CITY OF MELVILLE
NATURAL AREAS ASSET MANAGEMENT PLAN
2019

FINAL

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RECOMMENDED REFERENCE

The recommended reference for this document is:
City of Melville (2019) *City of Melville – Strategic Natural Areas Asset Management Strategy Plan 2019*, report by Woodgis Environmental Assessment and Management for the City of Melville, Western Australia.

CONFIDENTIALITY

Some information used by the City to identify and manage natural area assets is subject to confidentially clauses by the government departments who supplied the information. Restrictions on release of this information is intended to help protect assets from threats such as vandalism, trampling and artefact and plant collection. Therefore only general information is supplied in some of the City's public documents such as the NAAMP regarding the following:

Registered Aboriginal Sites

- Registered Aboriginal Sites
- Threatened and Priority Ecological Communities, Threatened Fauna and Rare Flora

Other Assets

The City reserves the right to restrict the public release of information on any natural area assets

vulnerable plant species with very low abundance and/or very restricted distribution within the City) when and where a significant level of damage (e.g. from vandalism, trampling and artefact and plant collection) could result from the public disclosure of specific information.

TERMS AND ACRONYMS

The following terms are used in the NAAMP for succinctness:

City	City of Melville
Reserves	Natural Area Reserves as identified by the City
Strategy/ies	Documents that may be strategies, guidelines, procedures etc
Taxa	Species, subspecies and varieties of plants (flora) and animals (fauna)

The following acronyms are used in the NAAMP for succinctness:

ANZEEC	Australian and New Zealand Environment and Conservation Council
CALM	Western Australian Department of Conservation and Land Management (now superseded by DBCA)
DIA	Department of Indigenous Affairs
DPLA	Department of Planning, Lands and Heritage
DBCA	Western Australian Department of Biodiversity Conservations and Attractions
EPA	Environmental Protection Authority
EPBC Act	Environment Protection Biodiversity Conservation Act 1999
FESA	Fire and Emergency Services Authority of Western Australia
KPI	Key Performance Indicator
NRMMC	Natural Resource Management Ministerial Council (under the auspice of the Government of Australia)
NAAMP	Natural Areas Asset Management Plan WAPC Western Australian Planning Commission

EXECUTIVE SUMMARY

The City Of Melville's *Natural Areas Asset Management Strategy Plan* (NAAMP) provides the context, and technical and policy framework, for the management of natural area reserves.

The City of Melville, which covers 53 km^2, is located on the southern shores of the Swan River, less than four kilometres inland of the Indian Ocean and eight kilometres from the Perth Central Business District.

The NAAMP establishes a risk-based framework for managing biodiversity at the scales of reserves, sites within reserves and species and identifies:

- biodiversity assets that are priorities for maintenance and enhancement;
- threats that impact upon those assets; and
- strategies and guidelines that manage threats to assets.

The NAAMP includes a comprehensive review of biodiversity data for the City and identified the following assets in natural areas:

- 9 regionally significant bushland reserves;
- 2 threatened ecological communities;
- 2 regionally significant ecological communities;
- 16 wetlands that are significant at regional, state or national level;
- 22 heritage sites registered on state and national lists;
- 18 local community interest sites;
- 5 scientific reference sites established as part of regional vegetation survey;
- 474 vascular and 126 non-vascular native plant species, including 4 species that are significant at regional, state and/or national level; and
- 188 bird, 17 mammal, 44 reptile, 9 amphibian and am undetermined number of invertebrate native animal species, including 53 species that are significant at regional, state and/or national level.

The NAAMP identified the extent and impacts of the 10 most significant threats to biodiversity assets. These threats being (without ranking):

- Physical Disturbance
- Fire
- Weeds
- Feral Animals
- Diseases/Pathogens
- Stormwater
- Reticulation
- Groundwater Alteration
- Acid Sulfate Soils
- Habitat Loss

The NAAMP framework for the management of 56 natural area reserves (which range in size from less than 1 hectare to almost 50 hectares) includes:

- the scope, philosophy and format of 11 guidelines to manage threats to biodiversity; and
- the scope and format for 15 strategic reserve plans that will document assets and threats, and the application of strategies, for individual larger and groups of smaller reserves.

1. INTRODUCTION

1.1. Background

The City of Melville, which covers 5,273 hectares, is approximately in the centre of the Perth Metropolitan Region (covering 0.5 million hectares) and the Swan Coastal Plain biogeographic region (covering 1.5 million hectares) as shown in Map 1.

The City of Melville, with a population of approximately 102 000 residents, is the fourth largest local government authority in the Perth Metropolitan Region and is located:

- approximately 3.5 km inland from the Indian Ocean;

- on the southern shores of the Swan River;
- approximately in the centre of the Perth Metropolitan Region; and
- 8 km south-west of the Perth Central Business District.

The extent of the City, which consists of 18 suburbs and covers an area of 52.73 km^2, is shown in Map 1.

The City includes 202 parks and reserves, featuring a total of 18.1 km of foreshore and comprising of 859 hectares of public open space and 281 hectares of bushland.

