 2004: **http://www.sercul.org.au/crrpv/downloads**.

The Canning River Residents Environment Protection Association also have a list of birds sighted on the Shelley Rossmoyne Foreshore **http://www.sercul.org.au/crrepa**.

2.4.3 Threatened ecological communities

An ecological community is a naturally occurring biological assemblage that occurs in a particular type of habitat. Its scale depends on the level of detail in the information source (Del Marco 2004). Under the EPBC Act, ecological communities are defined as assemblage of native plants that inhabit a particular natural area and meet the additional criteria specified in the regulations made for the purposes of this definition.

Ecological communities which are presumed to be totally destroyed or at risk of becoming totally destroyed are listed as threatened ecological communities. In Western Australia, threatened ecological communities have been identified and informally listed since 1994.

Ecological communities with insufficient information available to be classified as threatened, or which are rare but not currently threatened, are placed on the Priority list and referred to as 'priority ecological communities'.

There are three nationally listed threatened ecological communities occurring in the City. The buffer of one nationally listed threatened ecological community overlaps with the City, occurring on the boundary with the City of Gosnells. Activities on the adjoining lands may affect the condition of these ecological communities and need to be planned in a way that avoids adversely impacting on them. Threatened ecological communities mapped in the City are listed in Table 7.

Ecological communities mapped in the City	WA Conservation category	EPBC Act conservation category
Shrublands and woodlands on Muchea limestone of the Swan Coastal Plain	Endangered	Endangered
Subtropical and Temperate Coastal Saltmarsh	Priority 3(iii)	Vulnerable
Banksia Woodlands of the Swan Coastal Plain	Endangered	Endangered

Table 7, Threatened Ecological Communities in the City of Canning

One of the threatened ecological communities listed in Table 7 has an approved interim recovery plan; Shrublands and woodlands on Muchea limestone (English & Blyth 2000). The Recovery Plan identifies priority actions towards improving the conservation status of this threatened ecological community, including increasing its protection level and managing key threatening processes. Information regarding key threatening processes for the nationally listed threatened ecological communities which do not have a recovery plan yet, is available through the Commonwealth's Department of Environment website by searching for a 'Listing Advice' or 'Conservation Advice' that include recommendations regarding a recovery plan (**http://www.environment.gov.au/biodiversity/threatened/conservation-advices**).

These documents include important information and recommendations regarding ecological community specific management requirements. For example, while prevention of further clearing or weed control are common recommendations for most threatened ecological communities, key issues that need to be addressed when managing Claypans of the Swan Coastal Plain are maintenance of the hydrological regimes and prevention of fire (Australian Government 2012).

All of the threatened and priority ecological communities occurring in the City provide habitat to threatened or listed fauna and include threatened or priority flora. For example, the critically endangered bees occuring in the City, are dependent on the health of the threatened ecological community Claypans of the Swan Coastal Plain (Australian Government 2012).

Several of the listed threatened and priority ecological communities occur within lands managed by the City of Canning and there is one known occurrence on freehold land (EPA 2014). Considering the known distribution of threatened and ecological communities in and near the City, adequate plant community mapping should be undertaken on all remaining vegetation on freehold land.

SERCUL are currently undertaking a study of the saltmarsh community within the Canning River Regional Park. The study will provide site specific management recommendations for this Threatened Ecological Community.

2.5 Waterways and Wetlands

Maintenance of healthy waterways and sensitive management of drainage through the landscape is critical to maintaining the diversity of aquatic ecosystems and water dependent terrestrial ecosystems. The City of Canning is located within the lower catchment of the Canning River which runs through the centre of the City's local government area.

The portion of Canning River between the Kent Street Weir and the Canning Bridge is part of the Swan-Canning Estuary which is listed on the Commonwealth's Directory of Important Wetlands of Australia. The Directory lists wetlands of national significance. The Swan-Canning Estuary is a major nursery area for fishes, a major migration stop-over area for shorebirds and a vital feeding area for a large number of cormorants breeding in nearby lakes. Vegetation comprises mostly of fringing patches of tidal marsh comprising of low open-forest, low shrubland (samphire) and sedgeland (Canning River marshes), including a listed threatened and priority ecological community.

Construction of the Kent Street Weir and modification of the tributaries of the Canning River had a major effect on the Lower Canning River ecosystem. The Kent Street Weir was constructed to prevent estuarine water reaching upper reaches of the river where its waters were used to support agricultural purposes. The current weir was constructed in 1989 but its construction has a long history, with the first weir construction using sandbags started in 1911 (Storer et al. 2013).

Due to the weir construction, water changed from estuarine to freshwater above the weir, resulting in changes to vegetation composition over the past 100 years that adapted to the freshwater conditions. Spread of the introduced Bullrush (*Typha orientalis*) is associated with this change. Outbreaks of the aquatic weed *Hydrocotyle ranunculoides* and algal blooms are also occurring within this section of the river.

However, poor water quality issues affected the Canning River in all sections including high nutrient and organic loading, algal blooms, low oxygen levels, non-nutrient contaminants, pathogens or acidity. These are associated with land uses and drainage management in the catchment which within the City of Canning consist of 19 drainage catchments with 12 of these discharging directly into the Canning River (Essential Environmental 2014b).

Australasian Grebe, Tachybaptus novaehollandiae. Credit: Pam Walker

In 2010-2011, the Department of Water undertook an extensive study of the health of the Canning River, focusing on the health of the Kent Street Weir pool to inform its management under drying conditions (Storer et al. 2013). The study demonstrated the degraded environment of the pool, with low relative species richness, low abundance (compared with sites above and below the pool), dominance of exotics, and a community comprised largely of salt-tolerant species of fish, phytoplankton and aquatic macroinvertebrates. It is expected that the pool environment condition will worsen under predicted climate change conditions. Several options are being considered and assessed on future actions required to prevent further degradation of the pool system health and maintenance of the numerous values provided by the Kent Street Weir.

The Canning River is highly valued for its social values associated with aesthetics, abstraction and recreation. Despite levels of degradation recorded, it has been documented that the Canning River system supports a significant number and diversity of aquatic fauna. Therefore adequate management of the river ecosystem and its catchment is critical (Storer et al. 2013).

To address the water quality issues identified within the catchment of the Canning River, the Swan River Trust developed the Swan Canning Water Quality Improvement Plan (2009) with specific catchment management measures and control actions. The main objective was to reduce nitrogen and phosphorus inputs into the river system. The Swan Canning Water Quality Improvement Plan identified several drainage catchments with unacceptable water quality. In the City of Canning they included Lower Canning, Mill Street Main Drain, Bannister Creek and Bull Creek. Local water quality improvement plans were developed for the highest priority catchments:

- Canning Plain Local Water Quality Improvement Plan (Swan River Trust 2010) that covers Mill Street, Wharf Street, Cockram Street, Lacey Street and Wilson drain catchments.
- Bannister Creek Local Water Quality Improvement Plan (Swan River Trust 2011)
- Bull Creek Local Water Quality Improvement Plan (Swan River Trust 2012) that covers Riley Road, Marjorie Avenue, Modillion Avenue, Beatrice Avenue and Sixth Avenue drain catchments.

In August 2014, the City of Canning adopted its Water Management Strategy which aims to provide a framework for improved water management, responding to the needs of the environment and community in a changing climate (Essential Environmental 2014b). The Water Management Strategy identifies a range of actions that will not only contribute to improved water quality but will also have positive outcomes for biodiversity conservation in the City.

An example of such an outcome can be seen in the transformation of the Anvil Way compensation basin in Welshpool. The compensation basin was replaced with a landscaped living stream through implementation of engineering and revegetation modifications to the existing basin. By extending the flow path of water entering the basin, the detention time is extended, allowing more time for nutrient and pollutant uptake by microorganisms and plants. The whole basin area is revegetated with a variety of wetland, riparian and upland local species (SERCUL 2015). Ongoing studies have shown an improvement in water quality, most notably a decrease in nutrients and heavy metals since the drain's transformation was completed in 2011. Other examples of water improvement projects that have contributed to improved biodiversity outcomes include the Bannister Creek Urban Waterway Renewal, Wharf Street Wetland and Liege Street Wetland.

It will not be feasible to transform all compensation basins into living streams. Where good opportunities exist and the basins are within an ecological linkage, transformation of basins into living streams should be a high priority. As most of the compensation basins identified as a priority for modifications are managed by the Water Corporation, support for implementation by the Water Corporation will be essential.

The Water Management Strategy identifies drainage sumps and drain lines that present good opportunities for increasing vegetation cover using local species that will not only assist with nutrient stripping but also improve aesthetics and provide habitat for local species. Considering the high level of urbanisation in the City, these drainage sumps and drains provide a good opportunity to create stepping stones between the remaining natural areas and improving connectivity across the landscape. These recommendations informed the location of local ecological linkages in this Local Biodiversity Strategy (see section 3.2.1).

On the Swan Coastal Plain, wetlands were mapped and classified on the basis of landforms and water permanence (Hill et al 1996). This mapping was used to further classify wetlands according to their condition and conservation values into the following management categories:

- Conservation Category Wetlands – wetlands for which the appropriate management regime has the objective of preserving their natural attributes and functions. Examples of wetlands in this category in the City include the Canning River and its vegetated floodplain, Grose Avenue wetland also known as Carousel Swamp in Cannington or a dampland in the Caladenia Grove Wetland Reserve in Canning Vale.
- Resource Enhancement Wetlands – wetlands for which appropriate management objective should be restoration and enhancement of natural attributes and values. In the City of Canning, examples of wetlands in this category include wetland in Bush Forever Areas 283, 424 and 388 and Lambertia Park in Ferndale.
- Multiple Use Wetlands – wetlands are most appropriately managed for their use and development in the context of water, town and environmental planning. Most of the wetlands in this category have been modified or replaced with residential development.

Increasing the protection status of Conservation Category and Resource Enhancement wetlands in the City of Canning is one of the objectives of this Local Biodiversity Strategy.

Motorbike Frog, *Litoria moorei*. Credit: Pam Walker

Utricularia sp. Credit: Pam Agar.

2.6 Ecological Linkages

2.6.1 Impact of natural area fragmentation

Habitat loss and fragmentation are recognised as one of the key threatening processes to biodiversity conservation in urban and peri-urban landscapes (EPA 2007, Forman and Gordon 1996, How and Dell 1994). It is expected that the current loss of species due to habitat loss and fragmentation will be further exacerbated with predicted changes in temperatures and rainfall due to climate change (Dunlop and Brown 2008, Kauhanen 2011). Improvement of ecosystem resilience and connectivity, expansion of the network of protected areas and protection of important refugia are recommended priority management approaches to adaptation to impacts of climate change (CSIRO 2014, Australian Government 2012a, EPA, 2008; Wilkins et al, 2006; Molloy et al, 2009).

While the impacts of habitat fragmentation on fauna populations are documented to some degree, the effects of urbanisation on long term viability of plant communities is not well understood. A study by Ramalho (2012) into the effects of urbanisation on remnant Banksia woodlands in the Perth region demonstrated that long term isolation of Banksia plant communities leads to changes in the species composition and plant community structure, recording nearly 50 percent reduction in species richness within small (1-5 ha) remnants that were isolated for 45 years or more. This study also highlighted that the impacts of fragmentation on native vegetation will not be visible for some time and further studies are required to determine thresholds in remnant areas that prevent steep extinctions of species due to the multiple disturbances affecting remnant vegetation (Ramalho 2012). Finally, the study recommends focusing conservation efforts on areas that were recently fragmented and those without significant land-use legacies.

The long term survival of species, their genetic variation, their ability to adapt to changes in the environment and the maintenance of ecosystem services depend on how well individual living organisms and the associated genetic material can move between natural areas. Thus the viability of any natural area depends on its proximity to other natural areas and the quality of linkages between them (Del Marco et al 2004, Davis and Brooker 2008, Molloy et al 2009).

To increase the capacity of natural areas to retain biodiversity in fragmented urban landscapes and adapt to climate change, management responses should include the following (Molloy et al 2009, Commonwealth of Australia 2010, CSIRO 2014):

- Provision of access to a greater number and diversity of resources
- Conservation of larger and more viable populations
- Ensuring species distribution in many populations to spread extinction risk associated with catastrophic events
- Enabling species dispersal and migration; facilitating movement along corridors
- Provision of a more representative mosaic of habitat types and structures
- Facilitation of greater genetic variation within species
- Identification and management of refuges that buffer species from rapid change
- Increase the capacity of species and communities to persist through removal of threats and adapting to disturbances.

Maintenance and establishment of effective ecological linkages address many of the above recommendations.

2.6.2 Regional and Local ecological linkages

In the Perth Metropolitan Region, regional ecological linkages were identified by the Perth Biodiversity Project (Del Marco et al. 2004). They link Regionally Significant Natural Areas through Local Natural Areas available between them that act as stepping stones. The regional ecological linkages were designed to provide a framework that can be used to identify ecological linkages connecting locally significant natural areas.

The Perth regional ecological linkages are represented by linkage lines that were drawn to be broadly reflective of the intended direction of the linkage. While the spatial dataset forms a network of 500m wide linkage lines, the ecological linkages consists of natural areas within, crossing, touching or in close proximity to these linkage lines. It is important that any natural areas identified as part of the regional ecological linkage is retained in its entirety, not only a portion within the mapped 500m wide linkage line (Del Marco et al 2004).

Local ecological linkages are identified through this Local Biodiversity Strategy to reconnect isolated natural areas of high conservation values such as bushland in Queens Park and Welshpool (Bush Forever Areas 283 and 424). (Refer to figure 3 Ecological Linkages Map in section 3.2.1)

When using the regional ecological linkages and connectivity concepts presented in this document, it is important to acknowledge the following:

- Ecological linkages or measures of connectivity are just one measure of biodiversity conservation value of a patch of native vegetation and do not detract from any other existing ecological value of other native patches;
- The methodologies are based on general biodiversity management principles and do not recognise the specific requirements of all taxa occupying the landscape. It cannot be used as a substitute for focused species or communities management planning;
- The vegetation connectivity measures used in this study describe morphological attributes of native vegetation patches and their distribution in the landscape. They do not consider the inner patch diversity or permeability and do not consider functional responses of individual species.

This Local Biodiversity Strategy identifies opportunities for improving connectivity between isolated natural areas of regional and local conservation significance. Increasing vegetation cover in urban and peri-urban landscapes is beneficial not only to preserving biodiversity but improving quality of life in urban spaces by providing other benefits such as (TEEB 2011; Polyakov et al 2012):

- Moderation of heat effects experienced in highly urbanised spaces
- Provision of diverse recreational spaces
- Improved visual amenity and increased property values
- Carbon sequestration and storage.

Spotted pardalote, *Pardalotus punctatus.* Credit: S Mawson.

2.7 Threats to Biodiversity

In Western Australia, the ongoing loss, degradation of biodiversity and inadequate knowledge about species and ecosystems remain the key threats to biodiversity conservation (State of Western Australia 2007a). In the Perth Region, where the City of Canning is located, natural areas such as the Swan-Canning River system have been significantly altered due to past land management actions and restoring them to their original state is not feasible. Building resilience and preventing further loss of species needs to be the main focus of future conservation efforts in this region (Perth Region NRM, 2014).

In the Perth Region, the growing development pressure remains the main threat to biodiversity. This not only results in clearing of natural habitat, increase in habitat fragmentation, and the formation of barriers to fauna movement, but also leads to increased use of the existing natural areas for recreational activities, often in ways that are not compatible with the conservation purpose of these areas. In the City of Canning, over 30 hectares of native vegetation were lost over the past 13 years. While this can be viewed as a relatively small amount, in the landscape where less than 10% of the pre-European extent of native vegetation remains, any loss of vegetation further reduces the ability of remaining fauna to persist in the long term. Minimising the impact of future land use changes and development in the City on local biodiversity can be achieved through focusing development within cleared lands and providing for fauna movement where required within the new or upgraded built form (see Section 4.1).

2.7.1 An overview

The City's Environmental Management Strategy (Essential Environmental 2014a) lists thirteen plants and four animals declared and prohibited under the Biosecurity and Agriculture Management Act 2007 and occurring in the City.

A review of management plans developed for selected reserves in the City identified the following threats and management issues (SERCUL 2014; Brooker and Rigo 2000; City of Canning 2001; City of Canning 2006a; City of Canning 2006b; ATA Environmental 2004; Department of Conservation and Land Management 1997):

- Weeds, including aquatic weeds in waterways
- Fire risk management
- Restoration of degraded areas including riparian vegetation
- Lack of suitable fauna habitat within foreshore reserves
- Incompatible human use including trampling, rubbish dumping, fishing, illegal vehicle use and vandalism
- Altered hydrological processes (Canning River, Bannister Creek and other local tributaries)
- Poor water quality in waterways (Canning River, Bannister Creek) due to runoff from the catchments
- Sedimentation of waterways
- Erosion of the Canning River and Bannister Creek banks
- Pollution
- Eutrophication
- Feral animals such as foxes, rabbits, introduced bees, argentine ants and cats
- Introduced fish species such as Spangled perch, Goldfish and Eastern gambusia
- Mosquito control
- Dieback and other diseases of native plants such as marri canker
- Irresponsible dog owners (e.g. dogs off leads disturbing foraging, nesting and roosting birds and not disposing of dog faeces).

Banksia menziesii. Credit: S Mawson.

2.7.2 Feral animal control

To address the feral animals and cats in natural areas, the City implements an annual program, including cat trapping in areas declared under its Local Law, Control and Keeping of Cats Local Law 2007. The feral animal control program is targeted at foxes, cats, rabbits and feral bees.

Between 2011 and 2015, the City's fox control program was limited to four conservation areas: Canning River Regional Park, Caladenia Wetland Reserve/Canning Vale Waste Disposal Site, Clifton Road bushland (Jandakot Regional Park) and the Queens Park Regional Open Space (Jenni Andrews, personal comment).

Focusing the fox control program on a limited number of bushland reserves does not provide the most effective solution for controlling foxes in the City as foxes in urban areas are well adapted to the altered environment and utilise any suitable areas for shelter and scavenging, including private backyards. Fox populations have been recorded as up to 12 adults per square kilometre in some urban areas compared to 0.2 adults per square kilometre in rural landscapes (Animal Pest Management 2012). The most effective fox control is achieved during late winter and spring, when foxes are less mobile when rearing young and thus reinfestation can be delayed. It is also recommended that fox control is undertaken as part of a district-wide campaign involving all land managers to reduce re-infestation (Department of Agriculture and Food 2014). The City's current coordination of fox control with the City of South Perth and other adjoining local governments (Jenni Andrews, personal comment) provides a good example of a better coordinated approach that should be extended to other land managers.

It is recommended that the City prepares a new fox control strategy as part of the strategic reserve management plan (see section 4.2.1 of this document), considering the current information on native fauna distribution across the City, estimate of fox populations across the City and including a City wide awareness raising campaign targeting business and residents on how they can contribute to minimising risk of fox re-infestation.

It is recommended that fox control program is coordinated with rabbit control, targeting areas with any restoration activities or regenerating post fire. This is to prevent localised rabbit population explosions in particular in revegetation sites and within threatened communities.

The State's Cat Law 2011, was introduced to provide for the control and management of cats and to promote and encourage the responsible ownership of cats. Section 79 (1) of this Act provides for a local government to make local laws 'prescribing all matters that are required or permitted to be prescribed by a local law, or are necessary or convenient to be prescribed, for it to perform any of its functions under this Act.' Further section 79 (3)(f) of the Cat Act 2011 provides for specifying places where cats are prohibited absolutely within a local government area. These areas are defined in the City's 'Control and Keeping of Cats Local Law 2007 as 'Cat Prohibited Areas' giving the City powers to remove and impound any cats found within these designated areas. There are nine bushland areas listed in Schedule 1 of the Local Law as Cat Prohibited Areas:

1. Canning River Regional Park (City managed reserves)
2. Queens Park Regional Open Space (Maniana Bushland, Station Street Bushland/Black Creek, McDowell Street Bushland)
3. Clifton Park buffer
4. Canning Vale Waste Disposal Site
5. Livingston Bushland (Special Rural Zone)
6. Caladenia Grove Damp Land (Wetland Reserve)
7. Yagan Wetland Reserve
8. Centenary Park Foreshore
9. Prendwick Botanic Park.

Considering the more recent reports of native fauna sightings in other bushland reserves not listed above, it is recommended that the City reviews the Schedule 1 list and includes other high conservation value bushland and wetland areas, including Bannister Creek Park, Lambertia Park, Portcullis Park, the bushland within the future Canning Vale Sports Centre and any new areas acquired for conservation purposes in the future. An update of the Cats Local Law to make it up to date with the new State legislation is also recommended. Finally, cat trapping strategy should be developed as part of the wider strategic management plan recommended for all natural areas in the City.

Several other pest animals were identified in the City, including Argentine ants, different species of introduced fish and corellas. The City's current feral animal control program does not include any management actions for these species.

It is recommended that the City develops a strategic invasive species plan, including weeds and pest animals, affecting local biodiversity as part of the strategic management plan for all conservation areas (see section 4.2.1 of this document). Where gaps are identified regarding effective management approaches, seek to establish research partnerships to identify feasible control techniques.

Brown Goshawk,*Accipiter fasciatus*. Credit: S Mawson.

2.7.3 Human activities

The common issue for natural area mangers is the incompatible use of natural area reserves by visitors. Most common issues include dumping of garden waste which increases the risk of introduction and spread of weeds, rubbish dumping and vandalism which then affect the perception of natural areas by surrounding residents, unauthorised access by cars or motorbikes damaging existing tracks, vegetation and increasing the risk of spread of dieback, allowing pets, dogs and cats, to freely roam in bushland areas, feeding of wildlife and damage to fencing.

There are various strategies that can be used to reduce the incidence and impacts of these human activities. One is clear communication to surrounding land users and visitors the purpose of these areas, their values and benefits. Well-designed conservation fencing has proven to be effective in many areas in controlling off-track use and rubbish dumping. It is important to design the fencing and the designated network of walking track with an understanding of how local residents use the reserve, to minimise risk of future damage. In some areas, other approaches might be effective such as revegetation of unwanted tracks and potential entry points. Signage, temporary fencing and plant guards can help to minimise damage.

However, before deciding on the strategy to deal with any user related issues, it is recommended that research is undertaken to understand the users, their motivations, beliefs, barriers to changing their behaviour and, before installing signage, test the messaging on a sample group of users for effectiveness. It is also important to appreciate that malicious behaviours leading to vandalism cannot be influenced through persuasive communication (Ham et al. 2007).

The 2012 survey of Southern brown bandicoot distribution in the Southwest of Western Australia identified vehicle strikes and predation by foxes, cats and dogs as the main causes of death of this species (Howard et al. 2014). The survey also came to an unexpected finding that drowning in swimming pools and backyard ponds resulted in 16% of recorded deaths of the Southern brown bandicoot. Raising community awareness about ways to minimise drowning incidence has been recommended (Howard et al. 2014).