1.2. Objectives

The objectives for the Natural Areas Asset Management Strategy Plan (NAAMP) are the establishment of a consistent, holistic planning methodology that:

- achieves and maintains a cohesive approach to managing natural areas across the organisation;
- creates uniformity through the planning process, yet allows for flexibility to manage specific issues where necessary;
- aligns the management planning process with community outcomes, corporate plan and budget process;
- allows for more efficient resource allocation and prioritisation of budgets and resources; and
- integrates with current systems and corporate documentation

1.3. Scope

The scope of the Natural Areas Asset Management Plan are the 56 reserves managed by the City shown in Map 2.

Several of the reserves that are managed by the City by the natural areas team are highly modified and whilst containing some scattered remnant individual native plants do not meet either of the following definitions, and are therefore excluded from the NAAMP:

- **Natural Area**
  naturally vegetated area or non-vegetated areas such as water bodies (generally rivers, lakes and estuaries), bare ground (generally sand or mud) and rock outcrops (EPA, 2006a)
- **Bushland**
  land on which there is vegetation which is either a remainder of the natural vegetation, or if altered, is still representative of the structure and floristics of the natural vegetation, and provides the necessary habitat for native fauna (Government of Western Australia, 2000).

Most foreshore reserves have been excluded from the NAAMP as they will be managed under a Foreshore Restoration Strategy.

1.4. Integration with other Documents and Systems

A summary of the legislation and policies referred to in the NAAMP is included in Appendix 1 and the details of codes used under legislation and policies are included in Appendix 2. Flora and fauna inventories are included in Appendix 3 and Appendix 4 respectively.
The NAAMP has been prepared in the context of the City of Melville's existing management framework, which is summarised in Figure 1.

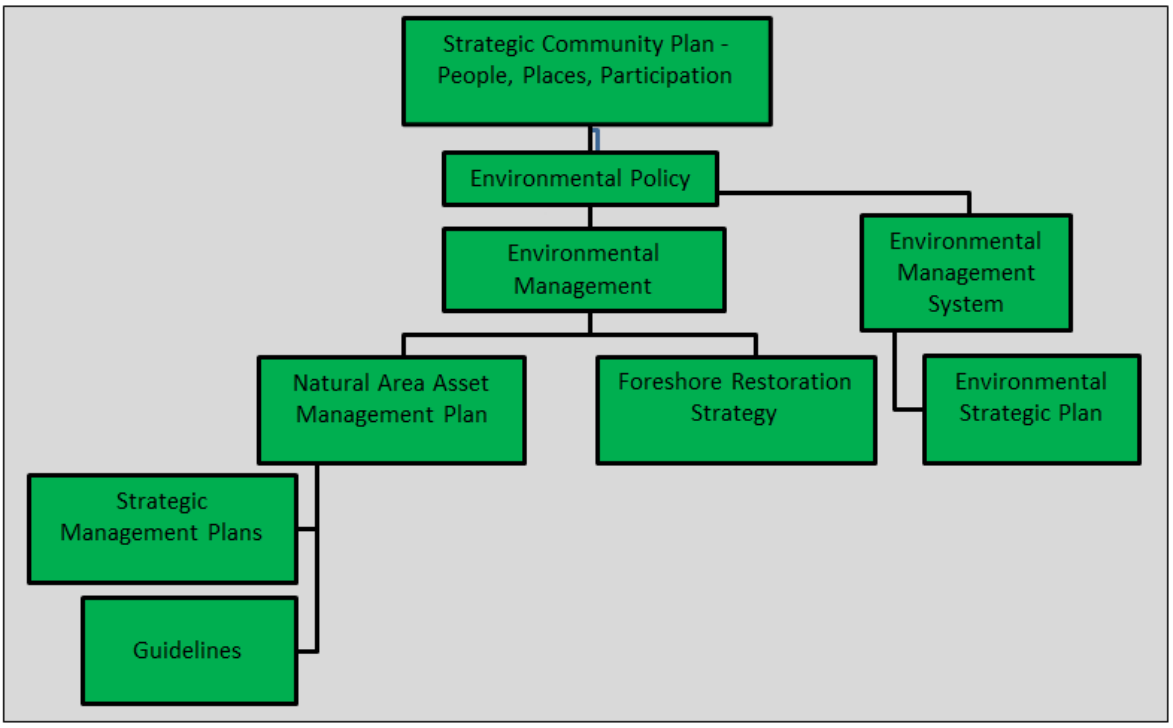

Figure 1 Management Framework

The City of Melville's existing strategic goal to 'contribute to the maintenance and enhancement of biodiversity for the preservation of our natural flora and fauna' is reflected in the City's:

- Strategic Community Plan – People, Places, Participation 2016-2026;
- Environment Policy 2018
- Environmental Management Framework 2016
- Environmental Strategic Plan 2016 - 2025

The *Natural Areas Asset Management Plan* is part of the following integrated set of documents:

- **The Natural Areas Asset Management Plan:**
  - documents strategic aims;
  - establishes a framework for ranking/prioritising assets and threats;
  - applies this framework to identify high and very high value assets and threats;
  - identifies broad strategies required to manage threats; and
  - establishes a framework for monitoring the degree to which strategic aims are met
- **Guidelines and Procedures:**
  - apply the NAAMP framework for ranking/prioritising assets and threats to identify medium and low priority assets and threats; and
  - document management and monitoring techniques that can be applied uniformly to all reserves
- **Strategic Reserve Plans:**
  - document
    - the extent and/or abundance and condition of assets;
    - the present and potential level and extent of impacts of threats;
    - any changes evident in the assets and threats over time;
    - reserve-specific risk-based management priorities; and
    - management strategies relevant to the specific reserve; and
  - discuss reserve-specific application of strategies (e.g. are any weed trees to be retained because of considerations such as historic value) and make reserve specific recommendation regarding the implementation of strategies.

1.4.1. Linkages to Strategic Community Plan and Corporate Business Plan

The City has developed this document in consideration of the Strategic Community Plan that outlines the Melville Community aspirations. The communities interests were consolidated into six (6) aspirations as outlined in the Corporate Business Plan (CBP). The CBP priorities strongly support the requirement for strategies to protect the City's natural area assets.

The Natural Areas Asset Management Plan directly relates to four of the key aspirations, which have been used to consider the objectives and goals outlined in this plan as demonstrated in Figure 2.

Figure 2 –Strategic community plan and corporate business plan integration

Key Aspirations	Key Strategies	Goal	Objectives
Clean and Green	Holistic and integrated strategies for protection of the City's natural resources	Maintain and enhance ecosystem; species and genetic diversity	No net loss of biodiversity in the City's natural areas Adaptive management of 10 identified threats to biodiversity
Sense of Community	Improve communication mechanisms to make information easy to access regarding community engagement	To partner with the Community and Stakeholders to encourage participation, education and engagement in environmental management. To ensure natural areas are managed for cultural and indigenous heritage, community wellbeing and future generations	Increase community awareness of environmental issues Engage the community through friends of groups in natural areas Engage the community in cultural and indigenous heritage of the City's natural areas Inclusive consultation
Healthy Lifestyle	Optimise facilities to achieve 'fit for use' facilities for current and future beneficiaries	Balance the needs of the community with the needs of the natural areas to ensure sustainable access for all	Provide appropriate and safe infrastructure in natural areas to facilitate access (such as footpaths, seating and signage)
Safe and Secure	Enhance community safety	Maintain natural areas to a standard that ensures community safety	Ensure hazards are managed to reduce public risk

1.5. Regional Context

1.5.1. Climate

Perth has a Mediterranean climate that was characterised by Seddon (1972) as having:

- wet, mild winters and dry hot summers;
- increased winds late winter through spring and summer;
- prevailing winds from the west, north-west and north in winter and spring;
- prevailing winds from the south-west, south and east in summer; and
- relatively little cloud.

The long-term rainfall and temperature for the weather station closest to the City, at Jandakot Airport, are shown in Figure 3.