Hydrological changes and inappropriate fire regimes are identified as the most significant threats to the threatened ecological community Clay pans of the Swan Coastal Plain and the associated rare and threatened native bees, resulting in changes to plant communities associated with clay pans and in the replacement of native species by weeds (Commonwealth of Australia 2012 and 2013b). Competition with introduced honeybees is also considered to be a potential threat to the threatened native bees.

To minimise risks of impacting these claypan communities, all land use changes within the buffer and the catchment of the associated wetlands should demonstrate that they will not have detrimental effect on the hydrology and any future development in the vicinity will have an adequate plan to minimise the risks of fire.

Samphire sp. Credit: P Agar.

2.7.4 Climate change

Observed and predicted effects of climate change may significantly impact on many groundwater or surface water dependent ecological communities such as the listed threatened saltmarsh communities found along the Canning River, the claypan communities as well as upland plant communities adjoining them.

The claypan communities are dependent on inundation during the winter-spring period. Due to the declining rainfall in the south-west of Western Australia, this periodic inundation is expected to be altered (Commonwealth of Australia 2012). Therefore it is critical to avoid any changes to the hydrological regimes of these clay pans and apply appropriate buffers.

The coastal saltmarsh communities are also considered to be threatened by the current and projected rises in temperature and sea level that could result in landward retreat, fragmentation or loss of habitat function (Commonwealth of Australia 2013a). Other threats than those already listed in this chapter are the activation of acid sulphate soils result in scalding of vegetation, increase in nuisance algae, fish and shellfish kills and outbreaks of disease in fish.

The effects of a warming and drying climate will affect all ecological communities due to increased number and severity of weather events such as storms and droughts, increased incidence and intensity of bushfires and, due to changes to the composition of critical habitats, local extinctions and species migration (Perth Region NRM 2014).

The recommended adaptation options seek to increase resilience of ecosystems through reduction of adverse impacts of human activities and facilitating species migration by improving landscape connectivity (Kauhanen et al. 2011, Natural Resource Management Ministerial Council 2010).

Clearing of habitat is well recognised as a major threat to biodiversity. In urban landscapes, the fragmentation of natural habitat due to clearing is further accentuated by the presence of human built barriers such as roads, hard surfaces, or high kerbing. These structures are limiting the effectiveness of ecological linkages for the smaller ground-dwelling animals that persist in urban bushland reserves. Provisions of well-designed underpasses, fauna friendly kerbing or no use of kerbing on roads and streets close to natural areas, use of adequate landscaping using local plants within median strips and on verges to provide shelter for crossing fauna are some measures that should be included in all infrastructure upgrades and new development projects within ecological linkages and within buffers of high conservation value natural areas.

2.7.5 Current approaches to the control of threats to biodiversity in the City of Canning

The City's Natural Area Team implements an annual program for weed, disease and pest control in natural areas. The City undertakes restoration works and supports community initiatives restoring natural areas and transforming highly modified urban drainage into living streams.

The effectiveness of targeted efforts is documented in the Bannister Creek Park where more than 60% reduction in weed cover was recorded between 1999 and 2014 as a result of weed control and revegetation undertaken by the Bannister Creek Catchment Group and the City (SERCUL 2014).

The City actively manages 42 natural areas including constructed wetlands. Twenty five of these natural areas are high and medium priority for management (Essential Environmental 2014a). Conservation works include fencing, weed control, dieback management, revegetation, fire risk management, feral animal control and monitoring. The scope of feral animal control has already been described in the section 2.7.2 of this document.

Many of the revegetation projects are undertaken in partnerships with community groups and local schools. The City supports community groups with financial and in-kind contributions by providing plants, labour and assistance with seed collection, propagation, weed control, weed bag collection and disposal, watering, feral animal control, provision of equipment and storage and care of native vegetation at the City's nursery. Key community groups involved in natural area management in the City are:

- Bannister Creek Catchment Group
- Canning River Regional Park Advisory Committee
- Canning River Regional Park Volunteers
- Canning River Residents Environment Protection Association Inc
- Friends of Queens Park Bushland
- Friends of Rossmoyne Park
- Friends of Brolga Park
- South East Regional Centre for Urban Landcare (SERCUL)
- Waterbirds Conservation Group
- Wilson Wetlands Action Group Inc.

The City's Canning River Eco Education Centre (CREEC) provides a hub for community education, providing access to resources and opportunities to host a range of educational activities addressing catchment management, local fauna and natural area values.

The City's Environmental Management Strategy (Essential Environmental 2014a) outlines actions to address a range of other environmental issues such as surface and groundwater quality, bushfire risk and management of impacts of climate change.

The Local Biodiversity Strategy informs the implementation of environmental management strategies by outlining ways of integrating biodiversity into land use planning, identifying ways to increase the protection of natural areas, identifying ecological linkages where natural area restoration will not only increase habitat, help to facilitate fauna movements, but also contribute to improved surface water quality and reduce the heat effect of the built environment.

Liparophyllum capitatum. and *Brachyscome sp.* Credit: Pam Agar

3 Prioritisation of Local Natural Areas for Biodiversity Conservation

3.1 Methodology

The local biodiversity conservation planning approach adopted in this study follows the State government-endorsed methodology (EPA 2008, State of Western Australia 2011) that was developed through the Perth Biodiversity Project and published in the Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region (Del Marco et al, 2004). It is used by numerous Local Governments in the South West of Western Australia. Local biodiversity conservation planning incorporates four major steps:

- assessment of ecological values of local natural areas,
- consideration of opportunities and constraints to their protection,
- identification of conservation priorities and local ecological linkages, and
- identification of feasible implementation actions to meet the biodiversity conservation objectives.

A set of biodiversity conservation principles guides the local biodiversity conservation planning process (Del Marco et al. 2004). Identification of local conservation objectives and identification of effective implementation mechanisms are based on the need to meet legislative, environmental and planning policy requirements and best practice in biodiversity conservation. These principles are:

1. Prevent exponential loss of species and ecosystem failure by retaining at least 30% of the pre-European extent of each ecological community
2. Protect regionally significant and locally significant natural areas
3. Biodiversity is best conserved in-situ - protect what you have before revegetating
4. Regeneration is a higher priority than revegetation
5. Prioritise protection and management of natural areas which have the highest biodiversity value
6. Involve the community in helping conserve biodiversity
7. Biodiversity values must be made transparent in decision-making processes
8. Site-specific field survey is essential to understanding biodiversity value
9. Natural area conservation is a legitimate land use

Native vegetation mapping is used to describe the various ecosystems represented in the City. Combining native vegetation mapping with other spatial data that describes biodiversity assets, such as significant flora and fauna records, forms the basis for the prioritisation of natural areas for conservation.

3.2 Criteria for determining conservation significance

Criteria for rating the conservation significance of local natural areas are based on Local Government Biodiversity Planning Guidelines (Del Marco et al, 2004) and reflect EPA criteria for identification of regionally significant natural areas (EPA, 2008). The criteria can be divided into four categories:

1. Representation – considers the regional and local level of retention and protection of all ecosystems represented within a Local Government, and compares this against accepted thresholds, such as the goal of retaining at least 30% of pre-European vegetation extent and protecting 17%. Ecological communities retained at less than 10% are considered threatened.
2. Rarity – considers the presence of rare flora and fauna.
3. Maintenance of ecological functions – reflects the level to which local natural areas contribute to the maintenance of healthy ecosystems in the landscape. Due to limited spatial data available to assess this at all ecosystem levels, vegetation connectivity and remnant patch size are used as a surrogate measure.
4. Protection of wetlands, riparian, estuarine and coastal ecosystems – recognises the important role these ecosystems play in maintaining biodiversity.

The EPA considers a range of additional criteria such as novel combination of species, diversity of species and vegetation, large populations, extreme ranges of species and scientific significance (EPA, 2008). However, this Strategy focuses on attributes that are mapped at Local Government and regional levels. It is not intended to undertake an all-inclusive assessment but rather to identify priority areas where further field assessments are required to confirm the inferred and other values.

Thirty two criteria represented by various spatial layers were applied to the 2014 native vegetation extent mapping (DAFWA 2014) to generate the prioritisation layer (see Appendix A). The final prioritisation layer shows the number of criteria met by each patch of remnant vegetation. The higher the number of criteria met, the higher the relative conservation priority of a given patch of remaining vegetation (See Figure 2. Number of Ecological Criteria in City of Canning Natural Areas).

While there were 32 criteria used, the maximum number that could potentially overlap at any one area in the region was 25 and the highest actual count recorded in Perth and Peel was 19 in Bush Forever area 387 and few other locations. In the City of Canning, count of 19 criteria was also recorded in a portion of the Canning River Regional Park.

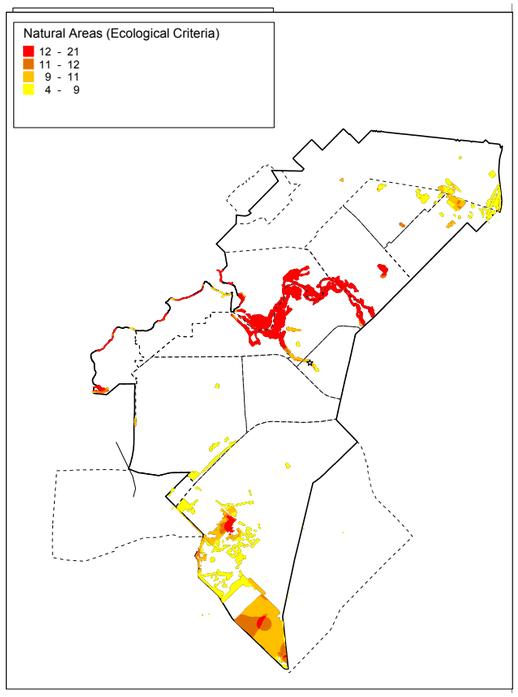


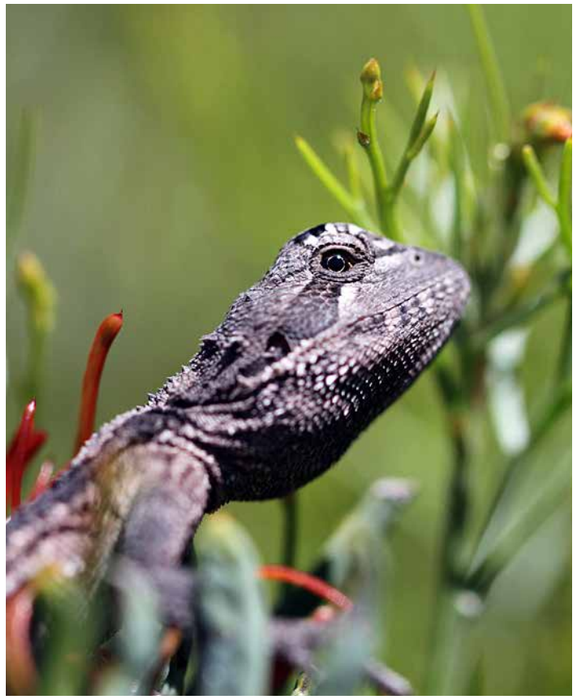
Figure 2. Number of Ecological Criteria in City of Canning Natural Areas.

To interpret this information, it is important to understand which criteria are being triggered. An absence of threatened flora, fauna or ecological community's records does not necessarily mean those features are not present within a patch of native vegetation, as the lack of records can be due to the lack of ecological survey of that patch.

An example of this is the vegetation in Portcullis Park in Willetton. The number of prioritisation criteria met by vegetation within the park is 7 and 8, less than half the highest values recorded. The dataset used in the analysis is based on DPAW data current on 14 July 2014 which does not include a record of the threatened flora reported to be occurring in Portcullis Park (Essential Environmental 2014a), significantly increasing the conservation significance of the vegetation. In addition, the vegetation is recognised as potential feeding habitat for Carnaby's black cockatoos, species protected under the EPBC Act and mapped as potential Quenda or Southern brown bandicoot habitat.

There are several examples of local natural areas with at least 12 criteria being met in the City. This indicates that those patches of native vegetation provide habitat to at least one conservation significance flora, fauna or ecological community as well as meeting other conservation significance criteria.

In the City of Canning, all local natural areas meet at least one of the above criteria, regardless of the overall criteria count. Vegetation in all local natural areas is mapped as potential feeding habitat for Carnaby's black cockatoos. Therefore, before any land use change or development proposal affecting local natural areas is approved, these areas need to be adequately assessed and vegetation clearing avoided.



Western Bearded Dragon, *Pogona minor.* Credit: S Mawson.

While the mobility of Carnaby's black cockatoos is not significantly affected by roads, vehicle strikes are identified as one of eight major threats to conservation of Carnaby's black cockatoo (Johnstone et al 2011). Therefore road design and revegetation within road reserves are critical to facilitating fauna movement across the landscape while preventing vehicle strikes.

Understanding the requirements of specific species is important when planning conservation actions or future developments. For example, a search of DBCA NatureMap shows several records of Southern brown bandicoot (*Isoodon obesulus subsp. Fusciventer*) within the City of Canning. While relatively small patches of habitat can support Southern brown bandicoots (Hussey and Mawson 2004), their ability to recolonise areas of localised extinctions are limited without any provisions to facilitate their movement.

The results of this prioritisation informed the selection of high conservation value native vegetation to be formally protected in the City of Canning (see section 3.4.1 of this document).

Summary of findings and recommendations

- All remaining native vegetation in the City of Canning includes at least one attribute protected by legislation.
- Prior development or land use change approval, adequate level field assessments are required to map the extent and conditions of vegetation.
- Use Areas of Priority Conservation Action (Section 3.4.1) categories and recommendations to identify recommended actions to increase protection levels of high conservation value local natural areas.

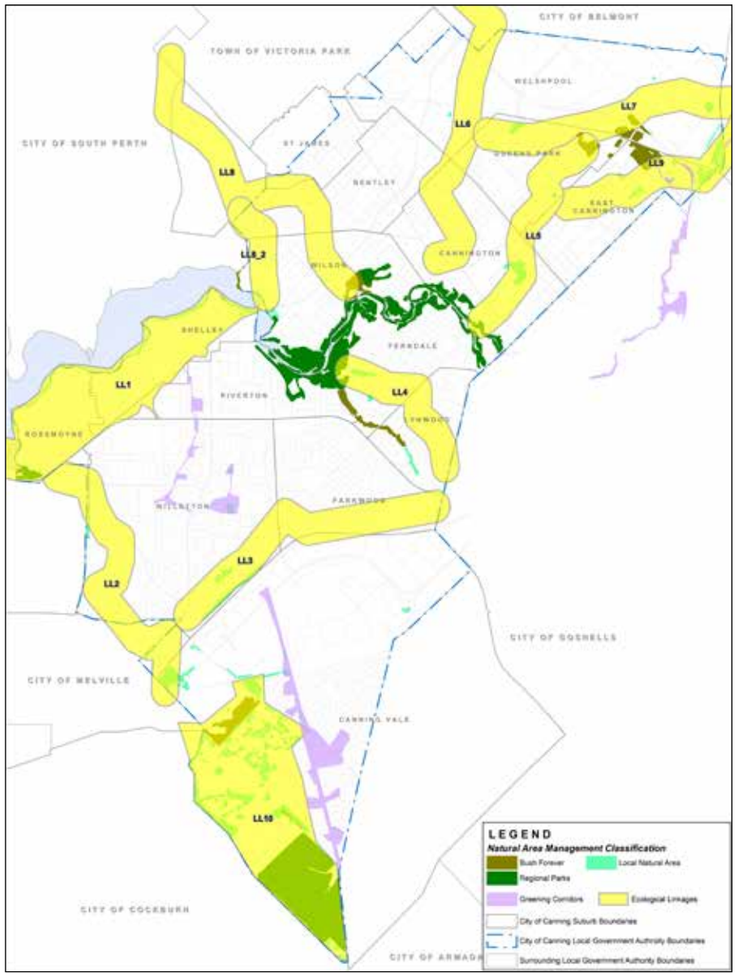


Figure 3. Ecological Linkages Map

3.2.1 Local ecological linkages

The Perth regional ecological linkages (Del Marco et al. 2004) provide the regional context for considering the role of individual patches of remaining native vegetation at the local scale. The Canning River and Bannister Creek are part of major regional ecological linkages connecting numerous high conservation value areas on the Swan Coastal Plain portion of the Perth metropolitan area.

Further spatial analysis was needed to better understand the impacts of changes in the current pattern of remnant vegetation and to identify priority areas for restoration to improve connectivity at the local level and reconnect regionally significant areas such as Bush Forever Areas 283 and 424.

Local linkages identify localities with opportunities to increase native vegetation cover in order to improve the connectivity of vegetation and ecologically important areas such as wetlands and waterways. Local linkages consist of stepping stones formed by POS or other public and private lands within the shortest distance between Bush Forever areas, existing local conservation reserves or high conservation value areas identified through this study (section 3.2) such as native vegetation and wetlands on Grose Avenue and William Street in Cannington.

In some instances local linkages replace recognised regional ecological linkages which have been affected by land use changes since they were identified in Del Marco et al (2004).

When selecting areas to be retained and managed as parts of a regional or local ecological linkage the following principles guided the selection (Del Marco et al 2004, Davis and Brooker 2008, Molloy et al. 2009):

- Aim for a heterogeneous matrix of habitats rather than a homogenous one.
- Utilise existing native vegetation matrix and complex landscapes with minimal disturbance.
- The widest possible diversity of habitat types should be sought within a linkage with similar habitats (preferably) with less than 500m -1000m apart.
- Where continuous stands of native vegetation are not available, ecological linkages should be made up of remnants that form stepping stones between larger intact patches.
- Provision of large regional linkages is preferable in supporting a wide range of communities and species, supporting their movement over generations to localised corridors.
- Regional corridors should be 500m wide where possible and a minimum of 300m.
- The number of linkages connecting to any given patch should be maximized as this improves overall connectivity and long-term viability.
- Ecological linkages should be selected along directions that facilitate normal migrations and aid in adaptation of species and assemblages to climate change, such as North-South, East-West, high points in the landscape, riparian communities. Patches at high points in the landscape, in the line of sight of other patches are important for species dispersal and home range utilisation.
- Re-vegetation is a viable strategy for establishing or strengthening corridors in cleared landscapes, with priority given to opportunities to expand existing remnant vegetation. Aim to form continuous vegetated linkages or corridors at least 100m wide. If this is not possible, ensure stepping stones of reconstructed or created habitat are at least 2ha to 4ha in size and no more than 500m to 1000m apart.
- Avoid or mitigate impacts of gaps in linkages caused by roads and other barriers to fauna mobility.
- Open canopies over highly disturbed understorey may be of little value, except for highly mobile species.

Through this study ten local ecological linkages and three areas of ‘greening opportunities’ were identified within the City, with numerous POS, reserves and other lands with remaining native vegetation and suitable for planting of native vegetation acting as stepping stones. Areas of ‘greening opportunities’ highlight continuous networks of local parks where increasing use of local plants in landscaping will contribute to the increase of native vegetation in the City. The distribution of local linkages is shown in Figure 3 Ecological Linkages Map.

Further spatial analysis was conducted to demonstrate that the proposed network of local ecological linkages will improve the connectivity between protected areas and other high biodiversity conservation value areas.

Summary of findings and recommendations

- Local linkages identify localities with opportunities to build connectivity between protected natural areas by increasing native vegetation cover through restoration and revegetation and formal protection of remaining native vegetation.
- Using the general principles for identifying ecological linkages, two regional ecological linkages and ten local ecological linkages were mapped in the City of Canning.
- Further opportunities for increasing native vegetation cover in the City exist within well connected networks of POS mapped as areas of ‘Greening Opportunities’

3.3 Opportunities and constraints to local natural area protection

In the context of the local biodiversity conservation planning (Del Marco et al, 2004), protected natural areas are those that are secured for conservation either as public lands vested for biodiversity conservation purpose or private lands where biodiversity values are secured under conservation type zoning in the planning scheme and/or are managed under covenanting agreements. Land use provisions under the region and local planning scheme are an important consideration when seeking to identify opportunities to increase natural area protection levels within a local government area.

Following the methodology developed for the Regional Framework for Local Biodiversity Conservation Priorities for Perth and Peel (Zelinova et al 2012), land use categories (zones and reserves) of the Metropolitan Region Scheme (MRS) and local planning schemes were classified into four categories, according to provisions for natural area retention or protection. The same classification was applied to land use categories in the City of Canning Town Planning Schemes No. 40, TPS 17 and No. 21:

1. Those providing protection, such as Conservation zone or Rural Conservation;
2. Those with good opportunities, such as Parks and Recreation, Rural – Water Protection, Waterways, and others;
3. Those with varied opportunities, such as Public Purposes, Special Use, Rural, Public Open Space and others;
4. Those with limited opportunities for natural area retention, such as Urban, Urban Deferred, Industrial, Road and Railway reserves, Rural Residential and Central City Area.

The land use categorisation was intersected with Level 1 Prioritisation of native vegetation (described in Section 3.1.1 of this document). The greater the number of criteria being met within a patch of remnant vegetation within each of the four land use opportunity categories, the higher priority for further investigation is assumed.

The majority of the remaining vegetation in the City of Canning is within land use categories providing good opportunities for its protection. Under the MRS provisions, 72% of the remaining native vegetation in the City of Canning is within land uses providing good opportunities for natural area protection, including Parks and Recreation, Rural – Water protection and Waterways. Under the local planning scheme provisions this proportion decreases to 66%. This is due to vegetation zoned Rural – Water Protection in the MRS, being classified as Rural Residential, Public Open Space and Special Residential/Kennels in TPS No. 40. These land uses are considered to provide varied opportunities for natural area protection. While the Special Rural zone provides for vegetation retention, due to the small lot sizes within the Special Rural subdivision (lots with less than 2 hectares), vegetation retention is limited and highly fragmented, often with degraded understorey.

A drop was also recorded in the portion of the remaining vegetation within land uses providing limited opportunities for natural area retention or protection when comparing the MRS (15%) and the Town Planning Scheme provisions (12%). This is because many areas reserved as Public Open Space in the TPS No.40 are zoned Urban in the MRS. For example, Bannister Creek (that is part of BF224) and the Lambertia Park are zoned Urban in the MRS while in TPS No. 40 they are reserved as Public Open Space.

This demonstrates the important role local planning scheme provisions have on vegetation retention and protection within a local government area.

When identifying land with good opportunities for increasing the protection status of remaining vegetation, reserved lands (under the Land Administration Act 1997) are examined as a priority. There are 497 hectares of land in Crown reserves managed by a range of agencies, with many vested in the City of Canning. Of this area, 107 hectares retain native vegetation; with 58 hectares retained within reserves vested with the City of Canning (see Table 8).

To improve the protection status of vegetation in the City and to formalize the recognition of the conservation significance of this vegetation on lands reserved under the Land Administration Act 1997, it is proposed to change the vesting purpose of selected reserves to conservation or to add conservation to the current purpose. Reserves with more than 1 hectare of native vegetation (including adjacent lot boundaries) were selected and are listed in Table 8. While most listed reserves are vested with the City, there are three reserves with more than 1 hectare of vegetation that are vested with other State agencies, including Water Corporation and Department of Planning, Lands and Heritage. It is recommended that the City seeks the support of these agencies in implementing the proposed extension of the current vesting purpose of these reserves (also listed inTable 8).

By changing the vesting purpose of reserves listed in Table 8 to include conservation, an additional 50 hectares of native vegetation would be afforded formal protection, increasing the current level of protection (0.65%) to 2.8% of the pre-European extent of native vegetation in the City.

Acacia applanata. Credit: S Mawson.

The green colour identifies reserves where the vesting and management authority is not the City.

Reserve Number	Reserve Name	Suburb	Reserve Purpose	Extend vesting to include Conservation under the LAA Act 1997	Area of Native Vegetation
R 984	McDowell Street Bushplan	Welshpool	Recreation	✓	6.92
R 7773	Bicentennial Adenia Park	Riverton	Parks and Recreation	✓	12.58
R 11431	Queens Park Regional Open Space	Queens Park	Recreation	✓	0.62
R 20265	Canning River Regional Park (Ferndale Cres)	Ferndale	Public Utility	✓	2.42
R 24973	Canning River Regional Park (Vervain Way)	Riverton	Recreation	✓	0.90
R 24987	Maniana Park	Queens Park	Recreation		0.03
R 26292	Shelley Rossmoyne Foreshore	Shelley and Rossmoyne	Parks and Recreation	✓	3.42
R 29130	Yagan Park	Rossmoyne	Conservation		4.28
R 32578	Bannister Creek Park	Ferndale	Public Recreation	✓	0.52
R 32704	Bannister Creek Park	Lynwood	Drainage	✓	0.49
R 33082	Bannister Creek Park	Ferndale	Public Recreation	✓	0.09
R 33289	Canning Vale Sports Reserve	Canning Vale	Recreation	✓	8.27
R 33845	Glamorgan Park	East Cannington	Public Recreation		0.36
R 36559	Clifton Park	Canning Vale	Public Recreation	✓	2.54
R 36621	Centenary Park	Wilson	Parks and Recreation	✓	1.01
R 40113	Wishaw Park	Leeming	Public Recreation	✓	0.65
R 42186	Canning River Regional Park (Vervain Way)	Riverton	Public Recreation		0.13
R 43599	Canning Vale Gardens	Canning Vale	Public Recreation	✓	0.58
R 43648	Clifton Buffer	Canning Vale	Public Recreation	✓	4.00
R 44594	Drainage Corridor (Woodloes Street)	Cannington	Drainage		0.11
R 45468	Railway Buffer (Parkland Trail)	Canning Vale	Public Recreation and Drainage	✓	0.25
R 47608	Turnstone Gardens	East Cannington	Public Recreation	✓	0.43
R 48327	Canning River Regional Park		Public Recreation	✓	3.38
R 48617	Caladenia Grove Wetland	Canning Vale	Public Recreation	✓	4.35
R 49104	Crawford Street Reserve	East Cannington	Public Recreation	✓	0.36
R 49362	Canning River Regional Park	Wilson	Conservation		11.70
R 49363	Canning River Regional Park	Wilson	Conservation		33.54
R 49364	Unnamed	Wilson	Recreation		2.08
R 51387	Bebington Park	Wilson	Recreation	✓	0.79
			Total	**50.83**	**106.80**

Table 8, Reserves in the City of Canning with Native Vegetation

In addition to reserved lands with management responsibilities vested in the City, the City of Canning holds numerous freehold land assets. While most of the freehold properties are cleared of native vegetation, approximately 58 hectares of native vegetation is retained on 16 freehold properties owned by the City. Most properties retain less than 1 hectare of native vegetation. There are seven properties with more than 2 hectares of native vegetation, including one with more than 10 hectares and one with more than 20 hectares. The list of City's freehold properties considered in this study is listed in Table 9, with information on the current land use, land area and where applicable area of native vegetation retained.

Property Pin	Suburb	TPS No 40 land use category	Property area (ha)	Native vegetation extent (ha)
261862	CANNINGTON	REG. PARKS & RECREATION	0.85	0.48
306651	CANNING VALE	LOCAL PARK & RECREATION	12.04	8.58
306659		LOCAL PARK & RECREATION	20.84	10.21
306672		LOCAL PARK & RECREATION	1.75	0.83
330443		LOCAL PARK & RECREATION	4.99	1.14
377048		LOCAL PARK & RECREATION	54.22	21.68
254891	FERNDALE	LOCAL PARK & RECREATION	4.52	3.77
255063		LOCAL PARK & RECREATION	3.33	1.93
311287		LOCAL PARK & RECREATION	3.36	2.14
330585	LYNWOOD	LOCAL PARK & RECREATION	1.73	1.33
330918		LOCAL PARK & RECREATION	3.35	Re-vegetation
246472	QUEENS PARK	REG. PARKS & RECREATION	2.23	0.63
262065	RIVERTON	REG. PARKS & RECREATION	4.43	1.04
11814945		REG. PARKS & RECREATION	1.32	0.77
306298	WILLETTON	LOCAL PARK & RECREATION	3.34	1.20
329842		LOCAL PARK & RECREATION	3.22	1.71
Total native vegetation:				58.13

Table 9, Freehold Properties in the City of Canning with Native Vegetation Proposed to be reserved Environmental Conservation

Properties held freehold by the City provide good opportunities for improving biodiversity conservation status in two ways:

- Recognition of the conservation values of selected freehold properties is proposed through a new local reserve classification, Environmental Conservation, in the City's Local Planning Scheme (see section 4.1.2 of this document);
- Cleared freehold properties can be considered for exchange for private lands with native vegetation on properties zoned Mixed Business in the local planning scheme, and where POS allocation proportion of the developable land is smaller than the remaining vegetation. This approach will allow retention and future management of all the remaining vegetation by the City as a POS.

The land exchange option has already been considered within suburbs of Queens Park and East Cannington both localities have inadequate POS provisions (Hester Property Solutions 2012, Davis Langdon 2014). There are several freehold properties not owned by the City containing native vegetation of high conservation value and therefore a land exchange should provide a viable option in addressing the current deficit of POS in these suburbs. However, the City will need to identify suitable properties outside Queens Park and East Cannington as majority of City's freehold land in these suburbs is already allocated as POS in Town Planning Scheme No. 21.

The City's Land Asset Assessment report (Hester Property Solutions 2012) was reviewed to identify any potential properties with competing recommendations such as retention and management of the existing asset or disposal. One property with native vegetation was proposed in the Land Asset Assessment report to be developed or to be sold, but this proposal is no longer relevant as the subject land forms one of the conservation zones in the Canning Vale Sports Master Plan, adopted in January 2015.

A large number of Public Open Space is on land held freehold by the City and not reserved under the Land Administration Act 1997. There are 203 properties owned by the City that are within regional or local linkages identified in this document, including 65 hectares of native vegetation of which 7.4 hectares is not reserved Public Open Space Area in TPS No.40, but on lands zoned Residential, Mixed Business and Railways. Half of the City owned land within ecological linkages is on land reserved Local Park and Recreation Area in TPS No. 40, thus providing a good opportunity to increase native vegetation cover in the City and facilitate fauna movement along these linkages.

It is recommended that the City adopts a landscaping program for all the POS areas within the regional and local linkages to identify portions of the POS where native vegetation can be re-introduced.

Finally, the City holds numerous other freehold properties outside the regional and local linkages. It is recommended that opportunities for land exchange of City's freehold land outside ecological linkages for privately owned land with native vegetation that is zoned Residential are investigated.

Summary of key findings and recommendations

- The City's Town Planning Scheme does not include any land use category which protects natural areas for conservation. Draft Local Planning Scheme 42, when adopted will introduce the reservation Environmental Conservation.
- By extending the vesting purpose of 18 reserves under the Land Administration Act 1997 to include conservation, the protection level of native vegetation in the City will increase to 2.8% of the pre-European vegetation extent in the City (from the current 0.65%).
- 58 hectares of native vegetation is retained on lands held freehold by the City, with nearly 90% reserved as Regional or Local Parks and Recreation in the City's local planning scheme. These properties provide further opportunity to increase vegetation protection through reservation for Environmental Conservation (see section 4.2.1 of this document).
- Investigate opportunities for land swap of privately owned land with high conservation value vegetation for cleared properties that form part of the City's land assets.
- Adopt a landscaping strategy for all the POS areas within the regional and local linkages to identify portions of POS and other lands where native vegetation can be revegetated.

Australian Pelican, *Pelecanus conspicillatus*. Credit: Pam Walker.

3.4 Conservation Priorities

3.4.1 Areas of Priority Conservation Action

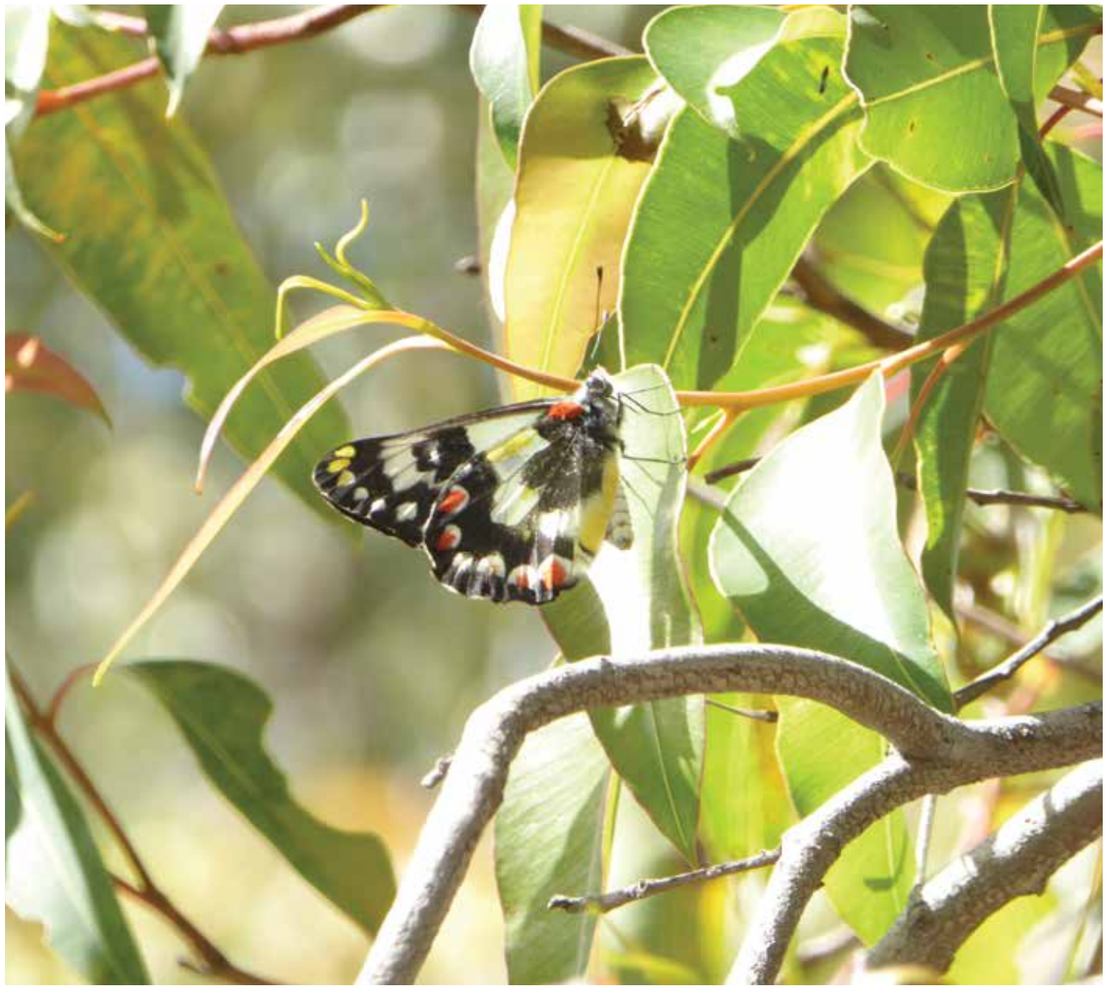
With less than 10% of the pre-European extent of native vegetation retained in the City of Canning, all remaining natural areas are high priority for conservation. However, different types of actions are required to improve or maintain the long-term conservation of biodiversity within these remaining areas. All remaining native vegetation is classified into nine categories of 'Areas of Priority Conservation Action'.

The native vegetation classification to identify 'Areas of Priority Conservation Action' considers:

- Ecological values (Level 1 Prioritisation) described in Section 3.2 of this report
- Land tenure (Crown/City of Canning freehold) described in Section 3.3 of this report
- Land use provisions (MRS and local planning scheme) described in Section 3.3 of this report.

Table 10 provides an overview of the nine categories identified and lists recommended actions for improvement of conservation status of biodiversity for each conservation priority category. Figure 4 shows the location of the Areas of Priority Conservation Action.

Site specific recommendations for each of the Areas of Priority Conservation Action are in Appendix B. Appendix C provides more detailed mapping of APCA properties. Site Specific Recommendations for Areas of Priority Conservation Action.



Spotted Jezebel. *Delias aganippe.* Credit: S Mawson

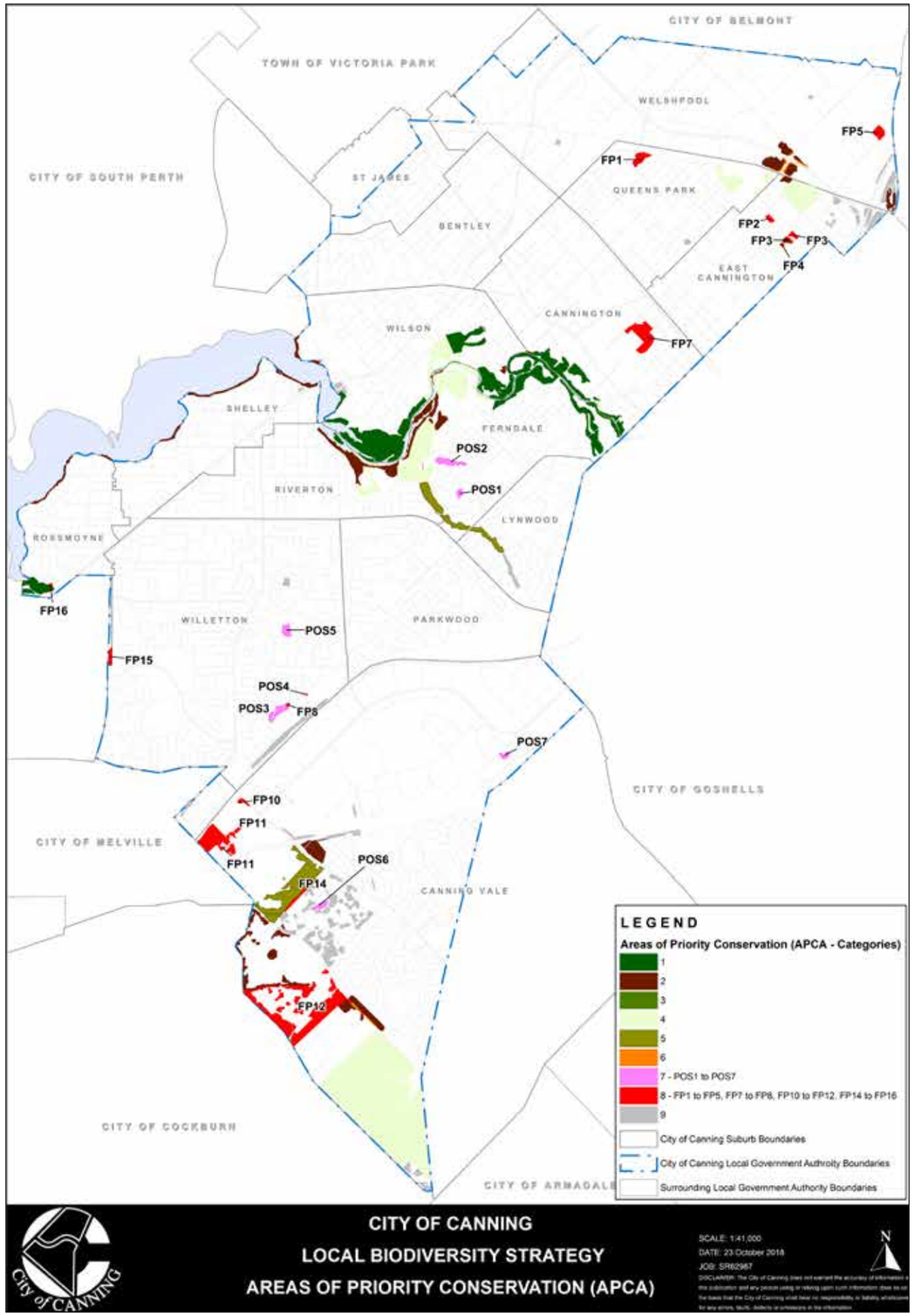


Figure 4. Areas of Priority Conservation Action.

APCA mapping code	Mapping unit name	Mapping unit description/ inclusion criteria	Total area of vegetation within APCA category	Recommendations regarding improving conservation status of biodiversity in APCAs
1	Conservation Reserves	Crown reserves with conservation vesting (LU1 and /or LU2): R28740 (1.03ha), R29130 (4.28ha), R47244 (0.13ha), R49363 (33.54ha), R49364 (2.08ha), R49362 (11.7ha), R48327 (4.03ha) (R48327 extends outside the City boundary along the river.)	76.49ha	• Seek the update of the Canning River Regional Park management plan (current version dated 1997) • Update the Yagan Wetland Reserve Management Plan (last updated in 2000) • Manage threats and restore degraded areas to extend habitat
2	Crown reserves recommended to have their purpose extended to include Conservation (some of these are in BF Areas and meet criteria for APCA 3 or 5, but are highlighted because of the specific recommendation)	R11431; R20265; R24973; R26292; R32578; R32704; R33082; R33289; R36559; R36621; R43599 (not mapped as native vegetation); R43648; R48617; R49104; R51387; R7773; R984; R 47608 See Table 8.	50.55ha	• Seek change of vesting purpose or management order of the listed reserves to include conservation (through an application to Landgate under the Land Administration Act 1997) • In the local planning scheme classify those reserves not mapped as Parks and Recreation in the MRS as Environmental Conservation (local reserves). They include: R32578, R32704, R33082, R48617, and R36559. • Develop a 5 year management action plan for all conservation reserves and new reserves formed on lands in category APCA4.
3	Reserves with other than conservation purpose in Bush Forever Areas and in Parks & Recreation and Waterways in the MRS	R42186 (0.13ha); R44594 (0.11ha); R47244 (0.13ha)	0.34ha	• Maintain native vegetation and control weeds and invasive pests to prevent their spread into the adjoining conservation reserves.
4	Vegetation in Bush Forever Areas and in Parks & Recreation and Waterways in MRS (but not on Crown land)		189.49ha	• Include sites managed by the City into the 5 year management action plan for all conservation reserves (see recommendation for APCA 2)
5	Bush Forever Areas reserved for Local Parks and Recreation in the TPS (not reserved in MRS)	Includes Bush Forever Areas classified in the MRS as Rural and Urban	23.83ha	• Seek the reclassification of these lands in the MRS to Parks and Recreation by the WAPC, it this is not feasible, reclassify these lands in the local planning scheme as Environmental Conservation • Include all new reserves managed by the City into the 5 year management action plan for all conservation reserves (see recommendation for APCA 2) and implement the Bannister Creek Reserve Management Plan (SERCUL 2014)
6	Bush Forever Areas - other			• There are no special recommendations for APCA category 6.
7	High conservation value Local Natural Areas in POS (Local Parks & Recreation) but not on Crown Land (not in reserves designated under the Land Administration Act 1997)	Local natural areas with more than 12 prioritisation criteria met and/or records of TEC, threatened flora or fauna, part of a regional and local ecological linkage	76.49ha	There are 7 areas classified Local Parks and Recreation Area in Town Planning Scheme No.40 that are not reserved under the *Land Administration Act 1997*. • In the local planning scheme reserve as Environmental Conservation. • Include sites managed by the City into the 5 year management action plan for all conservation reserves (see recommendation for APCA 2)
8	High conservation value Local Natural Areas subject to future structure planning or development (on lands zoned industrial, residential or City Centre)	Local natural areas with more than 12 prioritisation criteria met and/or records of TEC, DRF or threatened fauna, part of a regional and local ecological linkage	50.55ha	There are 16 areas where opportunities to protect or manage to retain their conservation values were identified.
9	Local Natural Areas to be retained	All other Local Natural Areas without the areas approved to be cleared and without areas identified by the City as not having native vegetation and areas approved or considered for development.	0.34ha	• This category includes native vegetation on lands with limited opportunities to formally protect this vegetation. This includes vegetation retained in road reserves and on rural lands. See section 4.1.
TOTAL			428.5ha	

Table 10, Areas of Priority Conservation Actions

3.4.2 Improving Connectivity

Significant improvement of habitat achieved along the Bannister Creek (SERCUL 2014) demonstrates the feasibility and effectiveness of restoration projects. To bring back vegetation cover levels in the City to at least 10% of its area, over 250 hectares of vegetation will need to be secured via retention of vegetation outside the current public open space network and through restoration.

In addition to the two regional ecological linkages mapped in the City of Canning (Del Marco et al. 2004), ten local ecological linkages and four areas of good greening opportunities were identified in the City (refer to figure in section 3.2.1).

It is recommended the following criteria are used to prioritise restoration works across regional and local ecological linkages in the City:

1. Restore degraded areas within regional ecological linkages by buffering the existing vegetation and wetlands. This includes lands in the Canning River Regional Park, Bannister Creek to BF456 and within adjoining Local Linkage 4, Linkage 1 and Linkage 10.
2. Reconnect BF283 (Queens Park bushland) and BF424 (McDowell Street Bushplan) to the Canning River and other regionally significant natural areas via Local Linkages 5, 7 and 9. Seek City of Gosnell's support for restoration of natural areas within the Greening Opportunity corridor D (Woodlupine Brook).
3. Continue restoration projects in Local Linkage 3, Linkage 6 and Greening Corridor B.
4. Utilise opportunities for the introduction of local species through landscaping along streets and POS upgrades, rejuvenations within Local Linkage 2, Linkage 7, Linkage 8, Greening Corridors A and C.