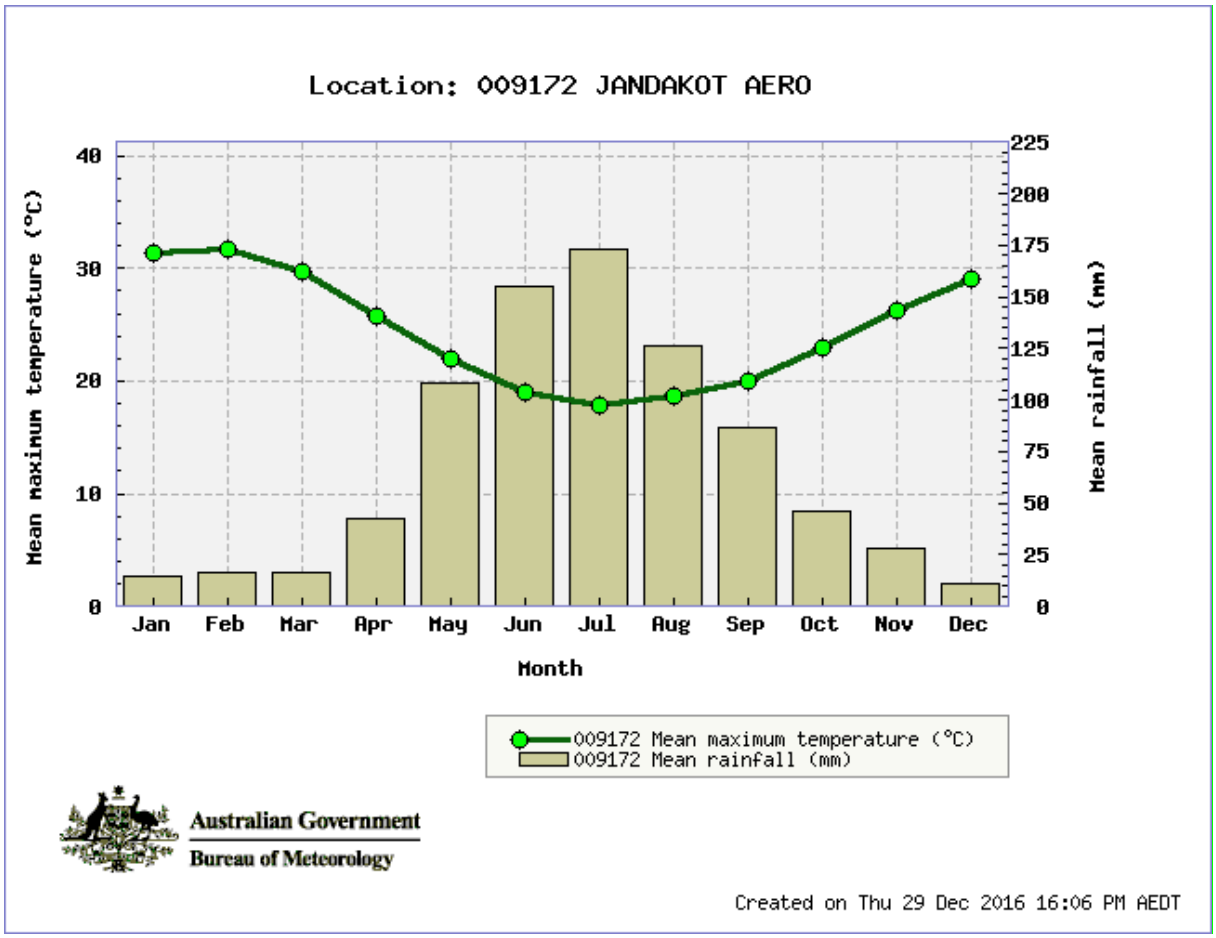

Figure 3 Long-term Average Monthly Rainfall and Temperatures for Jandakot Airport

The average annual rainfall between 1973 and 2018 was 823.7mm per annum, with the majority falling between May and September.

1.5.2 Regional Landforms, Soils and Vegetation

The City of Melville is located on the Swan Coastal Plain which is shown on Map 1. The Swan Coastal

Plain is approximately 400 km long, from just north of Jurien Bay in the north to Dunsborough in the south, and 30 km wide, from the Darling Scarp in the east to the Indian Ocean in the west. The coastal plain consists of a series of relatively flat dune systems running north-south (parallel to the coast) that were formed as the Indian Ocean retreated westward form the Darling Scarp and are therefore progressively older with distance from the coast (Seddon, 1972).

Ground elevation across the City varies between 0 m and 65 m above the Australian Height Datum at sea level, as is shown in Map 3.

The City of Melville straddles the Spearwood dune system to the west and the Bassendean dune system to the east. The characteristics of these geomorphological systems are summarised in Table 1 and the distribution of the soils are shown in Map 3.

Table 1 Characteristics of Regional Landforms in the City

	Spearwood Dunes		Bassendean Dunes	
Soil	Cottesloe	Karrakatta	Herdsman (occurs in depressions within Spearwood and Bassendean Dunes)	Bassendean
Soil Description	Brown or yellow sand over limestone	Yellow sand, no limestone near surface	Dark peaty sand	Pale grey or grey sand
Origin	Aeolian (deposited by wind)			

Source: Government of Western Australia (2000)

The four regional vegetation types (vegetation complexes) in the City coincide with the soils listed in Table 1 and are shown in Map 4.

Vegetation complexes are broad scale vegetation units defined in terms of consistently repeating plant communities in the context of landform-soil units. Plant communities may occur in more than one complex but the relative proportions of plant communities vary between complexes. A total of 38 vegetation complexes have been mapped on the Swan Coastal Plain, of which 26 occur in the Perth Metropolitan Area.

The four vegetation complexes in the City are characterised in
Table 2.

Table 2 Vegetation Complexes in the City

	Cottesloe Complex – Central And South	Karrakatta Complex - Central And South	Herdsman Complex	Bassendean Complex - Central And South
1750 original extent on the **Swan Coastal Plain**	44,995 ha	49912 ha	8,309 ha	87,477 ha
Uncleared extent on the **Swan Coastal Plain** [1]	18,474 ha (41%)	14,729 ha (29%)	2,875 ha (35%)	23,624 ha (27%)
Uncleared area on the **Swan Coastal; Plain** in secure tenure such as DBCA reserves[1]	3,951 ha (8.8%)	1,254 ha (2.5%)	952 ha (11.5%)	572 ha (0.7%)
City of Melville- Pre-European Extent[2]	334 ha	2609 ha	18 ha	2211 ha
City of Melville- Remnant Veg extent (2010)[2]	2 ha (0.49%)	124 ha (4.76%)	0 ha	183 ha (8.29%)
City of Melville- Remnant veg extent formally protected [2]	0%	1.61%	0%	0.80%
City of Melville- Remnant veg extent included in local reserves[2]	1 ha	31 ha	0 ha	95 ha
Typical Vegetation[2]	from woodland of Jarrah - Sheoak - Mosaic of woodland of Tuart and open forest of Tuart- Jarrah - Marri; closed heath on the limestone outcrops.	Predominantly low open forest of Tuart- Jarrah- Marri and woodland of Jarrah - Banksia species.	Sedgelands and fringing woodland of Flooded Gum - Melaleuca species (Paperbarks and Honeymyrtles).	Vegetation ranges Banksia species to low woodland of Melaleuca species and sedgelands on the moister sites. This area includes the transition of Jarrah to Prickly Bark in the vicinity of Perth.
Typical Plant Diversity (Number of plant species in 100m^2)[3]	37 - 55 species (Spearwood Dunes)	10 – 53 species (Seasonal Wetlands)	30 – 68 species (Bassendean Dunes)	

1. **Shepherd *et al.*** (2001)
2. **Zelinova (2012)**
3. **Powell and Keighery** (1995)
4. **Gibson *et al.*** (1994)

The plant diversities listed in Table 2, of 10 to 68 plant species per hundred square metres, is typical in the south west of Western Australia but high by world standards. A diversity in the order of 30

species per hundred square metres is commonly regarded as high in other parts of the world (EPA, 2000).

2. STRATEGIC AIMS FOR NATURAL AREAS

2.1. Defining Biodiversity

The Western Australian Environmental Protection Authority (2002) defined biological diversity (or biodiversity) as 'the variety of life forms, the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form' and considers biodiversity in terms of the following three levels of diversity:

1. **Ecosystem Diversity**
   The variety of all living organisms and non-living components within a given area and their relationships. Ecosystems include habitats (which includes abiotic components such as soil and climate), biotic communities and ecological processes.
2. **Species Diversity**
   The variety of individual species within a given area, such as a region.
3. **Genetic Diversity**
   The variety of genes/genetic information contained in all individual plants, animals and microorganisms both within and between populations of organisms that comprise individual species as well as between species.

The abstract commitment to maintain and enhance biodiversity and ecosystem health in the City can be interpreted as management of these three levels of diversity in terms of management at three different scales (reserves, sites and species), as conceptualised in Table 3.

Table 3 Management of Biodiversity

	Biodiversity Level: Broad Scale → Fine Scale		
	Ecosystem Diversity • Sites containing communities / combinations of plants, animals, microorganisms and habitats	**Species Diversity** • Populations of plants • Populations of animals • Populations of microorganism	**Genetic Diversity** • Individuals of plants • Individuals of animals • Individuals of microorganisms
Broad Scale	Individual and multiple reserves (which include sites, populations and individuals)		
Scale of Management	Sites in a reserve	Populations of significant species in a reserve	
Fine Scale	Individuals in a reserve that form part of an effective population across multiple reserves - movement of individuals (and genetic material e.g. pollen and seed) between multiple reserves		Individuals of a species in a reserve

2.2. Framework for Ranking

The NAAMP maintains and enhances biodiversity by managing threats to biodiversity. It achieves this by identifying:

1. assets that are priorities for maintenance and enhancement (and therefore protection from threats);
2. threats that impact upon those assets; and

3. guidelines that document techniques for threat management.

The multiple interactions between assets, threats and guidelines are summarised in Table 4, which:

- indicates the sections of the report discussing each individual asset, threat and guideline;
- identifies the strategies to be applied for the protection of each asset through the common linking threat/s (by reading the table left to right); and
- identifies the priority assets for protection by each strategy through the common linking threat/s (by reading the table right to left).

Table 4 Maintenance and Enhancement of Biodiversity through Threat Management

Priorities for Protection from Threats										Threats impacting on assets and therefore subject to Management	Techniques for Management of Threats									
BIODIVERSITY ASSETS										THREATS	MANAGEMENT GUIDELINES									
Bush Forever Reserves	Ecological Linkage Reserves	Ecological Community Sites	Fauna Habitat Sites	Wetland Sites	Heritage Sites	Community Interest Sites	Reference Sites	Native Flora Species	Native Fauna Species		Sign, Path and Barrier Guidelines	Bushfire Strategy	Weed Control Strategy & Guidelines	Revegetation Strategy & Guidelines	Feral Animal Strategy and Guidelines	Diseases and Pathogen Guidelines	Stormwater Management Strategy	Reticulation Guidelines	Acid Sulfate Soils Guidelines	Community Engagement
X	X	X	X		X	X	X	X		Physical Disturbance	X	X	X	X	X	X	X	X	X	X
X	X	X	X		X	X		X	X	Fire		X	X	X				X		X
X	X	X	X	X	X	X		X	X	Weeds		X	X	X				X		X
X	X	X	X					X	X	Habitat Loss				X	X					X
X	X	X	X					X	X	Feral Animals				X	X					X
X	X	X	X	X	X	X	X	X	X	Diseases & Pathogens	X					X				X
X	X	X	X	X	X		X	X	X	Stormwater							X			X
								X		Reticulation								X		
X	X	X	X	X	X			X	X	Acid Sulfate Soils									X	
X	X	X	X	X	X			X		Climate Change			X	X						

An overall rating for reserves has been retained under the NAAMP framework as a summary of assets. A comparison between the previous ratings (1 highest to 4 lowest) from 2011 and new ratings (1 highest to 5 lowest) is provided in Table 5. This is a reflection of increasing the number of categories to be in line with the way public open space and parks are prioritised and managed within the City.