There are five types of action that are required to significantly improve connectivity between natural area within the regional and local linkages:

1. Formalise the protection status of natural areas via reservation under the Land Administration Act 1997 and local planning scheme amendment – see recommendations for APCAs and Section 4.1 of this document;
2. Restore degraded areas within all conservation reserves;
3. Increase native vegetation in POS areas where the primary objective is public recreation by introducing hydrozoning (for more information see Section 4.1). Implement the recommendations of the City's Water Management Strategy (Essential Environmental 2014b) which identifies drain basins where improvement of landscaping is recommended. For example Mill Street basin in Linkage 6, Station Street and Wellington Street Basin in Linkage 5, Woodford Park basin in Linkage 4, Merrifield Court basin in Linkage 2 or Bannister Road basin in the Greening Corridor C.

Dragonfly Credit: P Walker

4. Adopt a landscaping policy that will require use of local native species in landscaping residential, business and industrial lands within regional and local linkages. Adopt a community incentive program to encourage use of local species in private gardens, street verges and within school grounds.
5. Adopt a City wide landscaping program that will aim to increase native tree cover across the whole City, with highest priority being public lands within ecological areas and in suburbs identified as having poor tree canopy cover (less than 5% in WAPC 2014).

An appropriate action will depend on the type of land within the ecological linkage. For example, in conservation reserves within ecological linkages the main objective is to restore any degraded areas to increase the habitat and improve its quality within the reserved land. Within Local Parks and Recreation Area reserves with no native vegetation, the objective is to identify opportunities for re-vegetation using local species. On freehold land, the priority is to secure remaining native vegetation through land use provisions or development conditions which can include landscaping using local species. Further opportunities to increase the use of native species on lands within ecological linkages are within streetscapes and front gardens.

The mapping representation of ecological linkages as mostly 500m wide corridors should not be interpreted as strips of contiguous vegetation. The linkages identify the shortest way of connecting high conservation value areas to other natural areas, utilising remaining vegetation and lands providing good opportunities to increase vegetation. Lands that are only partially covered by the ecological linkage mapping should be considered part of the linkage in their entirety, not only the overlapping portion.

4 Implementation

To achieve the Local Biodiversity Strategy vision and objectives, several types of implementation mechanisms will be initiated. Figure 5 shows which implementation tools will be utilised to meet the City's local biodiversity objectives. In addition, a clear community and stakeholder engagement strategy is needed to ensure active participation.

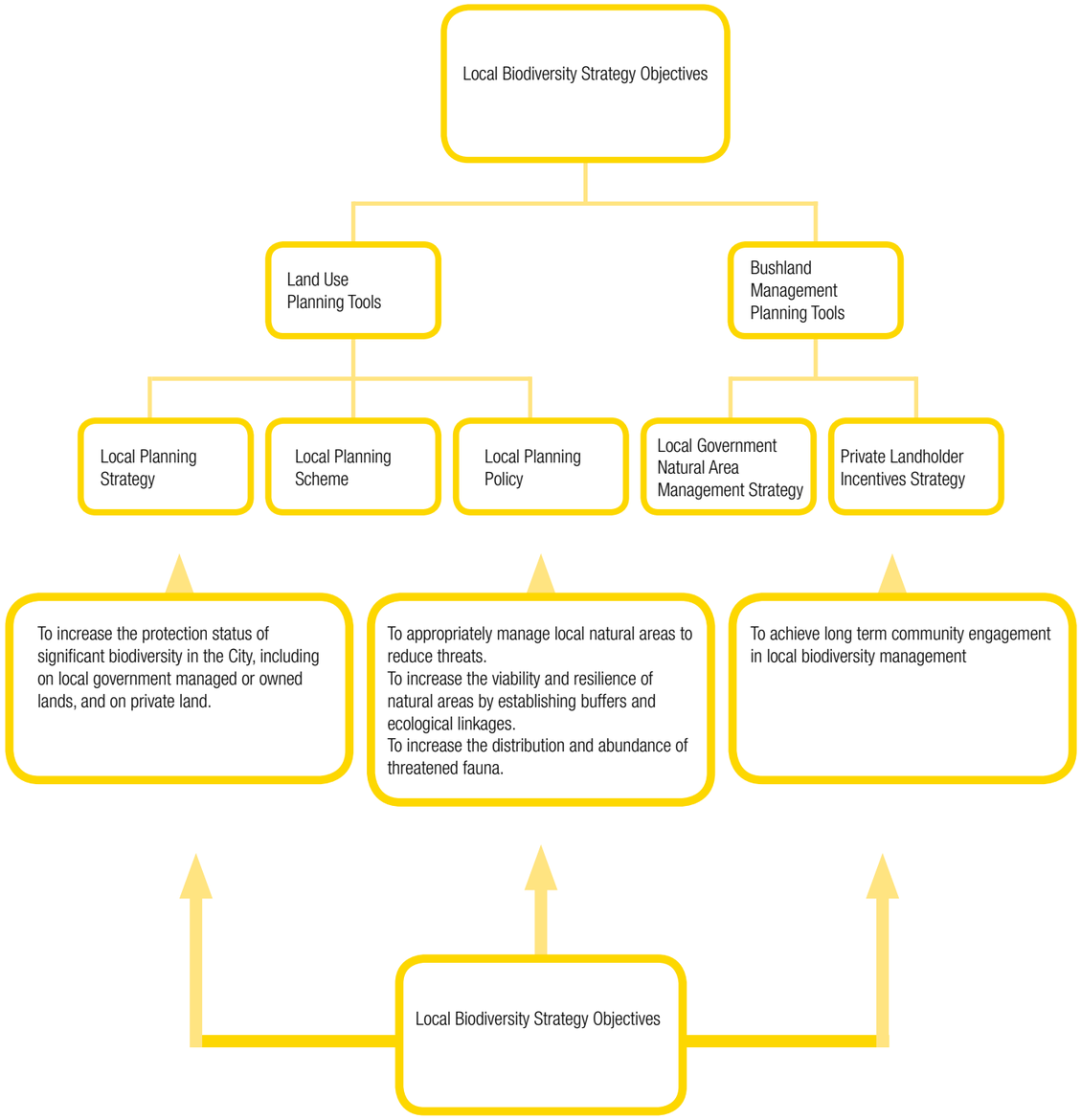


Figure 5. Local Biodiversity Strategy Implementation Framework.

To allow monitoring the effectiveness of the proposed implementation mechanisms and the level of implementation, adoption of targets specific to each objective of the City's Local Biodiversity Strategy is recommended. Table 11 lists the recommended targets and references sections of this document which discuss how to achieve them.

Local Biodiversity Strategy Objective	Targets to be achieved by 2033	How to achieve them?
To increase the protection status of significant biodiversity in the City, including on local government managed or owned lands, and on private land.	1.1 Formally protect 250ha of native vegetation in the City (and achieve 5% of pre-European vegetation extent protected in the City)	Section 3.4.1 Table 8: • Change of selected reserve purpose (50ha) • Minimising impacts of future land use.
To appropriately manage local natural areas to reduce threats.	2.1 All local conservation reserves vested in the City are managed in accordance of the approved management plan 2.2 Conservation signage is installed at all conservation reserves 2.3 Continuous decrease in weed cover and feral animal distribution is recorded in all conservation reserves managed by the City 2.4 No new dieback infestations are recorded within the City's natural areas	Develop and adopt a bushland management strategy for all City vested Local Natural Areas – see section 4.2.
To increase the viability and resilience of natural areas by establishing buffers and ecological linkages; considering the impacts of climate change.	3.1 Each high conservation value natural area is connected to at least three other significant natural areas through a network of ecological linkages 3.2 Revegetate at least 250ha of degraded or cleared land using local species to increase the native vegetation cover in the City to at least 10% of its area. 3.3 At least 20% increase in local tree species in the City streets and parks.	Implementation of protection and restoration of natural areas and replanting of native vegetation within the regional and local ecological linkages – see Section 3.4.2 and 4.2.
To increase the distribution and abundance of fauna, including threatened fauna.	4.1 All viable natural areas will show current records of threatened and priority fauna where they would have occurred prior fragmentation	See Section 4.2.
To increase local community awareness and support for biodiversity conservation	5.1 All current community groups are active and actively participating in the management of natural areas in the City 5.2 At least 70% of native vegetation mapped on rural lands is retained 5.3 10% increase in participation in the City's environmental initiatives	See Section 4.2.

Table 11, Local Biodiversity Strategy Targets

The target of at least 250 hectares of cleared land to be revegetated is based on the balance required to achieve at least 645ha of the City area being covered in native vegetation, with 645ha representing 10% of the City area:

This calculation only considers vegetation on lands that provide statutory protection for natural areas, including Crown reserves with conservation as the primary purpose or lands protected through local planning scheme provisions (e.g. Environmental Conservation local reserve classification). It is reasonable to assume that significant area of native vegetation will be retained in the City but not formally protected. However, considering the limitation of the vegetation mapping datasets and the unknown condition status for most of the vegetation, seeking to revegetate an additional 250ha is a sound target. To meet this target, revegetation of all degraded areas within conservation reservation reserves will need to be implemented.

Feasibility of the quantitative targets 3.3, 5.2 and 5.3 is discussed in sections outlining the recommended actions.

4.1 Integrating biodiversity into land use planning

A Local Government land use planning framework consists of several elements, ranging from long term strategic plans, through the statutory provisions of a local planning scheme to local planning policies providing guidance on the application of specific scheme provisions. It is important that biodiversity is considered at all levels of land use planning via provisions within all components of the local planning framework (State of Western Australia 2011).

Due to the small size of Rural Residential lots in the City, use of conservation covenants available through various covenanting programs is not considered an option for improving the vegetation protection levels on private land.

Eucalyptus marginata. Credit: S Mawson

4.1.1 Local Planning Strategy

The City of Canning has recently adopted (June 2017) the Local Planning Strategy (endorsed by the Western Australian Planning Commission in October 2017) that will outline the strategic planning direction for growth and new development in the City over a 10-15 year time frame. While local planning strategies are not statutory documents they provide a mechanism for applying state and regional planning policies as well as justification for proposed zones, reserves and other provisions of the local planning scheme.

To provide for biodiversity in the City's Local Planning Strategy, the following actions are included:

- Include local biodiversity conservation objectives and targets adopted through this local biodiversity strategy into the Local Planning Strategy;
- Include maps of regional, local linkages and greening corridors;
- Identify lands to be re-classified as Environmental Conservation local reserves;
- Provide for the adoption of new local planning policies regarding developments affecting Areas of Priority Conservation Action

Local planning strategies are prepared by the local government and, when following the prescribed consultation process, are granted final endorsement by the Western Australian Planning Commission (State of Western Australia 2011). This also provides a mechanism for formal endorsement by the State of local biodiversity conservation objectives adopted via local biodiversity strategies that are developed in accordance with the local government biodiversity planning guidelines (Del Marco et al. 2004, State of Western Australia 2011).

4.1.2 Local Planning Scheme and Local Planning Policy

The local planning scheme is the statutory tool through which local planning strategy objectives are implemented and is used to control land use and development within a local government area.

To achieve the local biodiversity conservation targets, it is proposed too:

- Introduce a new local reserve classification, Environmental Conservation (State of Western Australia 2015), and apply it to all high conservation value local natural areas and any new local reserves created on lands in APCA category 8);
- Amend general development control provisions to define requirements for landscaping using suitable local species (in accordance with a new local planning policy – see below), requirements for fauna friendly kerbing and requirements for re-vegetation where native vegetation clearing is un-avoidable to facilitate permitted development;

In the City of Canning, several Public Open Space areas are held freehold by the City. It is recommended that those identified as having biodiversity conservation values should be classified Environmental Conservation in the draft Local Planning Scheme 42.

The reserve purpose for all local reserves classified as Environmental Conservation in the Town Planning Scheme should be amended to include conservation purpose under the Land Administration Act 1997.

Banksia illicifolia. Credit: S Mawson

4.1.2.1 Local Planning Policies

Development of local planning policies is recommended to provide additional guidelines assisting the City in making decisions under the scheme and provide guidance to developers and community on how the City will be applying discretion in specific circumstances. While local planning policies are not endorsed by the WAPC, and do not form part of the Scheme, the requirements of the policy can be upheld in the case of an appeal. To be effective, the local planning policy needs to be developed, adopted and implemented in accordance with standard procedures described in the Planning and Development (Local Planning Schemes) Regulations 2015, be consistent with State and regional policy and be applied with consistency (State of Western Australia 2011) .

It is proposed that one local planning policies are adopted:

- Local planning policy guiding development and landscaping within regional and local ecological linkages, identifying areas (APCA 8 and 9, ecological linkages) where this policy will apply, define objective, outline criteria for assessing remnant vegetation values as part of an ecological linkage, define species accepted by the City in landscaping, acceptable planting densities and landscaping structures to achieve water sensitive landscapes that also support local fauna movement. Water sensitive design requirements will also support water quality improvement initiatives and controls to reduce mosquito breeding. The policy will also define requirements for underpasses and other structures to be installed as part of the landscape to provide fauna habitat and for fauna friendly kerbing. This policy will be an update of the City's current local planning policy SRS221(04) which addresses landscaping requirements focusing on appearance and maintenance but does not specify the use of local species.
- Tree protection policy applicable to private land. The policy will define the criteria for 'significant trees' such as size, species, historical or cultural significance and describe the designated tree preservation areas.

The City recently adopted Local planning policy LP.09 Tree Retention and Planting - Development which regulates tree retention and planting on sites being developed.

The City of Canning has several administrative policies which aim to address vegetation and fauna protection, consideration of environmental issues in structure plans and development proposals or landscaping provisions in urban areas (ET520, 521, 525, 526 and 527). It is recommended that these administrative policies are reviewed following the adoption of the proposed local planning policies and removed or updated considering the local planning policy provisions.

Summary of recommendations to improve native vegetation protection and retention levels:

- Introduce new local reserve classification, Environmental Conservation, into the local planning scheme and apply it to high conservation value local reserves;
- Amend the purpose of selected reserves to include 'conservation' under the Land Administrative Act 1997 provisions;
- Develop and adopt local planning policy to guide vegetation retention/protection while facilitating future development, to assist with the establishment of effective ecological linkages between remaining fauna habitat, and landscaping with suitable local species;
- Amend general development control provisions to define requirements for landscaping using suitable local species, requirements for fauna friendly kerbing and requirements for re-vegetation where native vegetation clearing is un-avoidable to facilitate permitted development.

4.2 Bushland Management

The City's Local Environment Management Strategy (Table 8, page 44-45 in Essential Environmental 2014a) identifies a number of actions to achieve objectives for natural area conservation in the City. The following section provides further information regarding prioritisation of natural areas for management and revegetation.

4.2.1 Strategic reserve management

The City of Canning actively manages 42 natural area reserves, with 15 identified as high priority for management, 10 being of medium priority and 17 being low priority. Seven of these natural areas have management plans and the City also have a Watercourse Reserves Management Strategy (2006). All but one management plan were prepared 9 or more years ago. Banister Creek Draft Park Management Plan for 2014-2024 is the most up-to-date document (SERCUL 2014). It is recommended that all outdated management plans are updated as a priority and that the City works in close partnership with DBCA on the update of the Canning River Regional Park Management Plan (Department of Conservation and Land Management 1997).

It might not be feasible to develop management plans for all existing and proposed reserves managed by the City in the near future. Therefore it is recommended that the City collates information on ecological values, major threats and weeds across all natural areas using a uniform method such as the Natural Area Initial Assessment (NAIA) Template (Del Marco et al. 2004) and the foreshore vegetation condition mapping adopted by the Swan River Trust (2008).

The NAIA Templates are not designed to replace detailed reserve management plans but they provide an effective tool for prioritisation of natural areas based on ecological values and for collection of relevant information to advise management priorities. Reserve prioritisation for management also considers the severity of threatening processes and community support for management (Lamond 2009). It is recommended that the City follows the Local Government Guidelines for Bushland Management (Lamond 2009) and prepares a 5 year strategic reserves management plan for all natural areas not covered by individual management plans.

Recommended components of the strategic reserve management plan include:

- Prioritisation of natural areas using ecological criteria;
- Assessment of threats, their categorisation and prioritisation considering current distribution, impact, risk/probability of spreading to new areas, availability of adequate control (see Appendix H in Lamond 2009);
- A clear communication strategy for natural areas impacted by incompatible human use;
- Identification of management priorities in partnership with community volunteers and other stakeholders (e.g. DBCA, SERCUL);
- Adopt clear standards for fencing, use of mulch and signage across all natural areas, to facilitate fauna movement and communicate the acceptable use of these areas to maintain their ecological values;

The City's Control and keeping of Cats Local Law 2007 is an important component of natural area management. It is recommended that the City updates this Local Law to align its provisions with the State's Cat Act 2011 and to list additional high conservation value natural areas as 'Cat Prohibited Areas'.

Bossiaea eriocarpa. Credit: S Mawson

Xanthorrhoea pressii. Credit: S Mawson

4.2.2 Greening the City - Increase of local species

As identified in this document over 250 hectares of degraded or cleared lands need to be restored using endemic to increase native vegetation cover in the City to at least 10% of the City area. While revegetation does not replace the natural ecosystems that were cleared, there are very good examples of natural area restoration in the City demonstrating the benefits of the long term commitment to restoration of cleared lands (SERCUL 2014).

Between 1994 and 2013, 45 hectares were revegetated through community projects in the City of Canning. To achieve further 250 hectares of revegetation by 2033, the revegetation efforts will need to intensify. Therefore, continuing with existing partnerships with the community, DBCA, Department of Water and Environment Regulation, but also exploring new opportunities with businesses and other State agencies will be required to achieve the restoration target.

Restoration of degraded areas in reserves already managed for biodiversity conservation should be of the highest priority. It is recommended that the City seeks support from the State through the processes of the Strategic Assessment for Perth and Peel, being currently undertaken under the provisions of the EPBC Act 1999. Bush Forever Areas 283, 224 and the area covered by the Canning Vale Sports Master Plan provide best opportunities for large scale restorations.

The next priority is the increase of local species within the City's local reserves (POS) and compensation basins (as recommended in the City's Water Management Strategy 2014). Improvements to the Anvil Way compensation basin and other 'Living Stream' projects in the City are good examples of opportunities for increasing native vegetation while improving water quality within the local water catchments.

Hydro-zoning or dividing public open spaces into zones based on water requirements are used by several local governments not only to reduce water consumption for POS maintenance but also to increase native vegetation in open spaces. Lands within regional ecological linkages and reconnecting BF283 and BF424 with other large conservation areas should be the highest priority.

It is recommended that the City develops a landscaping program for all POS and for increasing street trees across the City. The landscaping program should list suitable local species for various locations considering local soil and hydrological conditions.

In 2014-2015, the City mapped street and park trees across most of its area, recording the tree species, size, health and other characteristics for nearly 49,000 trees (City of Canning, April 2015). Parks with remaining native vegetation were not included in this analysis, only parks with trees without the understorey. Table 12 shows the representation of mapped tree species by four categories based on the species origin. Locally indigenous species represent only 8% of all street trees and 28% of park trees. It is recommended that this proportion is significantly increased to a proposed target of 20% of street and park trees being local species, using of suitable local species in all new landscaping and tree re-placement programs.

All locally indigenous tree species including *Eucalyptus, Banksia*, *Melaleuca*, *Casuarina obesa, Paraserianthes lophantha* and *Xylomeleum occidentale* are suitable for planting in parks but only few of them can be used as street trees. When selecting trees for street planting and landscaping within residential and commercial developments, specific locality conditions, safety, form and purpose need to be considered.

Tree groups by origin	Street trees		Park trees*	
	Number of trees	% of total number of street trees	Number of trees	% of total number of park trees
Local (City of Canning)	2089	8%	5985	28%
Native to Western Australian	4927	18%	2919	14%
Native to Australia (outside WA)	8327	30%	9468	44%
Exotic	12100	44%	2834	13%
Not listed	0	0%	74	0%
Total	27443	100%	21280	100%

*Trees in Public Open Space areas, not including areas with native vegetation.

Table 12, City of Canning Park and Street Trees Origin

Finally, residential and rural areas also provide opportunities to increase the extent of local species in the City. The following section describes ways of encouraging and supporting landholders to use local species in their gardens.

To achieve an increase of native vegetation cover in the City by 250 hectares, a range of strategies are recommended including restoration of degraded and cleared lands within conservation reserves, hydro-zoning and landscaping of recreational parks, transforming compensation basins into living streams or improving their landscaping, complemented by increasing the use of local plants in landscaping within residential, rural and business developments via incentives and development conditions.

4.2.3 Private Landholder Incentives and Community Support

In built-up areas, verges, public gardens, backyards or rooftops provide opportunities to grow local species that not only provide greenery but also support a range of native birds, insects and lizards. As not all native plants grow well in highly modified urban environments, providing practical advice to landowners on suitable plant selection promotes and encourages their use. Several Local Governments encourage the use of native species and support residents by providing lists of suitable plants and/or subsidy programs that offer access to local plants at subsidised price. For example see the City of South Perth's Landscaping Guidelines **(http://www.southperth.wa.gov.au/Documents/Services/Verges/Street-Verge-Landscape-Guidelines.pdf)** for a native plant subsidy scheme program run by the member councils of the Western Suburbs Regional Organisation of Councils each May.

To encourage participation by residents the subsidy program could include the following features:

- garden consultation by adequately qualified specialist that will assist with plant selection and planting design to maximise the benefits of local plants while meeting the aesthetic requirements ;
- Seek commitments from participating residents to encourage full establishment of local species;
- Seek 'neighbourhood champions';
- Monitor and report to the community within targeted areas (ecological linkages) the progress of transformation (e.g. % of properties with more than 60% of local species).

It is recommended that the City develops and implements an incentives program to encourage the use of local species in private gardens, targeting private landholders within identified ecological linkages and within about 250m of conservation reserves. Other activities that could be considered include:

- Hosting of practical gardening workshops focusing on growing local species
- Promoting open garden schemes and examples of public landscaping using local species
- In September (every 2-3 years), hosting gardening competitions
- In partnerships with community groups or BirdLife Australia encouraging monitoring of birds in private gardens
- Actively promoting and encouraging participation by local residents in well-established initiatives such as Turtle Watch **(http://www.aaeewa.org.au/turtlewatch.html)**, Osprey Watch **(http://www.osprey-watch.org/)**, Climate Watch **(http://www.climatewatch.org.au/)**.

Before implementing any new initiatives or promoting material, it is recommended that the messages and incentives are pre-tested on selected members of the target audience.

Finally, develop communication packages to inform the existing and new residents about actions they can take to reduce impact of cats and foxes on native fauna and maintain native fauna friendly backyard (e.g. cover pools, prevent native fauna drowning in ponds, create cat enclosures, provide bird water baths, remove opportunities for foxes to hide, mulch, install bat boxes). This information can be made available via local libraries, local shopping centres and distributed as 'Welcome Packages' to new residents.