Table 5 Reserve Ratings

Reserve	NAAMP Rating	Previous Rating
Heathcote Reserve	1	1
Ken Hurst Park	1	1
Piney Lakes Reserve	1	1
Point Walter Reserve	1	1
Wireless Hill Park	1	1
Attadale Reserve	2	1
Bateman Park	2	1
Blackwall Reach Reserve	2	1
Blue Gum Reserve	2	1
Booragoon Lake Reserve	2	1
Brockman Park	2	1
Bull Creek Park	2	1
Bill Brown Park	3	2
Ern Stapleton Reserve	3	2
George Welby Park	3	2
Harry Sandon Park	3	1
Harry Stickland Park	3	2
Peter Bosci Park	3	2
Peter Ellis Reserve	3	1
Phillip Jane Park	3	2
Quenda Wetland	3	1
Reg Bourke Park	3	1
Richard Lewis Park	3	1
Robert Weir	3	1
Ron Carroll Reserve	3	2
Wal Hughes Reserve	3	2

Reserve	NAAMP Rating	Previous Rating
Al Richardson Reserve	4	3
Alec Lambert Park	4	4
Art Wright Reserve	4	3
Beasley Park	4	3
Bob Crawford Park	4	3
Carawatha Park	4	N/A
Colleran Park	4	3
Connelly Park	4	3
Douglas Freeman Park	4	3
Dudley Hartree Park	4	3
Harold Field Reserve	4	3
Hatfield Park	4	3
Len Shearer Reserve	4	3
Olding Park	4	3
P J Hanley Park	4	3
Reg Seal Reserve	4	3
Tom Firth Park	4	3
Trevor Gribble Park	4	2
Arthur Kay Reserve	5	4
Bainton Park	5	4
Elizabeth Manion Park	5	4
Ellis Road Reserve	5	4
Fred Johnson Park	5	4
Harry Baker Park	5	4
Hugh Corbet Park	5	4
Jim Ainsworth Reserve	5	4

Reserve	NAAMP Rating	Previous Rating
Norm Godfrey Reserve	5	4
Trevor Knowles Park	5	4

Reserve	NAAMP Rating	Previous Rating
William Hall Park	5	4
William Reynolds Park	5	4

Whilst the system for resource allocation has been changed (resources are generally to be allocated on the basis of assets within reserves under the NAAMP framework, rather than overall reserve rankings under the previous framework), the reserves receiving most resources will likely be largely unchanged.

2.3. Document Structure

2.3.1 Assets

Assets were identified through:

- existing management plans for reserves in the City;
- searches of State and Federal Government databases;
- expert knowledge of City staff; and
- the City of Melville's *Natural Areas Risk Register.*

Assets were each categorised, as being defined and managed, at one of three scales:

1. **Reserves**
   Administrative units usually defined by cadastral boundaries.
2. **Sites**
   Management units (such as a vegetation type) within reserves. The extent of individual sites depends upon the specific asset and may encompass either a part, or the entirety, of reserve.
3. **Species**
   As defined by the EPA (2000), a group of organisms capable of interbreeding freely with each other but not with members of other species.

Framing natural area assets in terms of these three scales:

- aligns with the recognition of a number of levels of biodiversity;
- aligns with the definition, assessment and protection of environmental assets at different scales under commonwealth and state legislation and policies (e.g. properties, ecological communities and species); and
- facilitates the precise definition of the aspects of biodiversity that are to be maintained and enhanced through management strategies.

The significance of assets was assessed using the process summarised in Figure 4. The process commenced with an assessment at the highest level of significance and progressed to lower levels of significance to ensure that the highest applicable level of significance was identified most efficiently.

The assets of higher (regional, state, national or international) significance were all individually identified with reference to the policies and legislation of the Western Australian and Australian governments, and their departments and agencies. The significance of these assets, as established by these statutory authorities, does not tend to frequently change (although they may be reviewed regularly), and there is sufficient information available to characterise these assets in the City.

Assets of lower significance (high – local and medium – local) are to be identified and ranked during the development of the City's strategies, as the data and resources required to make those more detailed assessments becomes available. These assessments will be undertaken using the same framework used in the NAAMP.