Around 35 hectares of native vegetation remains on rural type lands in the City. While the remaining vegetation is highly fragmented, these rural lots are within an important ecological linkage and opportunities to improve the condition of this vegetation should be explored. Key issues to address is the need to minimise further loss of vegetation due to incremental clearing and weed invasion, fire risk management, impacts of feral animals, cats, increase in the use of local species in landscaping and improve opportunities for native fauna movement across rural lots.

It is recommended that the City surveys private landholders to collect information on the level of understanding of environmental management issues, barriers to retaining more vegetation, the values of native vegetation on rural lots and the motivations for choosing to live on rural lands in the City. This information can then be used to tailor the incentives programs and environmental education programs that will be designed to improve native vegetation status on lands zoned rural.

The City already offers considerable support to community groups that volunteer their time to improve the City's natural areas. Key community groups working in the City are:

- Bannister Creek Catchment Group
- Canning River Regional Park Advisory Committee
- Canning Ricer Regional Park Volunteers
- Canning River Residents Environment Protection Association Inc.
- Friends of Queens Park Bushland
- Friends of Queens Park
- Friends of Brolga Park
- Waterbirds Conservation Group
- Wilson Wetlands Action Group Inc.

The City also works with SERCUL, an independent natural resource management body that brings together community, local government and business to deliver natural resource management and environmental education projects focusing on the Canning River, parts of the Swan River and the Southern Wungong River.

The Canning River Eco Education Centre (CREEC) near the Kent Street Weir within the Canning River Regional Park, operated by the City, is a facility providing resources and workshops for schools, volunteers groups and corporate organisations. The City supports community volunteers by providing financial support, plants, labour and assistance with seed collection and propagation, weed control, weed and rubbish bag collection, watering, vegetation monitoring, feral animal control, repair of reserve infrastructure, provision of equipment, storage and care of seedlings for re-vegetation projects. To acknowledge and recognise the contribution of volunteers to natural area management, in 2013 the City installed an Environmental Volunteer Honour Board that is being updated annually through nominations.

Continued support to the community groups and active promotion of their activities in all City communication should be a highest priority as the benefits of such partnerships are well recognised (Stenhouse 2005).

Christmas Spider, *Austracantha minax*. Credit: S Mawson

Summary of recommendations to improve bushland management:

- Assess the ecological values and the threats to these values in all natural area reserves, including the existing and the proposed additions in this document, using a standard methodology to allow prioritisation of natural areas for management;
- In consultation with interested community groups and other relevant stakeholders, prepare a strategic five year management plan addressing key issues across all natural areas and incorporating recommendations from existing updated reserve management plans (see section 4.2.1);
- Adopt a strategic and operational plan for restoration of degraded and cleared lands in local parks and other public lands within the regional and ecological linkages, considering priorities listed in Section 3.4.2;
- Adopt and implement a City wide landscaping program (including active public open space, compensation basins, drainage reserves, streets and other public lands) to increase the proportion of local plants in landscaping;
- Develop and adopt an incentives package to encourage the use of local species in landscaping around businesses and on private land, including landowners in both rural and residential areas;
- Actively support local community groups interested in bushland management;
- Develop a range of activities that engage general public and raise their awareness of biodiversity conservation issues in the City of Canning;
- Develop an information package for landowners on fauna friendly backyards.

4.3 Communication

To effectively engage the local community and other land managers in the City, it is important to maintain consistent communication on the City's objectives for biodiversity conservation. This should be facilitated by:

- Including all Local Biodiversity Conservation mapping on the City's information system available to all internal services, including planning, engineering and infrastructure maintenance.
- Informing State agencies such as the Department of Planning, Department of Water, Department of Parks and Wildlife about the City's Local Biodiversity Strategy objectives and seek their cooperation in implementation.
- Referring to the findings of the Local Biodiversity Strategy when providing comments on initiatives by State Agencies.
- Referring to the findings of the Local Biodiversity Strategy when providing comments on subdivision and scheme amendment proposals.
- Including the Local Biodiversity Strategy objectives and actions into the induction package for new staff, including staff joining planning and asset management services.
- For each business unit, developing a check list of activities that might impact biodiversity management in the City, including links to relevant staff within the Parks and Place Improvement business unit that can provide advice or approval.
- Facilitating discussions with peak natural resource management groups such as Perth Region NRM, SERCUL, local friends groups or other not-for-profit organisations active in the City to develop potential partnerships that will support on-ground management on public and private lands and the extensive re-vegetation program.
- Reporting to the local community at least every two years on the progress with implementation.
- Including articles on biodiversity values in the City, prompts for actions in all City newsletters and at least once a month in the local newspaper.

Action Plan

Priority: High – complete by 2018-2019 | Medium – complete by 2019-2022 | Low – complete by 2033

	Action	Priority	Responsibility	Key Performance Indicator	Contributing to target (Table 1)
	Integration into the land use planning framework				
1	Integrate Local Biodiversity Strategy objectives, targets and mapping into the City's Local Planning Strategy	High	Canning Sustainable Development	WAPC endorses the City's local planning strategy with adequate provisions for local biodiversity (including mapping and targets)	1.1
2	Confirm the conservation values of the selected reserves with proposed change of purpose under the Land Administration Act 1997 or change of local reserve classification to Environmental Conservation in the local planning scheme.	High	Parks and Place Improvement Canning/ Land Utilisation	All reserves assessed and reserve purpose change made	1.1 and 2.1
3	Scheme Amendment to change the classification of selected high conservation value reserves vested in the City to Environmental Conservation	High	Canning Sustainable Development	All selected reserves with confirmed high conservation values classified for Environmental Conservation, contributing to the achievement of the target of 5% of pre-European vegetation extent protected in the City	1.1
4	Seek support from the relevant State Government agencies for a Scheme Amendment to change the classification of selected high conservation reserves vested in them	Medium	Parks and Place Improvement Canning/ Land Utilisation	90% of selected reserves reserved for Conservation of Flora and Fauna, contributing to the achievement of the target of 5% of pre-European vegetation extent protected in the City	1.1
5	Develop and adopt Local Planning Policies addressing native vegetation retention in POS, development within ecological linkages, landscaping standards and tree preservation (see section 4.1.2)	High	Parks and Place Improvement Canning/ Canning Sustainable Development	Local Planning Policy adopted by the Council All new subdivisions and streetscape upgrades in accordance with the landscaping standards (minimum 20% of plants used are local species)	1.1, 3.1, 3.2, 5.2
6	Implement recommendations for vegetation retention and protection on lands that may be subject to future development (Appendix B).	Ongoing	Parks and Place Improvement Canning/ Canning Sustainable Development	Contribute to the achievement of 5% of pre-European vegetation extent protected and 10% native vegetation cover	1.1 and 3.2
	Local Government Natural Area Management				
7	Assess the ecological values, condition and management issues in all natural areas proposed to be managed for conservation	High	Engage adequately qualified consultant	All current and new natural areas assessed and prioritised according to ecological values and management issues	2.1
8	In consultation with interested community groups and other relevant stakeholders, prepare a strategic five year management plan addressing key issues across all natural areas and incorporating recommendations from existing updated reserve management plans	Medium	City to engage adequately qualified consultant or Parks and Place Improvement Canning	Strategic Management Plan adopted by the Council	2.1, 2.2, 2.3, 2.4
9	Update the Control and keeping of cats Local Law 2007	High	Parks and Place Improvement Canning	Updated Local Law enacted	2.3, 4.1
10	Develop and implement best-practice procedures for all City staff and contractors working and accessing natural areas and managing infrastructure assets	Medium-High	Parks and Place Improvement Canning	Best practice procedures part of induction of new staff and training for existing staff, part of contractual agreements for all works potentially within or near protected natural areas	2.3, 2.4

Action Plan

Priority: High – complete by 2018-2019 | Medium – complete by 2019-2022 | Low – complete by 2033

	Action	Priority	Responsibility	Key Performance Indicator	Contributing to target (Table 1)
10	Develop and implement best-practice procedures for all City staff and contractors working and accessing natural areas and managing infrastructure assets	Medium-High	Parks and Place Improvement Canning	Best practice procedures part of induction of new staff and training for existing staff, part of contractual agreements for all works potentially within or near protected natural areas	2.3, 2.4
11	Implement the strategic reserve management plan	Ongoing	Parks and Place Improvement Canning	At least 80% of conservation reserves being actively managed by 2022	2.1, 2.2, 2.3, 2.4, 3.2
12	Undertake periodic fauna monitoring and keep records of all incidental fauna observations for all natural areas.	Ongoing	Parks and Place Improvement Canning	All viable natural areas will show current records of threatened and priority fauna where they would have occurred prior fragmentation	2.1, 4.1
13	Report any new fauna records to DBCA	Ongoing	Parks and Place Improvement Canning	DBCA records of fauna in the City are up-to-date	1.1, 2.1
14	Adopt a strategic and operational plan for restoration of degraded and cleared lands in local parks and other public lands within the regional and ecological linkages, considering priorities listed in Section 3.4.2	Medium	Parks and Place Improvement Canning	At least 90% of mapped degraded areas in conservation reserves are revegetated by 2033	3.1, 3.2
15	Adopt and implement a City wide landscaping program (including active public open space, compensation basins, drainage reserves, streets and other public lands) to increase the proportion of local native plants in landscaping	Medium	Parks and Place Improvement Canning/ Canning Sustainable Development	By 2033, at least 20% park trees and 10% of street trees are local species	3.1, 3.3
	Private landholder and community volunteers support				
16	Prepare and implement a private landholder incentives package to support biodiversity conservation on private rural lands.	Medium	City to engage adequately qualified consultant/ Parks and Place Improvement Canning	Private landholders incentive strategy adopted by the council At least 50% of native vegetation mapped on rural lands is retained in 2033	5.2, 5.3
17	Adopt a local plant subsidy scheme, targeting properties within ecological linkages	Medium	Parks and Place Improvement Canning	60% of land owners within each linkage actively participate in the scheme	5.2
18	Actively support local community groups interested in bushland and weed management	Ongoing	Parks and Place Improvement Canning / CREEC	All current community groups are actively participating in the management of natural areas in the City	3.2, 3.3, 5.2, 5.3
19	Develop a range of activities that engage the community and raise awareness of biodiversity conservation issues in the City of Canning	Ongoing	Parks and Place Improvement Canning / CREEC	10% increase in participation in the City's environmental initiatives	5.3
	Communication and Local Government capacity building				
20	Integrate all Local Biodiversity Strategy mapping into the City's information system	High	Connect Canning	Mapping accessible to all City services	1.1, 3.1
21	Develop a new staff induction package that includes the Local Biodiversity Strategy objectives and actions, highlighting relevant responsibilities for each business unit	High	Connect Canning	All staff refer to the checklist prior commencing delivery of planned activities.	1.1, 3.1

Action Plan

Priority: High – complete by 2018-2019 | Medium – complete by 2019-2022 | Low – complete by 2033

	Action	Priority	Responsibility	Key Performance Indicator	Contributing to target (Table 1)
22	For each business unit, develop a check list of activities that might impact biodiversity management in the City, including links to relevant staff within the Parks and Place Improvement that can provide advice or approval	High	Parks and Place Improvement Canning	All staff refers to the checklist prior commencing delivery of planned activities.	1.1, 3.1
23	Develop and promote a sustainable landscaping information package for residential areas and verges (focusing on the use of local species) – linked to the local plant subsidy program	Medium	Parks and Place Improvement Canning / City to engage a qualified consultant	Landscaping information package available through the City's website and promoted annually	3.1, 3.3
24	Facilitate discussions with local Aboriginal leaders to investigate opportunities for their involvement in promoting the cultural values of natural areas in the City	Ongoing	Parks and Place Improvement Canning / CREEC	Cultural knowledge sought on projects, where relevant	2.1, 5.3
25	Develop a monitoring and reporting schedule for the Local Biodiversity Strategy	High	Parks and Place Improvement Canning	Annual report on progress with implementation of the Local Biodiversity Strategy and on the status of biodiversity in the City presented to Council	5.3
26	Undertake a review of the feasibility and effectiveness of the proposed implementation actions every 5 years.	Medium	Parks and Place Improvement Canning	Results of the review with recommendations on further actions presented to Council	1.1, 2.1, 3.3, 5.2, 5.3
27	Form partnerships with not-for-profit groups to facilitate reserve management and environmental education	Ongoing	Parks and Place Improvement Canning	At least one long-term (5 years) working partnership formed	2.1, 5.1, 5.2, 5.3

REFERENCES

Animal Pest Management (2012) *Foxes*. Website accessed on 14 August 2015: http://www.animalpest.com.au/feralfoxes/

ATA Environmental (2004) *Wetland and Public Open Space Management Plan. Part Lots 72 & 501 and Lot 502 Ranford Road, Canning Vale*. Report prepared for the City of Canning.

Australian Government (2012a) *National Wildlife Corridors Plan: A framework for landscape-scale conservation*. Department of Sustainability, Environment, Water, Population and Communities, Canberra

Australian Government (2012b) *Approved Conservation Advice for Clay Pans of the Swan Coastal Plain*. http://www.environment.gov.au/biodiversity/threatened/communities/pubs/121-conservation-advice.pdf

Brooker, J. and Rigo, M. (2001) Yagan Wetland Reserve Management Plan. Prepared by the Yagan Wetland reserve Advisory Working Group in 1996 revised by M. Rigo in 2000. City of Canning.

CATALYSE (2007) *Local Nature Spot Project – Results from a Community Survey, June 2007*. Unpublished report prepared for the Perth Biodiversity Project, Western Australian Local Government Association, West Perth.

CATALYSE (2017) *MARKYT Community and Wellbeing Scorecard 2017*. Survey report prepared for the City of Canning.

Chambers, B. (2014) *Wildlife Research Blog: Category Archives: Paganoni Swamp Reserve*. Available on http://bcwildliferesearch.com/category/paganoni-swamp-reserve/ Accessed on 29 March 2015.

Churchward, H.M. and McArthur, W.M. (1980) *Landforms and Soils of the Darling System Western Australia. In Atlas of Natural Resources Darling System Western Australia*, Department of Conservation and Environment, Western Australia.

City of Canning (2001) S*helley Rossmoyne Foreshore Management Plan 2001-2006*. City of Canning.

City of Canning (2006a) *City of Canning Watercourse Reserves Management Strategies 2006. A revision of the City of Canning foreshore reserves management policy document*. City of Canning

City of Canning (2006b) *Prendwick Botanic Park Draft management plan*. City of Canning.

City of Canning (2014) *Strategic Community Plan*. http://www.canning.wa.gov.au/C/city-futures.html

City of Canning (2017) *Our City, Our Future, A Strategic Community Plan for 2017-2027*. http://www.yoursaycanning.com.au/23389/documents/59569

Commonwealth of Australia (2008) *Approved Conservation Advice for Neopasiphae simplicior (a short-tongued bee)*. Approved by the Minister on 16 December 2008, Department of Sustainability, Environment, Water, Populations and Communities, Canberra.

Commonwealth of Australia (2012a) *EPBC Act referral guidelines for three threatened black cockatoo species,* Department of Sustainability, Environment, Water, Populations and Communities, Canberra.

Commonwealth of Australia (2012b) *National Wildlife Corridors Plan: A framework for landscape-scale conservation*. Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Commonwealth of Australia (2013a) *Conservation Advice for Subtropical and temperate coastal saltmash*. Department of Sustainability, Environment, Water, Populations and Communities, Canberra

Commonwealth of Australia (2013b) *Approved Conservation Advice for Leioproctus douglasiellus (a short-tongued bee)*. Approved by the Minister on 24 April 2013. Department of Sustainability, Environment, Water, Populations and Communities, Canberra

Commonwealth of Australia (2015) *Action Plan for Australian Marsupials and Monotremes: Recovery outline – Brush-tailed Phascogale*. Department of the Environment website accessed 20 March 2015: http://www.environment.gov.au/node/14789

Conservation International (2011) *Hotspots revisited* http://www.conservation.org/where/priority_areas/hotspots/hotspots_revisited/Pages/hotspots_revisited.aspx

CSIRO (2014) *Biodiversity – science and solutions for Australia*. Edited by Steve Morton, Andy Sheppard and Mark Lonsdale. CSIRO Publishing, Australia.

Davis Langdon Australia (2014) *Draft City of Canning Public Open Space Strategy*. Unpublished report prepared for the City of Canning, October 2014.

Davis, R.A. and Brooker, L. (2008) *Ecological Linkages and Urban Fauna at Risk on the Swan Coastal Plain, Perth, Western Australia*. Final Report. Unpublished report prepared for the Swan Catchment Council

Del Marco, A., Taylor, R., Clarke, K. Savage, K. Cullity, J. and Miles, C. (2004) *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region*. Western Australian Local Government Association, West Perth

Department of Agriculture and Food (2014) *Fox baiting*. Website accessed 14 August 2015: https://www.agric.wa.gov.au/1080/fox-baiting

Department of Conservation and Land Management (1997) *Canning River Regional Park Management Plan 1997-2007*. Management Plan No 36. Department of Conservation and Land Management, National Parks and Nature Conservation Authority and the City of Canning.

Department of Environment and Conservation (2012a) *Chuditch (Dasyurus geoffroii) Recovery Plan*. Wildlife Management Program No.54. Department of Environment and Conservation, Western Australia.

Department of Environment and Conservation (2012b) *Brush-tailed Phascogale (Phascogale tapoatafa) Fauna Profiles*. Department of Environment and Conservation, Western Australia.

Department of Environment and Conservation (2012c) *Water Rat (Rakali) Hydromys chrysogaster – Fauna Profiles*. Department of Environment and Conservation, Western Australia.

Department of Parks and Wildlife (2014) Tuart Conservation. http://www.dpaw.wa.gov.au/management/forests/about-our-forests/173-tuart-conservation

Dunlop, M. and Brown, P.R. (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment.* Report to the Department of Climate Change, February 2008. Canberra: Australian Government Department of Climate Change.

Eastern Metropolitan Regional Council (2008) *Collective Local Biodiversity Strategy*. Report produced by the EMRC on behalf of the Town of Bassendean, the City of Bayswater and the City of Belmont.

English, V. and Blyth, J. (2000) *Shrubland and woodlands on Muchea limestone-Interim Recovery Plan 2000-2003*. Department of Conservation and Land Management, Wanneroo, Western Australia.

Environmental Protection Authority (2007) *State of the Environment Report 2006*. Environmental Protection Authority, Perth.

Environmental Protection Authority (2008) *Guidance Statement No 33: Environmental Guidance for Planning and Development*. Environmental Protection Authority, Perth.

Environmental Protection Authority (2014) *Decision Under Section 48A(1)(a) Environmental Protection Act 1986 – City of Canning Town Planning Scheme 40 Amendment 196* – Canning City Centre Amendment. August 2014

Essential Environmental (2014a) *City of Canning Environmental Management Strategy*. Adopted by the Council in April 2014. City of Canning. http://www.canning.wa.gov.au/E/environment-management-strategy.html

Essential Environmental (2014b) *City of Canning Water Management Strategy*. Adopted by the Council in August 2014. City of Canning

Forman, R.T.T and Gordon, M. (1996) *Landscape Ecology*, John Wiley & Sons

Gardner, S. (2007) (Ed.) Clearing of native vegetation in Special Rural Zones: Issues and Solutions – Workshop Summary. Unpublished workshop proceedings, World Wild Fund, Perth.

Glossop, B., Clarke, K. and Mitchell, D. (2010) *Methods for assessment of Carnaby's Black Cockatoo habitat*. Department of Environment and Conservation, Western Australia.

Government of Western Australia (2000a) Bush Forever – Keeping the bush in the city. Volume 1: policies, principles and processes, Western Australian Planning Commission, Perth.

Government of Western Australia (2000b) Bush Forever Volume 2: Directory of Bush Forever Sites. Western Australian Planning Commission, Perth.

Ham, S.H., Brown, T.J., Curtis, J., Weiler, B., Hughes, M. and Poll, M. (2007) *Promoting Persuasion in Protected Areas. A Guide for Managers developing strategic communication to influence visitor behaviour*. Sustainable Tourism CRC.

Heddle, E.M., Loneragan, O.W. and Havel, J.J. (1980) *Vegetation complexes of the Darling System, Western Australia*. In Atlas of Natural Resources Darling System Western Australia, Department of Conservation and Environment, Western Australia.

Hester Property Solutions (2012) *City of Canning Land Asset Assessment*. Report prepared for the City of Canning, November 2012.

Houston, T. (2000) *Native bees on wildflowers in Western Australia*. Special publication No 2. of the Western Australian Insect Study Society Inc. WA Museum, Perth.

How R.A. and Dell J. (1994) The zoogeographic significance of urban bushland remnants to reptiles in the Perth region, Western Australia. Pacific Conservation Biology, 1, 132-140.

Howard, K.H., Barrett, G., Ramalho, C.E., Friend, J.A., Boyland, R.J.I., Hudson, J. and Wilson, B. (2014) *Community Quenda Survey 2012. Report prepared by WWF-Australia and the Department of Parks and Wildlife, Western Australia*.

Hussey, P. and Mawson, P. (2004) *Requirements for native mammals*. Wildlife Notes No. 11. May 2004. Department of Conservation and Land Management, Western Australia.

Jandakot Airport Holdings (2009) Jandakot Airport Master Plan 2009. Jandakot Airport Holdings, Western Australia

Johnstone, R.E., Kirkby, T. and Sarti, K. (2011) *Cockatoos Calling*. In: Endangered Black Cockatoos in Western Australia, Proceedings of a symposium about their biology, status, threats and efforts to restore their habitat and populations, November 2010. Urban Bushland Council.

Kauhanen, J. Chambers and F. D'Souza (Eds.) (2011) *Report Card of Climate Change and Western Australian Aquatic Ecosystems*. 2011. National Climate Change Adaptation Facility, Murdoch University

Lamond, S. (2009) *Local Government Guidelines for Bushland Management in the Perth and Coastal South-West NRM Regions of Western Australia*. Western Australian Local Government Association, West Perth.

Local Biodiversity Program (2014a) T*owards Establishing a Green Network. Vegetation connectivity modelling -Testing the effectiveness of a proposed green network for the South West Group member Local Government*. Western Australian Local Government Association , West Leederville.

Local Biodiversity Program (2014b) *Connectivity Analysis for Perth and Peel. Update to the Regional Framework for Local Biodiversity Conservation Priorities for Perth and Peel, August 2014*. Available through the on-line mapping viewer http://lbp.asn.au/index_public.html

Molloy, S., Wood, J., Hall, S., Wallrodt, S. and Whisson, G. (2009) *South West Regional Ecological Linkages Technical Report*, Western Australian Local Government Association and Department of Environment and Conservation, Perth.

Myers, N., Mittermeler, R.A., Mittermeler, C.G., da Fonseca, G.A.B. and Kent, J. (2000). *Biodiversity hotspots for conservation priorities*. Nature 403: 853-858.