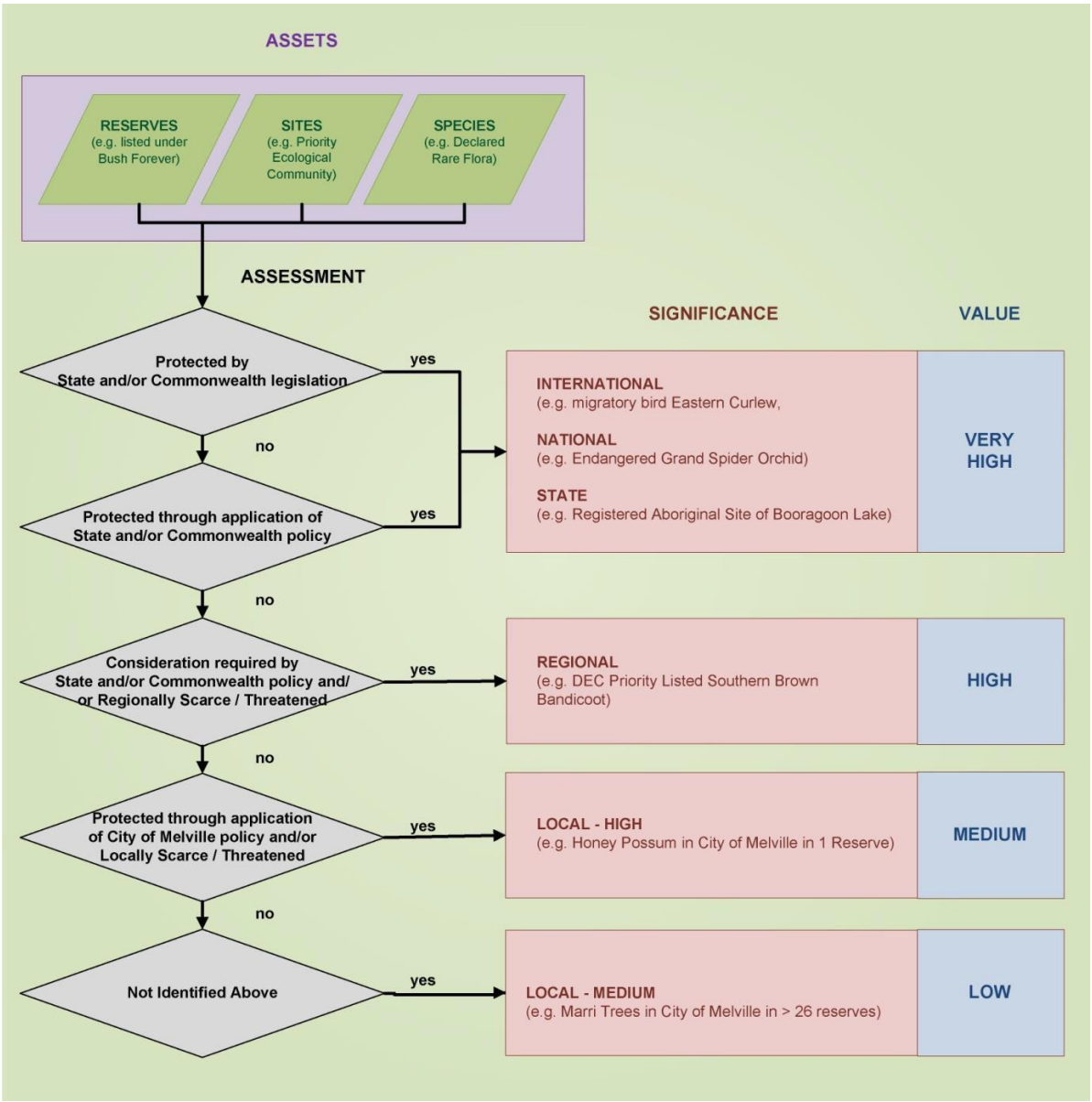

Figure 4 Assessment of Assets in Natural Areas

The details considered in the asset assessment process are listed in Table 6.

Table 6 Significance of Assets

Significance	Value	Reserves	Sites	Species
National / International statutory protection	Very High	• Matter of National Environmental Significance under EPBC Act 1999	• Matter of National Environmental Significance under EPBC Act 1999 (including Threatened Ecological Communities) • Registered Aboriginal Sites under the Aboriginal Heritage Act 1972 • Registered Site under the Heritage	• Matter of National Environmental Significance under EPBC Act 1999 • Threatened Flora, Fauna, and Ecological Communities under the Biodiversity Conservation Act 2016
National / International non-statutory protection		• WAPC listed Bush Forever Protection Area	• DBCA listed Threatened Ecological Communities • DBCA listed Priority Ecological Communities • Vegetation Complexes in Perth Metropolitan Area with <10 % uncleared • DBCA listed Conservation Category Wetland • DBCA listed Resource	• DBCA listed Priority Flora • DBCA listed Priority Fauna • Flora and fauna listed by WAPC in Bush Forever Volume II Tables 13, 14 or 15
Regional	High	• WALGA listed Perth Biodiversity Plan Regional Linkage	• Regional Floristic Survey Reference Sites (e.g. Bush Forever Reference Sites) • DBCA listed Multiple Use Category Wetland • City of Melville listed Heritage Sites • > 25 % of flora and/or fauna species in City of Melville • Floristic Survey	• Flora and fauna listed by WAPC in Bush Forever Volume II (but excluded from Tables 13, 14, 15) • occurring in few reserves on Swan Coastal Plain by DBCA

			• Reference Sites (e.g. Bush Forever Reference Sites) • DBCA listed Multiple Use Category Wetland • City of Melville	
Local – High	Medium	• > 4ha of bushland •	• sites involving active community groups or individuals • revegetation sites • large habitat trees • nesting boxes • recreation facilities • Local Floristic Survey Reference Sites (e.g. City of Melville Reference Sites)Site with active community involvement in management	• occurring in few reserves in the City of Melville
Local – Medium	Low	• Not identified above.	• Not identified above.	• Not identified above.