Natural Resource Management Ministerial Council (2010) *Australia's Biodiversity Conservation Strategy 2010-2030*. Department of Sustainability, Environment, water, Population and Communities, Canberra.

Perth Biodiversity Project (2008) *Behaviour Change for Natural Diversity (or Local Nature Spot Project) Project Summary*. Perth Biodiversity Project, Western Australian Local Government Association, West Perth http://pbp.walga.asn.au/Portals/1/Templates/docs/lns_summary.pdf

Perth Biodiversity Project (2012) *Guidance for the Integration of Biodiversity Conservation into Local Planning Strategies and Schemes*. Perth Biodiversity Project, Western Australian Local Government Association, West Perth http://pbp.walga.asn.au/Publications/IntegrationofBiodiversityintoLocalLandUse.aspx

Perth Biodiversity Project (2013) *Central Perth Regional Parklands Concept – Vegetation Connectivity Analysis*. In: Capital City Planning Framework, Western Australian Planning Commission.

Perth Region NRM (2014) *Swan Region Strategy for NRM – Consultation Draft*. Perth Region NRM , Middle Swan, Western Australia.

Polyakov, M., Pannel, D.J., Pandit, R., Tapsuwan, S. and Park, G. (2012) Valuing environmental assets on rural lifestyle properties, Working Paper 120010, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Australia

Powell, R. (2009) *Leaf and Branch Trees and tall Shrubs of Perth*. Department of Environment and Conservation, Kensington, Western Australia.

Ramalho, C.E. (2012) *Effects of Urbanisation on Remnant Woodlands*. Unpublished PhD thesis, University of Western Australia, Perth.

SERCUL (2014) *Bannister Creek Park Management Plan 2014-2024*. SERCUL, Beckenham.

Scott, P., Barber, P., Hardy, G. and Shearer, B. (2011) *Can a microscopic plant pathogen kill a large tuart tree?* Bulletin No. 15, Centre of Excellence for Climate Change, Woodland and Forest Health, Murdoch University, Western Australia.

South-East Regional Centre for Urban Landcare (2005) *Proposal for Natural Resource Enhancement – Anvil Way Compensating Basin*. Unpublished report prepared by South-East Regional Centre for Urban Landcare, Beckenham.

Southwest Australia Ecoregion Initiative (2012) A *Strategic Framework for Biodiversity Conservation. Report B: For practitioners of conservation planning*. Southwest Australia Ecoregion Initiative, Wembley Western Australia.

State of Western Australia (2014) *The Urban Forest of Perth and Peel. Statistical report CSIRO 2009 Urban Monitor*. Western Australian Planning Commission, Perth.

State of Western Australia (2013) *Canning Vale Sports Masterplan*. Department of Planning, Perth.

State of Western Australia (2011) Directions Paper on the Integration of NRM into Land Use Planning. Western Australian Planning Commission, Perth.

State of Western Australia (2007a) *State of the Environment Report 2007*. Environmental Protection Authority, Perth.

State of Western Australia (2007b) C*ity of Canning – Control and Keeping of Cats Local Law 2007*. Western Australian Government Gazette No 166, 21 August 2007, Perth.

State of Western Australia (2000) *Bush Forever Volume 1: Policies, Principles and Processes*. Western Australian Planning Commission, Perth.

Stenhouse, R. (2005) *Ecology and Management of Bushland in Australian Cities*. Thesis, University of Western Australia.

Storer, T., Robb, M., Norton, S., Kilminster, K. and Nice, H. (2013) *Ecosystem health in the Canning River, focusing on the influence of the Kent Street Weir*. Water Science Technical Series, Report No 50, Department of Water, Western Australia.

Swan River Trust (2008) Swan and Canning Rivers Foreshore Assessment and Management Strategy. Swan River Trust, Western Australia.

Swan River Trust (2012) *Black Swan Fact Sheet*. Published by the Swan River Trust on 6/06/2012. http://www.swanrivertrust.wa.gov.au/docs/fact-sheets/black-swan-fact-sheet.pdf

TEEB – The Economics of Ecosystems and Biodiversity (2011) TEEB Manual for Cities: Ecosystem Services in Urban Management. www.teebweb.org

Western Australian Planning Commission (2010) *Statement of Planning Policy No. 2.8: Bushland Policy for the Perth Metropolitan Region*. Department of Planning, Perth.

Western Australian Planning Commission (2004) *Planning Bulletin 69 Proposed Bush Forever Protection Are*a. Department of Planning and Infrastructure, Perth.

Woodman Environmental (2005) Western Power - *Cannington Terminal Vegetation*. In Essential Environmental (2012) Canning Activity Centre – Local water management strategy, Report prepared for the City of Canning.

Zelinova, R,. Oh, T., Deeley, J. and Guthrie, N. (2012) *Regional Framework for Local Biodiversity Conservation Priorities for Perth and Peel*. Unpublished report.

GLOSSARY

Adequate refers to how much of each ecosystem should be sampled to provide ecological viability and integrity of populations, species and ecological communities at a bioregional scale. The concept of adequacy incorporates ecological viability and resilience of ecosystems for individual protected areas and for the protected area system as a whole (National Reserve System Task Group, 2009).

Areas of Priority Conservation Action classify natural areas according to opportunities to improve their formal protection in the City. It should be noted that it is not intended that all vegetation mapped within these vegetation will be formally protected or all lands considered for restoration. They should be used to identify areas where any remaining vegetation and other natural areas are of conservation significance and their retention and protection should be a priority when deciding on future land use planning.

Bushland is land on which there is vegetation which is either a remainder of the natural vegetation of the land or, if altered, is still representative of the structure and floristics of the natural vegetation, and provides the necessary habitat for fauna (Bush Forever, Vol 1 & 2). 'Bushland' falls into the following condition classes: Pristine, Excellent, Very Good and Good (after Keighery 1994).

Comprehensive refers to the degree to which the full range of regional ecosystems recognisable at an appropriate scale within and across each IBRA bioregion is included within protected areas (National Reserve System Task Group, 2009).

Connectivity refers to the degree of connection between natural areas. Effectiveness will vary according to the type and mobility of different species.

Ecological community is a naturally occurring biological assemblage that occurs in a particular type of habitat. The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore, no particular scale is specified (Environmental Protection Authority 2003). The criteria in this document are based on using vegetation complexes as a means of interpreting ecological communities (except for threatened ecological communities).

Under the Environment Protection and Biodiversity Conservation Act 1999, ecological communities are similarly defined as assemblage of native species that:

- inhabits a particular natural area
- meets the additional criteria specified in the regulations made for the purposes of this definition.

Ecological linkages are non-contiguous natural areas that connect larger natural areas by forming stepping stones that allow the movement over time of organisms between these larger areas.

Endemic refers to a species having a natural distribution confined to a particular geographical region.

Habitat is the natural environment of an organism or community, including all biotic (living) or abiotic (non-living) elements; a suitable place for an organism or community to live (Environmental Protection Authority 2004). This term can be applied at a range of scales (Environmental Protection Authority 2004). Vegetation can become a reasonable surrogate for outlining habitat when its main components, structure and associated landform are also described (Environmental Protection Authority 2004). Habitat can be occupied by an organism or community continuously, periodically or occasionally or can have once been occupied and still have the potential for organisms of that kind to be reintroduced (Williams et al 2001).

IBRA Bioregion or subregion as determined by the Interim Biogeographic Regionalisation for Australia (IBRA), is a region defined by a combination of biological, social and geographical criteria rather than geopolitical considerations; generally, a system of related, interconnected ecosystems. Region descriptions seek to describe the dominant landscape scale attributes of climate, lithology, geology, landforms and vegetation (Commonwealth of Australia 2010). A subregion is a subdivision of a bioregion which contains distinctive geomorphic units that closely align with land capability and development potential (Commonwealth of Australia 2010).

Local Natural Areas (LNAs) are natural areas that exist outside of Bush Forever Sites (Swan Coastal Plain), the DPaW Managed Lands and Regional Parks.

Local Plant for the purpose of the Local Biodiversity Strategy a local plant is one that would be naturally found on the Swan Coastal Plain geographical area.

Native vegetation is indigenous aquatic or terrestrial vegetation. It does not include vegetation that was intentionally sown, planted or propagated unless that vegetation was sown, planted or propagated as required under the Environmental Protection Act 1986 or another written law; or that vegetation is of a class declared by regulation to be included in this definition. Native vegetation does not include dead vegetation unless that dead vegetation is of a class declared by regulation to be included in this definition. Native vegetation does include non-vascular plants (for example, mosses, fungi, algae) and marine plants (seagrass, macro algae [seaweed]). Native vegetation is more than trees and includes understorey and groundcover plants.

Natural area is used to describe an area that contains native species or communities in a relatively natural state and hence contains biodiversity. Natural areas can be areas of native vegetation, vegetated or open water bodies (lakes, swamps), or waterways (rivers, streams, creeks – often referred to as channel wetlands, estuaries), springs, rock outcrops, bare ground (generally sand or mud), caves, coastal dunes or cliffs (adapted from Environmental Protection Authority 2003). Note that natural areas exclude parkland cleared areas, isolated trees in cleared settings, ovals and turfed areas.

Regionally significant bushland is a component of remnant vegetation that collectively aims to form a comprehensive, adequate and representative system of conservation areas (Environmental Protection Authority 2003). In order for bushland areas to fall into this category, they need to be part of the existing or proposed conservation system or to meet, in part or whole, a range of criteria which are outlined in Appendix 3 of Environmental Protection Authority (2003).

Representativeness: Comprehensiveness considered at a finer scale (IBRA subregion), and recognizes that regional variability within ecosystems is sampled within the reserve system. One way of achieving this is to aim to represent each regional ecosystem within each IBRA sub-region (National Reserve System Task Group, 2009).

Reserves are lands designated under the Land Administration Act 1997. They are areas of Crown land reserved for various public purposes, for example, parks, recreation, drainage or a range of public purposes. The reserve is identified by a number, for example, Reserve No. 12345. Reserves may be vested, leased or Crown Granted in Trust. Crown Reserves have varying levels of protection depending on the purpose of the reserve.

Vegetation complexes (as defined by Heddle, Loneragan & Havel 1980; Mattiske & Havel 1998). Vegetation complexes are based on the pattern of vegetation at a regional scale as they reflect the underlying key determining factors of landforms, soils and climate. In the area covered by the Perth and Peel Regions, there was a reliance on the underlying landform and soils as defined and mapped by Churchward and McArthur (1980) and a major review of the forest climates by Gentilli (1989).

Viability (as in ecological viability) is the likelihood of long-term survival of a particular ecosystem or species.

Common Bronzewing, *Phaps chaloptera*. Credit: S Mawson

APPENDIX A: Ecological Criteria for Local Natural Area Prioritisation

Regional Framework for Local Biodiversity Conservation Priorities for Perth and Peel Level 1 Prioritisation Criteria (Zelinova et al. 2012)

Key to a Priority Field in the on-line model	Criteria	Spatial data representation of remnant vegetation extent within the following categories	Data custodian and currency
P1_1	recognised international, national or regional conservation value	DPaW Conservation Estate: National Park, Nature reserve, Conservation park, Section 5 (1) (g)	DPaW, 2014
		DPaW Regional Parks	DPaW, 2010
		Bush Forever Sites	Department of Planning, 2011
		Peel Regionally Significant Natural Areas	EPA, 2010
		Fauna Habitat Zone	DPaW, 2013
		DPaW Conservation Covenants	DPaW, 2013
		Ramsar wetlands	DPaW, 2009
		Directory of Important Wetlands	Auslig, 2002
P1_2a	of an ecological community with only 1500 ha or 30% or less remaining and <10% protected (formal) in the IBRA sub-region (here we use <or=40%)	2014 Vegetation extent by vegetation complexes: Bassendean complex Central & South, Beermullah, Cannington, Coolakin, Dardanup, Cottesloe Central & South, Dardanup, Forrestfield, Guildford, Karrakatta Central & South, Karrakatta -North, Mogumber South, Pinjar, Reagan, Serpentine River, Southern River, Swan, Vasse, Yanga	Local Biodiversity Program, 2014
P1_2b	of an ecological community with only 1500 ha or 30% or less remaining	2014 Vegetation extent by vegetation complexes: Dardanup, Bassendean complex Central & South, Beermullah, Cannington, Coolakin, Cottesloe Central & South, Dardanup, Forrestfield, Guildford, Herdsman, Karrakatta Central & South, Karrakatta -North, Mogumber South, Pinjar, Reagan, Serpentine River, Southern River, Swan, Vasse, Yanga, Yoongarillup	
P1_2c	of an ecological community with 90-100% of its original proportion of the original extent occurs within the study area	2014 Vegetation extent by vegetation complexes: Beermulah, Cannington, Cottesloe Central and South, Forrestfield, Herdsman, Pinjar, Helena 2	
P1_2d	of an ecological community with 60-89% of its original proportion of the original extent occurs within the study area	2014 Vegetation extent by vegetation complexes: Bassendean Central and South, Guildford, Karrakatta Central and South, Serpentine River, Swan, Darling Scarp, Quindalup, Dwellingup D2, Helena 1	Local Biodiversity Program, 2014
P1_3	large (greater than 20ha) natural areas	Remnant vegetation in patches greater than 20ha.	
P1_4	of an ecological community with only 1500 ha or 15% or less protected for conservation in the Jarrah Forest sub-region	2014 Vegetation extent by vegetation complexes: Cooke, Coolakin, Dwelingup D1-D4, Darling Scarp, Murray 2, Pindalup, Yalanbee 5, Yalanbee 6, Yarragil 1, Yarragil 2	
P1_5	of an ecological community with only 400 ha or 10% or less protected for conservation on the SCP portion of Perth and Peel	2014 Vegetation extent by vegetation complexes: Bassendean Central and South, Beermullah, Cannington, Coonambidgee, Cottesloe Central and South, Dardanup, Forrestfield, Guildford, Karrakatta Central & South, Mogumber-South, Pinjar, Quindalup, Reagan, Serpentine River, Southern River, Swan, Yanga	

Key to a Priority Field in the on-line model	Criteria	Spatial data representation of remnant vegetation extent within the following categories	Data custodian and currency
	Rarity		
P3_1	of an ecological community with only 1500 ha or 10% remaining in the IBRA sub-region	2014 Vegetation extent by vegetation complexes: Beermullah, Cannington, Dardanup, Forrestfield, Guildford, Pinjar, Serpentine River complex, Swan Complex,	Local Biodiversity Program, 2014
P3_2	of an ecological community with only 400 ha or 10% or less remaining in the Bush Forever and Peel section of the Swan Bioplan Areas	2014 Vegetation extent by vegetation complexes: Beermullah, Cannington, Coonambidgee, Dardanup, Forrestfield, Guildford, Mogumber South, Reagan, Serpentine River complex, Swan Complex	
P3_3, P3_4, P3_5, P3_6, P3_7, P3_8	Rare features	Threatened and priority flora, fauna or ecological communities and their buffers	DPaW, August 2014
P3_9a	significant habitat for significant fauna	Areas requiring investigation for Carnaby's cockatoo feeding habitat (Swan Coastal Plain) Areas requiring investigation for Carnaby's cockatoo feeding habitat (Jarrah Forest)	DPaW, 2011
P3_9b		Carnaby's Cockatoo habitat - breeding sites (confirmed & possible) with 12 km buffer	
P3_9c		Carnaby's Cockatoo habitat - roosting sites (confirmed & unconfirmed) with 6 km buffer	
P3_9d		Western Swamp Tortoise Critical Habitat Policy Area (EPP 2010)	EPA, 2012
P3_10	contains other significant flora	Significant flora - range ends and disjunct populations; Swan Coastal Plain endemics based on Gibson et al 1994 Tuart woodlands	Perth Biodiversity Project, 2011 DPaW, 2003
P3_11	or other significant fauna	Decliner Bird Species	Perth Biodiversity Project, 2011
	Maintaining ecological processes or natural systems – connectivity		
P4_1	natural areas acting as stepping stones in a regionally significant ecological link	Connectivity layer - current remnant vegetation that touches the Perth Metropolitan Region Regional Ecological Linkages or South West Regional Ecological Linkages 500m wide axis line (plus three additional lines from working group meeting in the Peel Region)	Local Biodiversity Program, 2014
	Protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation		
P5_1	Remnant vegetation within Conservation Category Wetlands plus 50m buffer	Geomorphic wetland mapping	DPaW, 2013
P5_1b	Remnant vegetation within Resource Enhancement Wetlands plus 50m buffer	Geomorphic wetland mapping	DPaW, 2013
P5_2	Remnant vegetation within Environmental Protection Policy (Swan Coastal Plain Lakes) 1992 plus 50m buffer	epp_1992_scp_lakes_policy_boundaries	DPaW, 2006

Appendix B. Site Specific Recommendations for Areas of Priority Conservation Action

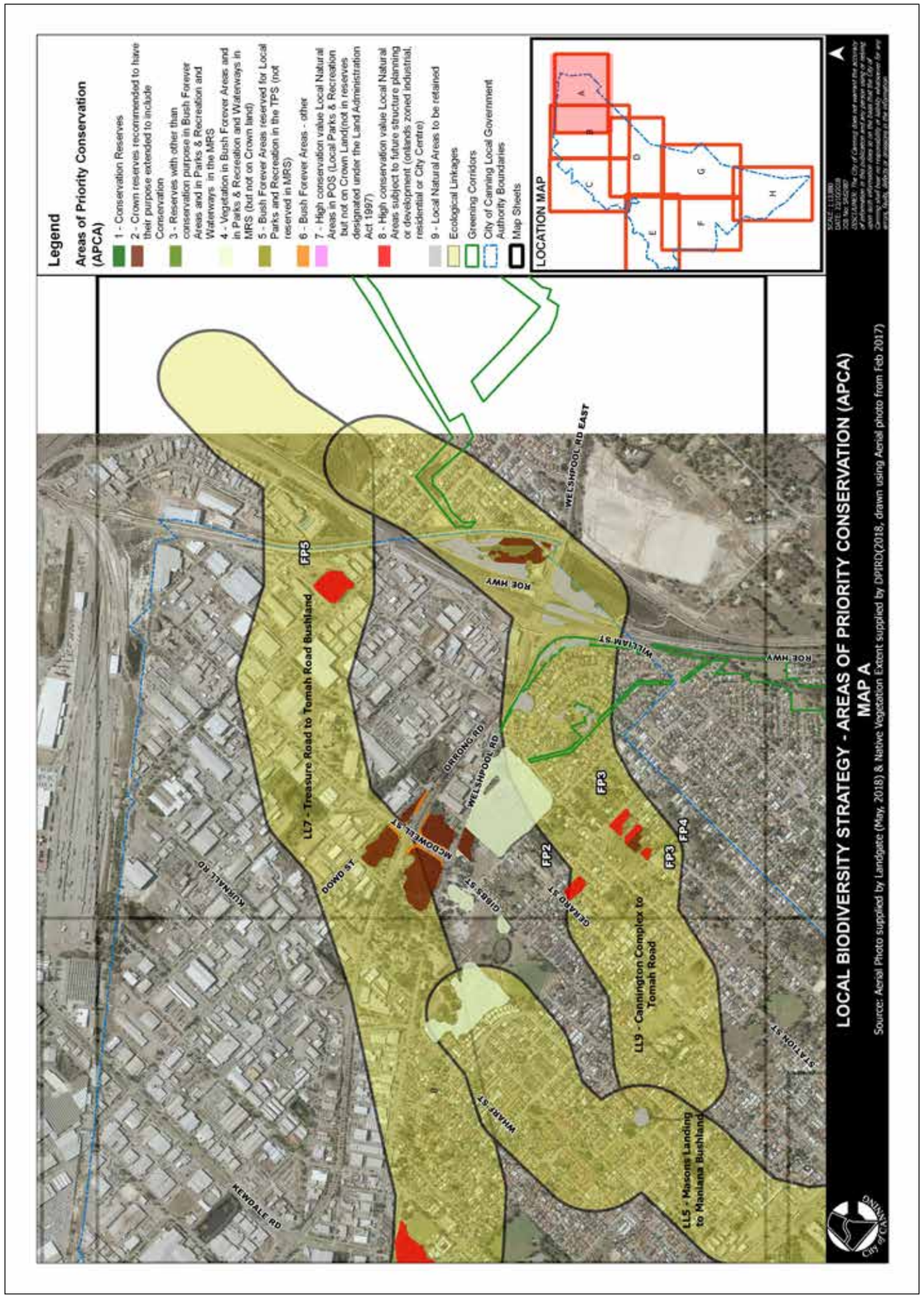
Key to a Priority Field in the on-line model	Criteria	Spatial data representation of remnant vegetation extent within the following categories	Data custodian and currency
P5_3	riparian vegetation	riparian vegetation surrogate - hydro lines buffered and used to intersect with current remnant vegetation	Local Biodiversity Program, 2014
P5_4	floodplain area	floodplain areas	Local Biodiversity Program, 2014
P5_5	estuarine area	hydrography - estuarine	Local Biodiversity Program, 2014
P5_6	coastal vegetation on foredunes and secondary dunes	Q3 and Q4 units in the Soil Landscape Units	Local Biodiversity Program, 2014
		Remaining Quindalup Soil Landscape Units within 150m from the coastline	
	Representation – Local		
P6_1	of an ecological community with 10% or less remaining within Local Government area	2014 remnant vegetation extent by vegetation complexes within each Local Government in the Perth and Peel Scheme Regions	Local Biodiversity Program, 2014
P6_2	of an ecological community with 30% or less remaining within a Local Government area	2014 remnant vegetation extent by vegetation complexes within each Local Government in the Perth and Peel Scheme Regions	Local Biodiversity Program, 2014

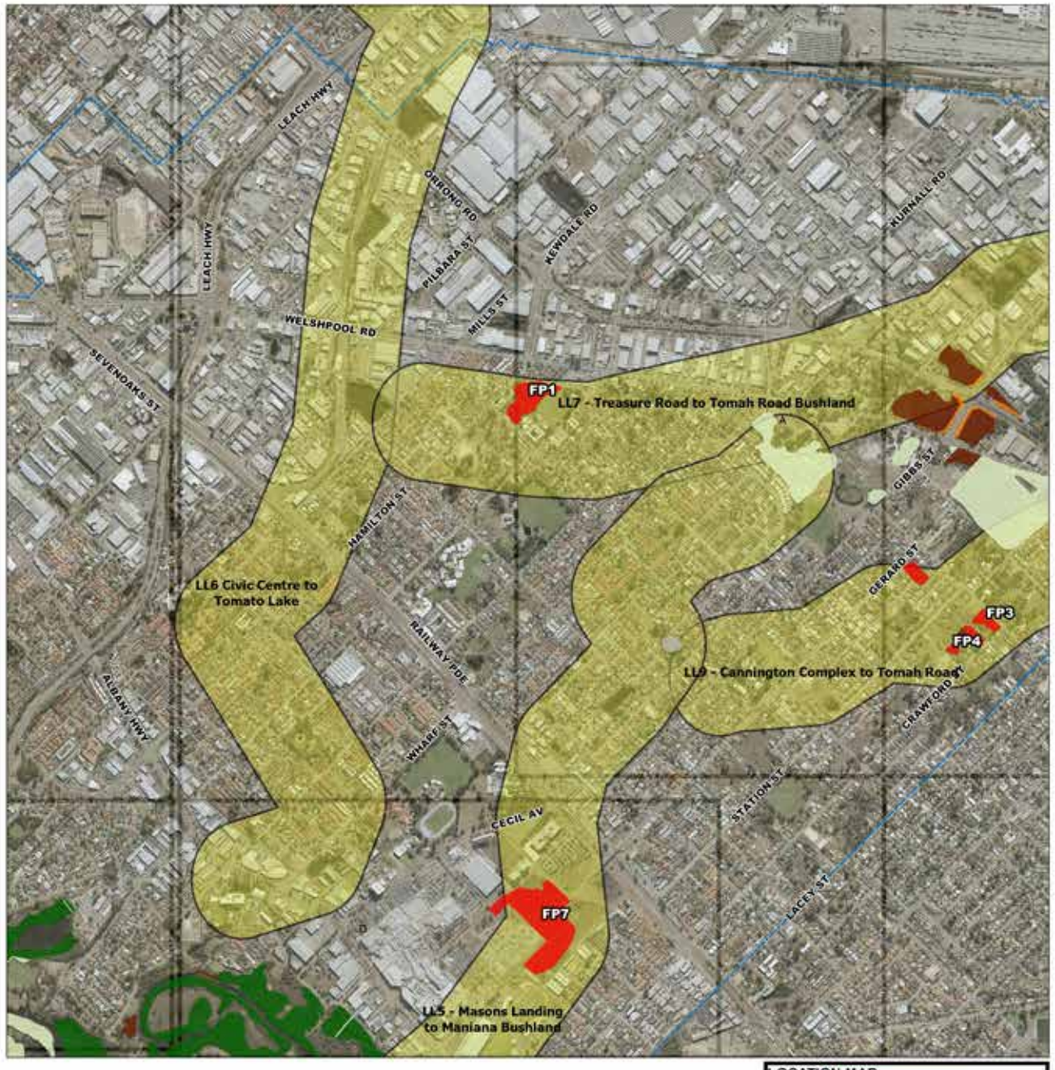
APCA mapping ID	Land use provisions by TPS No 40/MRS	2014 native vegetation extent	Ecological values	Recommendations on vegetation retention and protection
High conservation value LNA in POS (Local Parks & Recreation) but not on Crown Land (not in reserves designated under the Land Administration Act 1987)				
POS1 Karri Way Bushland	Subject to implementation of TPS Amendment No 177: Local Parks and Recreation/Urban	0.7ha	Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Representative of regionally significant vegetation complex – Southern River Part of regional ecological linkage and Local linkage 4.	• Seek Management Order in the favour of the City of Canning under the Land Administration Act 1997 with vesting purpose passive recreation and conservation (or fauna habitat). • In the local planning scheme reserve as Environmental Conservation • Include into the 5 year management action plan for all City managed conservation reserves (see Section 4.2 of the main document)
POS2 Lambertia Creek Park	Local Parks and Recreation/Urban Held freehold by the City (PIN 255063)	2ha	Riparian vegetation Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Representative of regionally significant vegetation complex – Southern River Part of regional ecological linkage and Local linkage 4.	• In the local planning scheme reserve as Environmental Conservation • Include into the 5 year management action plan for all City managed conservation reserves (see Section 4.2 of the main document) • Lambertia Creek Park is listed by the City as medium priority for management (Essential Environmental 2014a). Extension of fauna habitat and restoration of riparian vegetation along the eastern end of the POS area (to Blancoa Road) will improve connectivity between the Canning River and BF456.
POS3 Portcullis Conservation Area	Local Parks and Recreation/Urban Held freehold by the City PIN 329842	1.7ha	Threatened flora Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Representative of regionally significant vegetation complex – Bassendean Central and South Part of Local linkage 3.	• In the local planning scheme reserve as Environmental Conservation • Include into the 5 year management action plan for all City managed conservation reserves (see Section 4.2 of the main document). Ensure adequate management responses are included for the threatened flora. • Portcullis Conservation Area is listed by the City as medium priority for management (Essential Environmental 2014a).
POS4 Woodthorpe Road Development	Subject to implementation of TPS Amendment No 206: Local Parks and Recreation/Urban	Approx. 0.2ha	Representative of regionally significant vegetation complex – Bassendean Central and South Part of Local linkage 3	• In the local planning scheme reserve as Public Open Space
POS5 Prendwick Park	Public Open Space & Public Purposes/Urban Held freehold by the City (PIN 306298)	1.6ha + 1.7ha revegetation with an EPP Lake	EPP Lake Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Representative of regionally significant vegetation complex – Bassendean Central and South Local Greening Corridor B	• In the local planning scheme reserve as Environmental Conservation • Include into the 5 year management action plan for all City managed conservation reserves (see Section 4.2 of the main document). • Prendwick Botanical Park is listed as medium priority for management by the City (Essential Environmental 2014)
POS6 Livingston Conservation Area	Public Open Space/ Rural Held freehold by the City (PIN 306672)	1.6ha	Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Representative of regionally significant vegetation complex – Bassendean Central and South Part of regional ecological linkage and Local linkage 10	• In the local planning scheme reserve as Environmental Conservation • Include into the 5 year management action plan for all City managed conservation reserves (see Section 4.2 of the main document). • Livingston Conservation Area is listed by the City as high priority for management (Essential Environmental 2014a).
POS7 Canning Gardens	Public Open Space/ Industrial Held freehold by the City (PIN 330443)	Approx. 2.5ha	Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Representative of regionally significant vegetation complex – Bassendean Central and South	• In the local planning scheme reserve as Environmental Conservation • Include into the 5 year management action plan for all City managed conservation reserves (see Section 4.2 of the main document). Currently not listed as priority for management (Essential Environmental 2014).

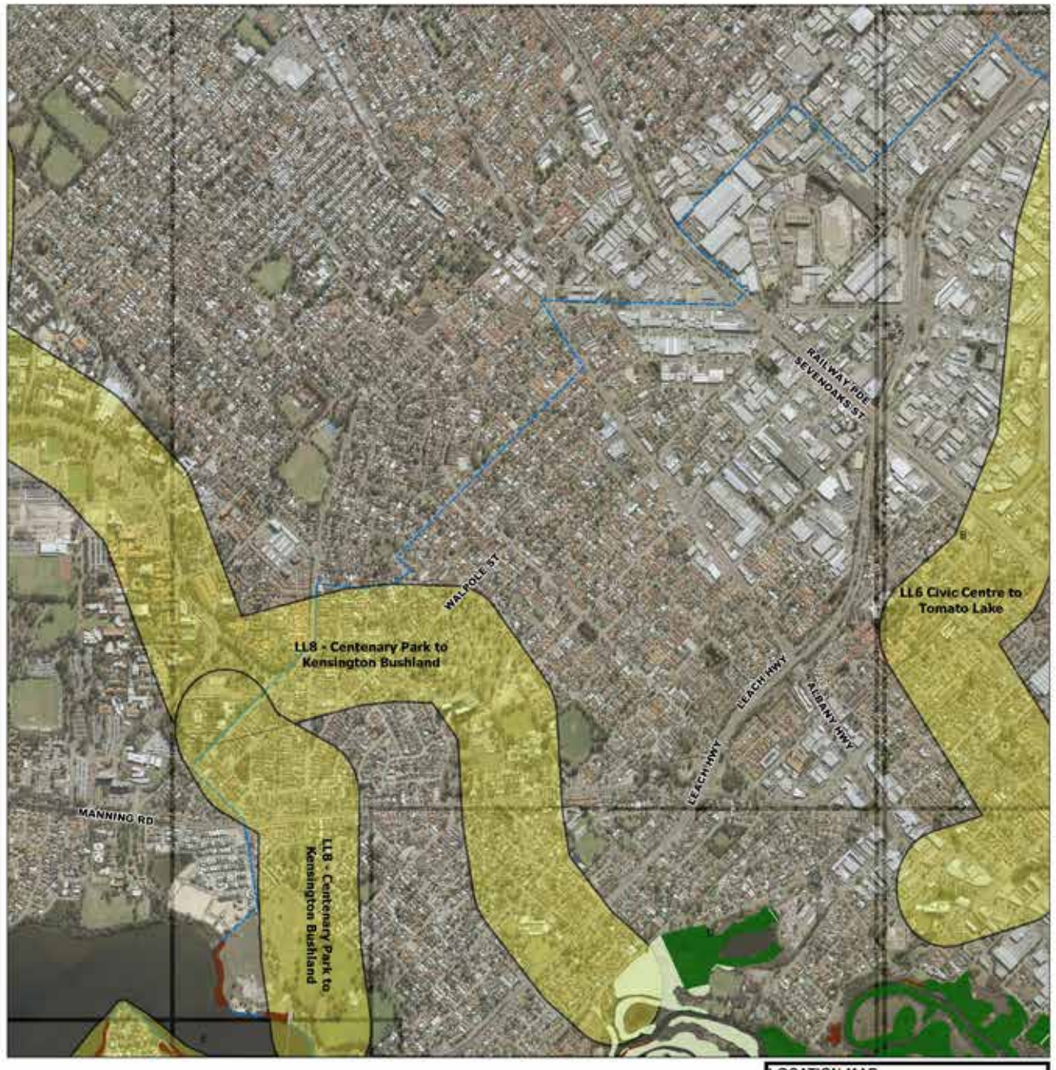
APCA mapping ID	Land use provisions by TPS No 40/MRS	2014 native vegetation extent	Ecological values	Recommendations on vegetation retention and protection
High conservation value LNA subject to future structure planning or development (on lands zoned industrial, residential or City Centre)				
FP1 Treasure Road, Queens Park	Residential /Urban	1.7 ha	Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Representative of regionally significant vegetation complex – Southern River and potentially Cannington complex Part of Local linkage 7	Require adequate vegetation and fauna surveys to assess the biodiversity values prior lodging a development or subdivision application. Support the implementation of the Sister Kate's Home Kids Aboriginal Corporation (SKHKAC) Place of Healing
FP2 (Queens Park)	Residential/Urban In TPS No.21 portion identified as POS required, Proposed subdivisional road and Residential	0.5ha	Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Representative of regionally significant vegetation complex – Southern River Part of Local linkage 9.	• Require adequate vegetation and fauna surveys to assess the biodiversity values prior lodging a development or subdivision application. Seek to retain most of the vegetation as POS. • Vegetation restoration on the portion adjoining Gerard Street would increase the potential habitat. Using local street trees along Gerard Street and Sittella Gardens will connect this potential new POS to other small POS areas nearby such as the Gerard Russell Reserve.
FP3 and FP4 (Queens Park)	Residential/Urban In TPS No.21 portion identified as POS required, Proposed subdivisional road and Residential	1ha	Last remaining patches (in the MRS) of vegetation representative of Cannington vegetation complex. Potential Carnaby's black cockatoo feeding habitat. Stands of mature marri (Corymbia calophylla) Part of local linkage 9.	Of the 1.41ha of Cannington vegetation complex remaining in the City, 0.4ha is reserved for Public Recreation in R49104. Consider reviewing the TPS No.21 regarding the design of the future POS and subdivision roads to minimise impact on the remaining Cannington vegetation complex. Extend the R49104 to include all additional vegetation to be incorporated into the future POS. In the local planning scheme reserve as Environmental Conservation.
FP5 Sheffield Road, Welshpool	General Industry/ Industrial	1.84ha	Carnaby's black cockatoo feeding habitat EPP lake Representative of regionally significant vegetation complex – Southern River Part of Local linkage 7.	Investigate opportunities to support landowner in managing the natural area to maintain its habitat values. • In the local planning scheme reserve as Environmental Conservation
FP7 (Cannington)	Centre	4.62ha	TEC (EPBC Act listed) Threatened fauna (EPBC Act listed) Priority flora Conservation category wetland Part of Local linkage 5.	• Seek the long term protection of the Conservation Category Wetland and the associated Threatened ecological community (TEC) and threatened species. Due to high sensitivity of the TEC and the threatened native bee species, further fragmentation and incursions into the vegetated area is not recommended. • Any adjoining development needs to demonstrate that it will not adversely affect the hydrology within the site and its buffer. • In the local planning scheme reserve as Environmental Conservation
FP8 Portcullis Park, Willeton	Civic and Community/ Urban Held freehold by the City	0.12ha	Adjoins Portcullis Conservation Area Part of Local linkage 3	• While the vegetated area is small, its retention will contribute to the long term viability of biodiversity within the adjoining Portcullis Conservation Area (POS3). • Review the need for the Civic and Community facilities. If required, seek an alternative location on already cleared land (e.g. City owned land Pin 330050 on Portcullis Drive could provide an opportunity for land use swap as this parcel is cleared and reserved Public Open Space in the TPS No. 40).
FP10 (Canning Vale)	Mixed Business/ Industrial	0.4ha	Mature trees (confirmation needed)	Retain
FP11 (Canning Vale)	Mixed Business/ Industrial Held freehold by the City	8.23ha	Representative of regionally significant vegetation complex – Bassendean Central and South; adjoins BF245 (Ken Hurst Park) High probability of threatened and priority fauna Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Part of Local linkage 2. As demonstrated by the connectivity analysis, loss of vegetation within FP9 and FP11 will affect the size of the network for BF245.	• Develop a Strategic Plan for the Mixed Business area on Bannister Road, seeking to retain native vegetation that has significant biodiversity value.

APCA mapping ID	Land use provisions by TPS No 40/MRS	2014 native vegetation extent	Ecological values	Recommendations on vegetation retention and protection
FP12 (Canning Vale)	Rural Residential and Local Parks and Recreation/Rural-Water Protection and Rural Held freehold by the City	23.25ha	Representative of regionally significant vegetation complex – Bassendean Central and South; adjoins BF245 (Ken Hurst Park) Five threatened and priority flora considered likely to be present Three species of significant flora Two endangered species of fauna likely to be found on the site Priority 5 fauna Two Priority 3 ecological communities occurring near the site and considered likely to occur on the site Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site	• Implement the proposal for the conservation precinct (Precinct 4) and vegetation retention within Precinct 2 as outlined in the Canning Vale Sports Masterplan (State of Western Australia 2013). • In the future, form a reserve with conservation purpose and reserve the land in the local planning scheme to afford long-term protection. • Provide for terrestrial fauna movement between the main conservation area and the other retained vegetation (e.g. include underpasses at strategic locations, use fauna friendly kerbing and all landscaping surrounding parking and active sports facilities to use local species).
FP14 (Canning Vale)	Road reserve and Local Public Open Space/ Rural	1ha	Representative of regionally significant vegetation complex – Bassendean Central and South Adjoins BF 388; buffer between the conservation area and the adjoining Special Rural subdivision Part of Local linkage 10.	Remove the road reservation and incorporate the vegetation into the adjoining Public Open Space reservation in the local planning scheme.
FP15 (Willeton)	Public Open Space/ Urban	0.68ha	Representative of regionally significant vegetation complex – Bassendean Central and South Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Part of Local linkage 2.	Formalise the status of this land in the Local Planning Scheme and reserve for Public Recreation. The City of Canning lists this area as low priority for management (Essential Environmental 2014).
FP16 (Rossmoyne)	Private Community Purpose/Urban and Parks and Recreation	0.18ha	Representative of regionally significant vegetation complex – Bassendean Central and South Carnaby's black cockatoo feeding habitat within a buffer of a confirmed roosting site Adjoins Yagan Wetland reserve Part of Regional linkage/Local linkage 1	Investigate opportunities to include all remaining vegetation to conservation reserve R29130 and seek MRS amendment to adjust the Parks and Recreation reservation boundary.

APPENDIX C: Maps A - H Areas of Priority Conservation





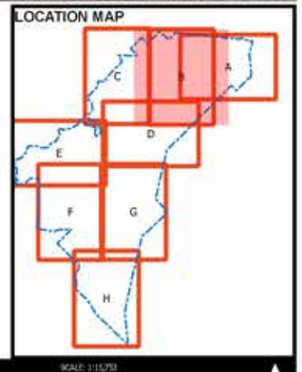


Legend

Areas of Priority Conservation (APCA)

- 1 - Conservation Reserves
- 2 - Crown reserves recommended to have their purpose extended to include Conservation
- 3 - Reserves with other than conservation purpose in Bush Forever Areas and in Parks & Recreation and Waterways in the MRS
- 4 - Vegetation in Bush Forever Areas and in Parks & Recreation and Waterways in MRS (but not on Crown land)
- 5 - Bush Forever Areas reserved for Local Parks and Recreation in the TPS (not reserved in MRS)
- 6 - Bush Forever Areas - other
- 7 - High conservation value Local Natural Areas in POS (Local Parks & Recreation but not on Crown Land(not in reserves designated under the Land Administration Act 1997)
- 8 - High conservation value Local Natural Areas subject to future structure planning or development (onlands zoned industrial, residential or City Centre)
- 9 - Local Natural Areas to be retained
- Ecological Linkages
- Greening Corridors
- City of Canning Local Government Authority Boundaries
- Map Sheets

LOCATION MAP



Source: Aerial Photo supplied by Landgate (May, 2018) & Native Vegetation Extent supplied by DPIRD(2018, drawn using Aerial photo from Feb 2017)

LOCAL BIODIVERSITY STRATEGY - AREAS OF PRIORITY CONSERVATION (APCA) MAP B

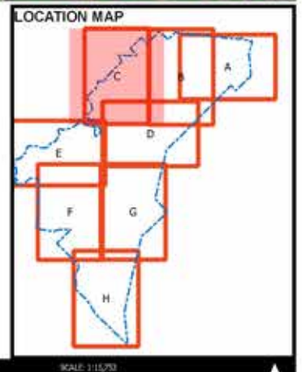
SCALE: 1:15,753
DATE: 09/10/2019
JOB No: SR07987
DISCLAIMER: The City of Canning does not warrant the accuracy of information in this publication and any person using or relying upon such information does so on the basis that the City of Canning shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

Legend

Areas of Priority Conservation (APCA)

1 - Conservation Reserves
2 - Crown reserves recommended to have their purpose extended to include Conservation
3 - Reserves with other than conservation purpose in Bush Forever Areas and in Parks & Recreation and Waterways in the MRS
4 - Vegetation in Bush Forever Areas and in Parks & Recreation and Waterways in MRS (but not on Crown land)
5 - Bush Forever Areas reserved for Local Parks and Recreation in the TPS (not reserved in MRS)
6 - Bush Forever Areas - other
7 - High conservation value Local Natural Areas in POS (Local Parks & Recreation but not on Crown Land(not in reserves designated under the Land Administration Act 1997)
8 - High conservation value Local Natural Areas subject to future structure planning or development (onlands zoned industrial, residential or City Centre)
9 - Local Natural Areas to be retained
Ecological Linkages
Greening Corridors
City of Canning Local Government Authority Boundaries
Map Sheets

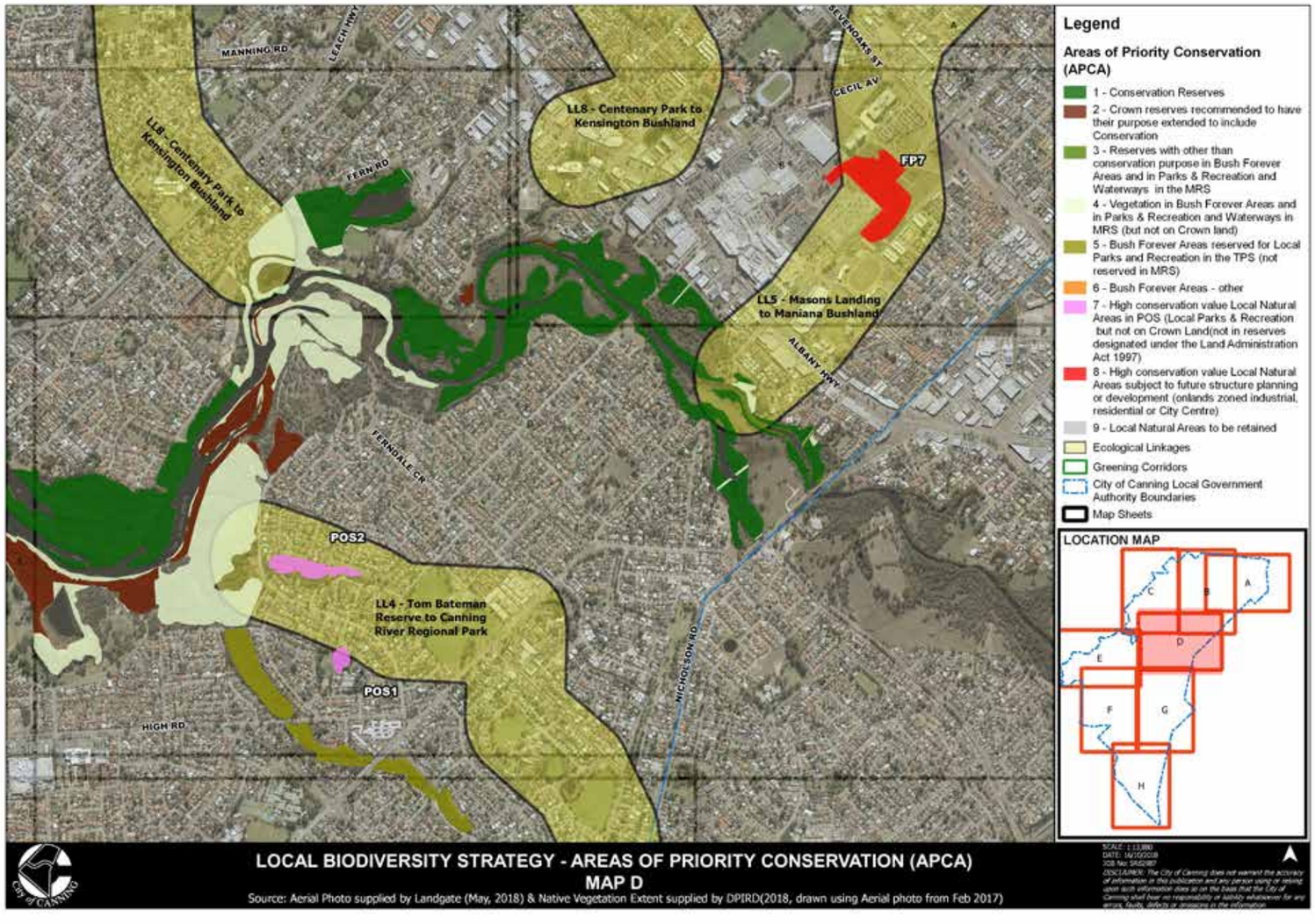
LOCATION MAP

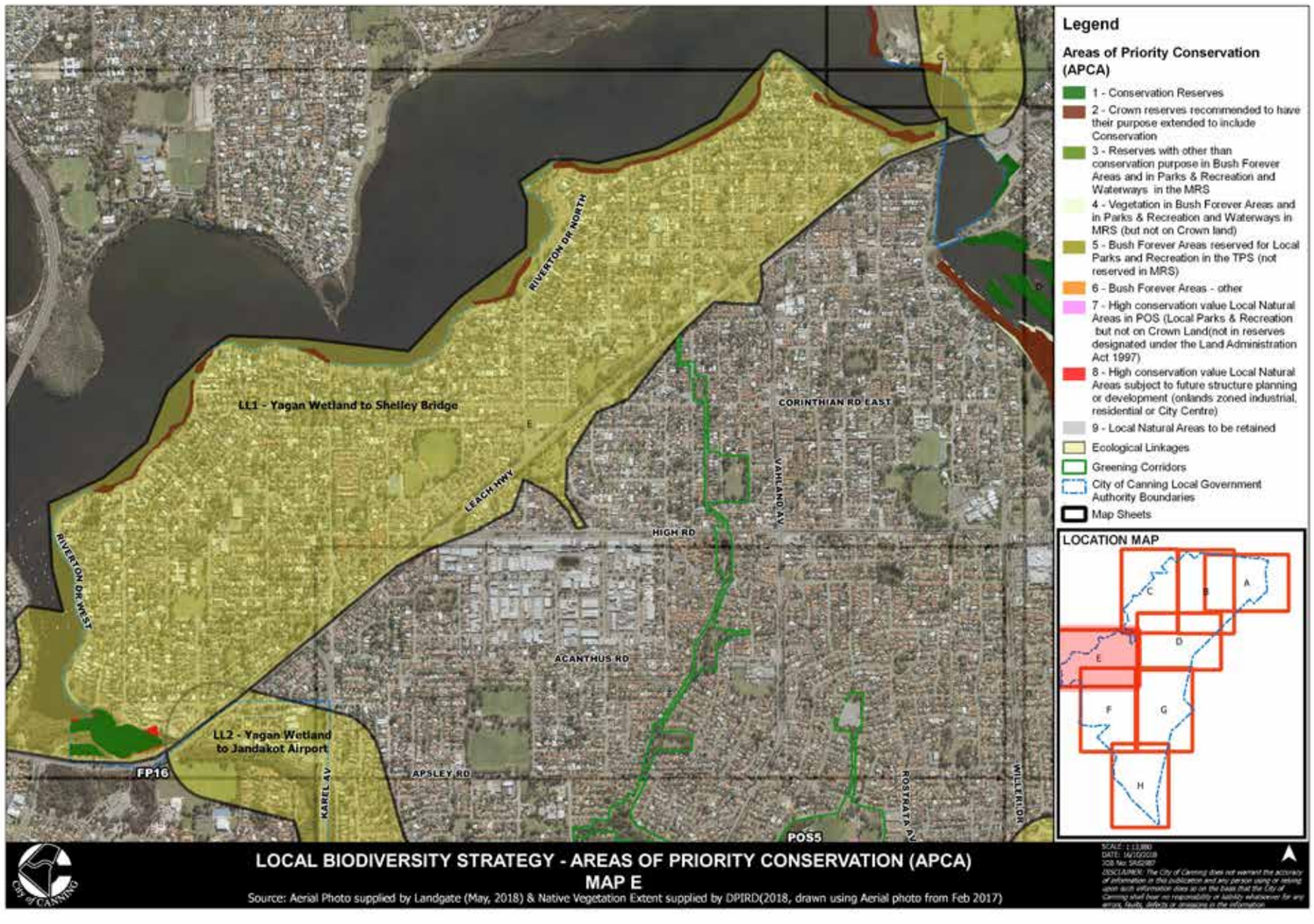


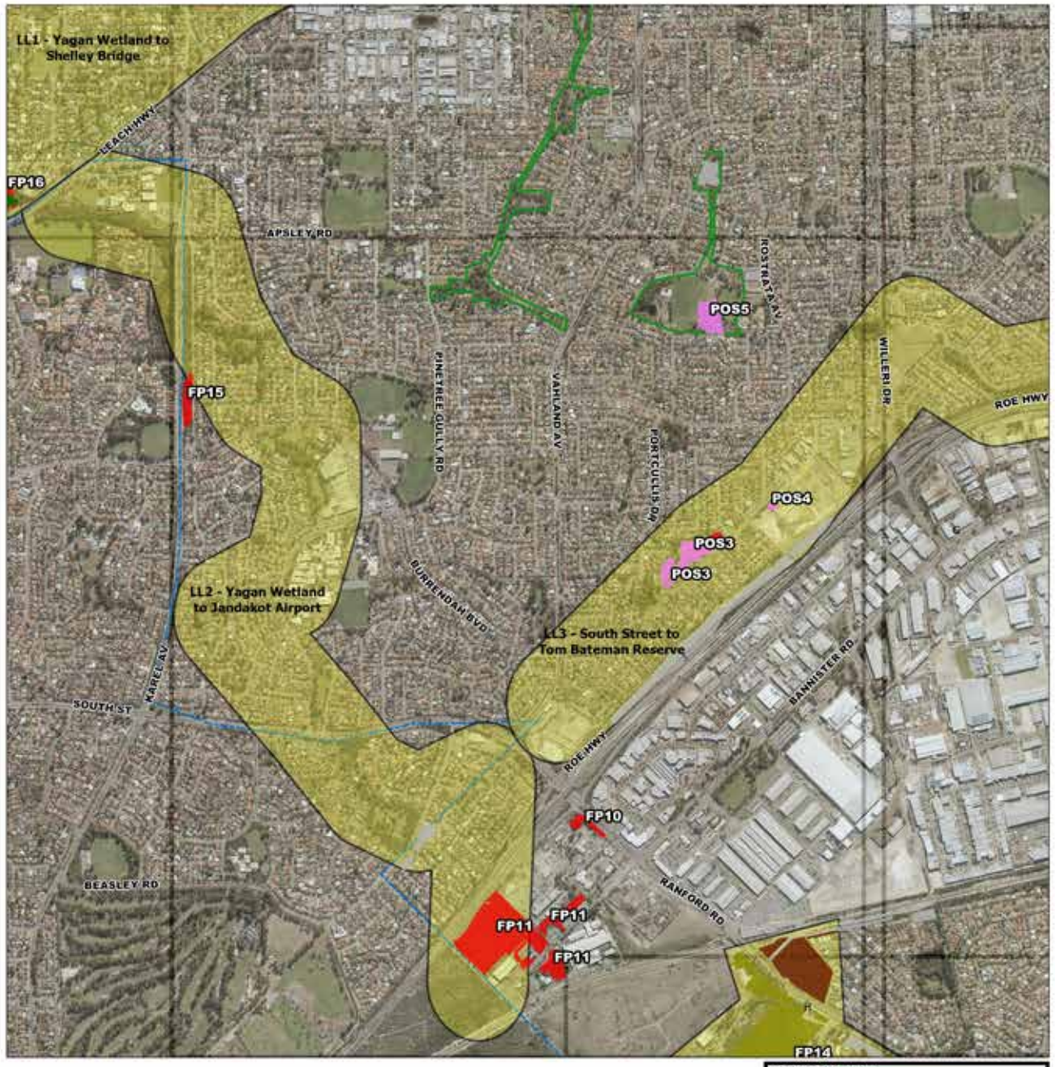
Source: Aerial Photo supplied by Landgate (May, 2018) & Native Vegetation Extent supplied by DPIRD(2018, drawn using Aerial photo from Feb 2017)

LOCAL BIODIVERSITY STRATEGY - AREAS OF PRIORITY CONSERVATION (APCA) MAP C

SCALE: 1:15,753
DATE: 09/10/2019
JOB No: SR07987
DISCLAIMER: The City of Canning does not warrant the accuracy of information in this publication and any person using or relying upon such information does so on the basis that the City of Canning shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.


MANNING RD
LEACH HWY
SEVENOAKS ST
CECIL AV
LL8 - Centenary Park to Kensington Bushland
FERN RD
FP7
LL5 - Masons Landing to Maniana Bushland
ALBANY HWY
FERNDALE CR
POS2
LL4 - Tom Bateman Reserve to Canning River Regional Park
NICHOLSON RD
POS1
HIGH RD
Legend
Areas of Priority Conservation (APCA)
1 - Conservation Reserves
2 - Crown reserves recommended to have their purpose extended to include Conservation
3 - Reserves with other than conservation purpose in Bush Forever Areas and in Parks & Recreation and Waterways in the MRS
4 - Vegetation in Bush Forever Areas and in Parks & Recreation and Waterways in MRS (but not on Crown land)
5 - Bush Forever Areas reserved for Local Parks and Recreation in the TPS (not reserved in MRS)
6 - Bush Forever Areas - other
7 - High conservation value Local Natural Areas in POS (Local Parks & Recreation but not on Crown Land(not in reserves designated under the Land Administration Act 1997)
8 - High conservation value Local Natural Areas subject to future structure planning or development (onlands zoned industrial, residential or City Centre)
9 - Local Natural Areas to be retained
Ecological Linkages
Greening Corridors
City of Canning Local Government Authority Boundaries
Map Sheets
LOCATION MAP
A
B
C
D
E
F
G
H
LOCAL BIODIVERSITY STRATEGY - AREAS OF PRIORITY CONSERVATION (APCA)
MAP D
Source: Aerial Photo supplied by Landgate (May, 2018) & Native Vegetation Extent supplied by DPIRD(2018, drawn using Aerial photo from Feb 2017)


RIVERTON DR NORTH
LL1 - Yagan Wetland to Shelley Bridge
CORINTHIAN RD EAST
LEACH HWY
VANLAND AV
HIGH RD
RIVERTON DR WEST
ACANTHUS RD
LL2 - Yagan Wetland to Jandakot Airport
FP16
KAREL AV
APSLEY RD
ROSTRATA AV
WILLERTON
POS5
Legend
Areas of Priority Conservation (APCA)
1 - Conservation Reserves
2 - Crown reserves recommended to have their purpose extended to include Conservation
3 - Reserves with other than conservation purpose in Bush Forever Areas and in Parks & Recreation and Waterways in the MRS
4 - Vegetation in Bush Forever Areas and in Parks & Recreation and Waterways in MRS (but not on Crown land)
5 - Bush Forever Areas reserved for Local Parks and Recreation in the TPS (not reserved in MRS)
6 - Bush Forever Areas - other
7 - High conservation value Local Natural Areas in POS (Local Parks & Recreation but not on Crown Land(not in reserves designated under the Land Administration Act 1997)
8 - High conservation value Local Natural Areas subject to future structure planning or development (onlands zoned industrial, residential or City Centre)
9 - Local Natural Areas to be retained
Ecological Linkages
Greening Corridors
City of Canning Local Government Authority Boundaries
Map Sheets
LOCATION MAP
A
B
C
D
E
F
G
H
LOCAL BIODIVERSITY STRATEGY - AREAS OF PRIORITY CONSERVATION (APCA)
MAP E
Source: Aerial Photo supplied by Landgate (May, 2018) & Native Vegetation Extent supplied by DPIRD(2018, drawn using Aerial photo from Feb 2017)

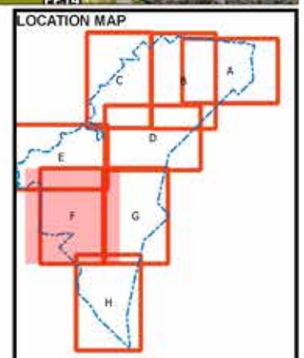


Legend

Areas of Priority Conservation (APCA)

- 1 - Conservation Reserves
- 2 - Crown reserves recommended to have their purpose extended to include Conservation
- 3 - Reserves with other than conservation purpose in Bush Forever Areas and in Parks & Recreation and Waterways in the MRS
- 4 - Vegetation in Bush Forever Areas and in Parks & Recreation and Waterways in MRS (but not on Crown land)
- 5 - Bush Forever Areas reserved for Local Parks and Recreation in the TPS (not reserved in MRS)
- 6 - Bush Forever Areas - other
- 7 - High conservation value Local Natural Areas in POS (Local Parks & Recreation but not on Crown Land(not in reserves designated under the Land Administration Act 1997)
- 8 - High conservation value Local Natural Areas subject to future structure planning or development (onlands zoned industrial, residential or City Centre)
- 9 - Local Natural Areas to be retained
- Ecological Linkages
- Greening Corridors
- City of Canning Local Government Authority Boundaries
- Map Sheets

LOCATION MAP

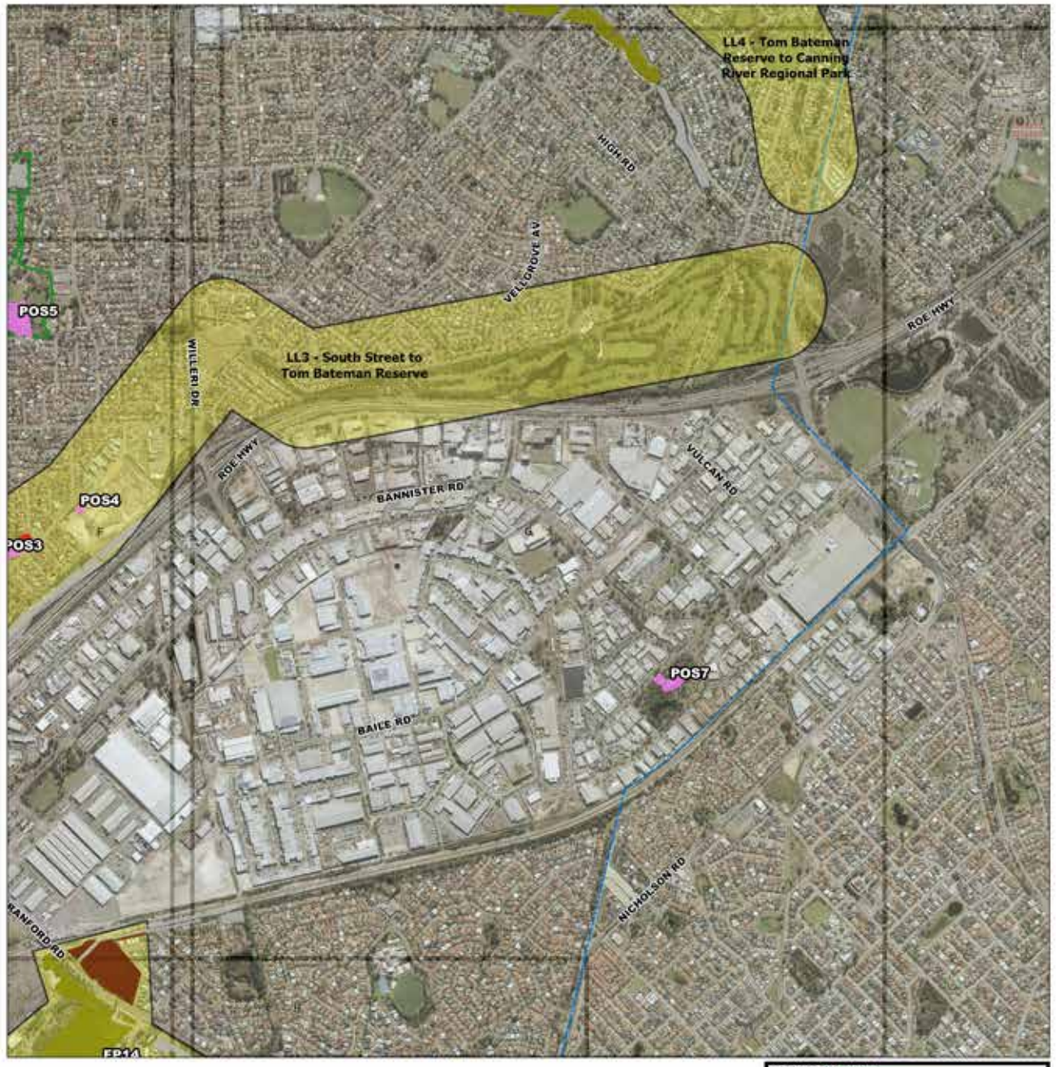


Source: Aerial Photo supplied by Landgate (May, 2018) & Native Vegetation Extent supplied by DPIRD(2018, drawn using Aerial photo from Feb 2017)

LOCAL BIODIVERSITY STRATEGY - AREAS OF PRIORITY CONSERVATION (APCA)
MAP F

SCALE: 1:15,753
DATE: 19/10/2018
JOB No: 5992987

DISCLAIMER: The City of Canning does not warrant the accuracy of information in this publication and any person using or relying upon such information does so on the basis that the City of Canning shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

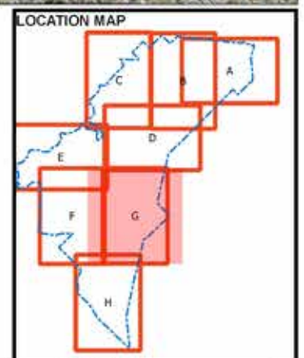


Legend

Areas of Priority Conservation (APCA)

- 1 - Conservation Reserves
- 2 - Crown reserves recommended to have their purpose extended to include Conservation
- 3 - Reserves with other than conservation purpose in Bush Forever Areas and in Parks & Recreation and Waterways in the MRS
- 4 - Vegetation in Bush Forever Areas and in Parks & Recreation and Waterways in MRS (but not on Crown land)
- 5 - Bush Forever Areas reserved for Local Parks and Recreation in the TPS (not reserved in MRS)
- 6 - Bush Forever Areas - other
- 7 - High conservation value Local Natural Areas in POS (Local Parks & Recreation but not on Crown Land(not in reserves designated under the Land Administration Act 1997)
- 8 - High conservation value Local Natural Areas subject to future structure planning or development (onlands zoned industrial, residential or City Centre)
- 9 - Local Natural Areas to be retained
- Ecological Linkages
- Greening Corridors
- City of Canning Local Government Authority Boundaries
- Map Sheets

LOCATION MAP

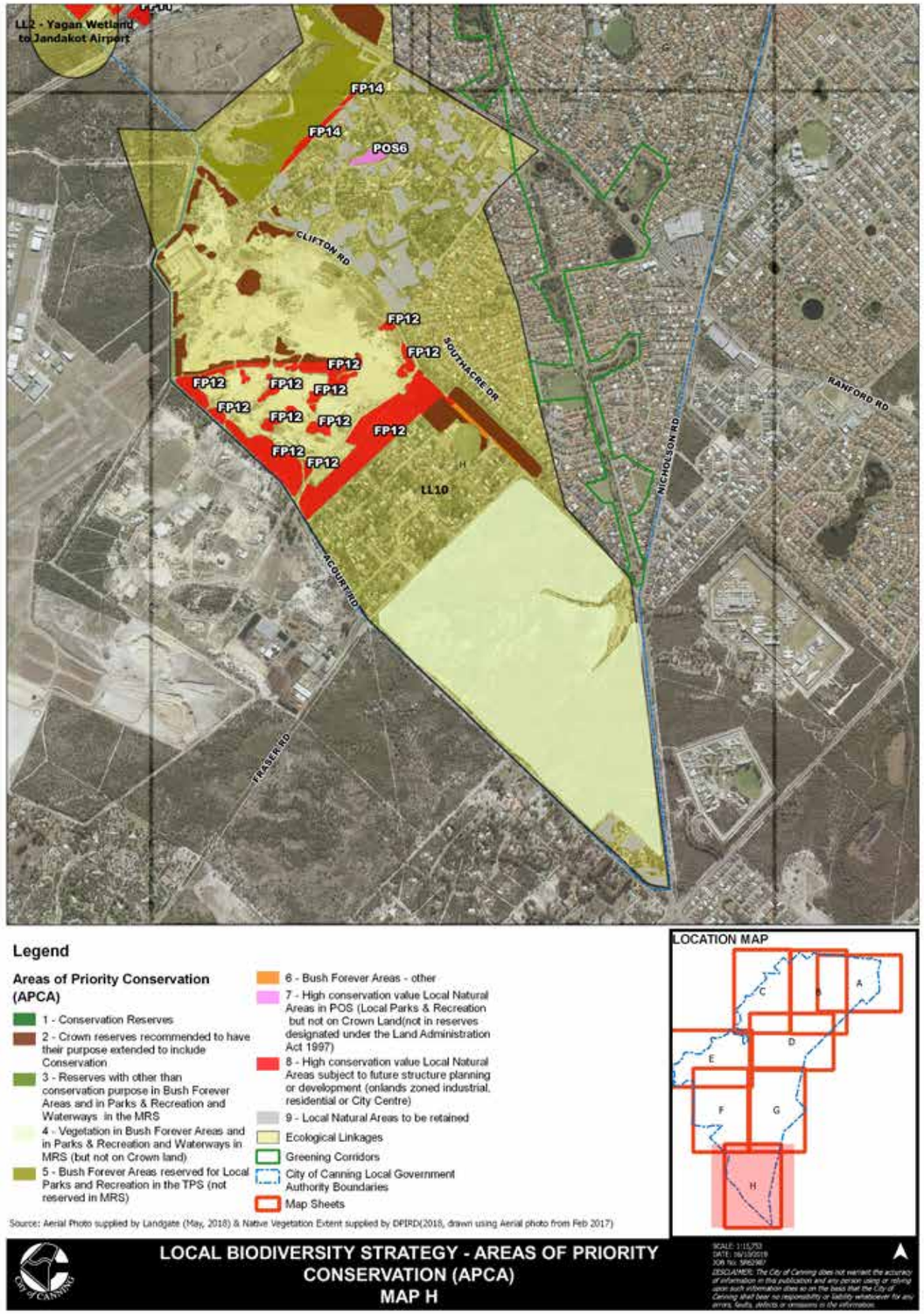


Source: Aerial Photo supplied by Landgate (May, 2018) & Native Vegetation Extent supplied by DPIRD(2018, drawn using Aerial photo from Feb 2017)

LOCAL BIODIVERSITY STRATEGY - AREAS OF PRIORITY CONSERVATION (APCA)
MAP G

SCALE: 1:15,753
DATE: 19/10/2018
JOB No: 5992987

DISCLAIMER: The City of Canning does not warrant the accuracy of information in this publication and any person using or relying upon such information does so on the basis that the City of Canning shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.



Willie Wagtail, *Rhipidura leucophrys*

1317 Albany Highway, Cannington WA 6107
Ph: 1300 4 CANNING (1300 422 664)
E: customer@canning.wa.gov.au

Connect with us

canning.wa.gov.au