A summary of the legislation and policies used in this assessment are provided in Appendix 1. The details of codes used under legislation and policies are provided in Appendix 2.

2.3.2 Threats

Threats were identified through:

- existing management plans for reserves in the City;
- searches of State and Federal Government databases;
- expert knowledge of City staff; and
- the City of Melville's *Natural Areas Risk Register.*

Threats that were excluded from consideration were those that cannot be managed in a meaningful form at the scale of the City, that is:

- threats of international significance (such as highly contagious pathogens which are a matter of quarantine) and managed by the Western Australian and Australian governments.

Climate change is a threat of international significance but the impact of this threat can potentially be mitigated to some degree at the scale of the City, through managing impacts from a falling water table associated with a regional decline in rainfall. This threat is therefore considered in the NAAMP, and is discussed in Section 4.10.
Threats were defined in the context of how management strategies are formulated and implemented (for example the impacts from altered water quality and quantity are both captured under the threat of stormwater, which is currently the subject of a management strategy).

The significance of threats can be assessed in a similar manner to that used for assets in Section 2.3.2 as indicated in Table 7.

Table 7 Significance of Threats

Significance	Impact	Threats
Regional/National /International	Very High	Species, diseases and processes listed as any of the following: • a Key Threatening Process under the EPBC Act 1999 • a declared Plant under the WA Agricultural Protection Act 1976 • a declared Animal under the WA Agricultural Protection Act 1976
Regional/National /International		Species, diseases and processes listed as any of the following: • a Weed of National Significance by the NRMMC under the Australian Pest Animal Strategy • a vertebrate pest animal of national significance by the NRMMC under the Australian Pest Animal Strategy • a disturbance of acid sulfate soils potentially of causing a site to be listed as a contaminated site under the Contaminated Sites Act 2003
Local - High	High	Species, diseases and processes listed as any of the following: • Highly invasive and capable of forming monocultures or substantially modifying structure, composition and function of ecosystems by City of Melville • No effective elimination (e.g. dieback) • Distribution or impact is unknown or highly unpredictable
Local – Medium	Medium	Species, diseases and processes listed as any of the following: • moderately invasive and/or capable of moderate structure, composition and function of ecosystems by City of Melville • Potentially costly elimination, remediation
Local – Low	Low	Species, diseases and processes listed as any of the following: • not identified above.

The approach represented in Figure 4 is useful in the initial identification of potentially significant threats and determining legal requirements. A summary of the legislation and policies used is this assessment is provided in Appendix 1. The details of codes used under legislation and policies are provided in Appendix 2.

However the threats addressed in the NAAMP were primarily assessed in terms of their impacts and extent in the local context. As with assets, threats of lower significance are to be identified and ranked during the development of the City's guidelines, as the data and resources required to make those assessment becomes available. These assessments will be undertaken using the same framework used in the NAAMP.

2.3.3 Management Documents

The management documents that are to integrate with the NAAMP were proposed on the basis of:

- existing City of Melville documents (plans, strategies, manuals and guidelines etc);
- searches of State and Federal Government strategies and guidelines;
- expert knowledge of City staff (current practices not currently formalised in documents); and
- the City of Melville's *Natural Areas Risk Register.*

3. ASSETS

3.1. Reserves

3.1.1. WAPC Bush Forever Reserves

Reserves that are listed as Bush Forever Sites by the Government of Western Australia (2000) are reserves subject to non-statutory (policy) protection by the Government of Western Australia as discussed in Appendix 1.

Bush Forever Sites are land properties on the Swan Coastal Plain portion of the Perth Metropolitan Area that were identified as containing regionally significant bushland by the Government of Western Australia (2000) on the basis of the following criteria:

- **Representation of ecological communities**
  Areas that as a suite represent the range of ecological communities and the places in which these communities merge
- **Diversity**
  Areas with a high diversity of flora and/or fauna species or communities in close association
- **Rarity**
  Areas containing rare or threatened communities or species, or species of restricted distribution
- **Maintaining ecological processes or natural systems**
  Maintenance of ecological processes or natural systems at a regional or national scale
- **Scientific or evolutionary importance**
  Areas containing evidence of evolutionary processes either as fossilised material or as relict species and areas containing unusual or important geomorphological or geological sites; Areas of recognised scientific and educational interest as reference sites or as examples of the important environmental processes at work
- **General criteria for the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation**
  Conservation category wetlands areas including fringing vegetation and associated upland vegetation. Coastal vegetation within the accepted coastal management zone
- **Criteria not relevant to determination of regional significance, but which may be applied when evaluating areas having similar values**
  Attributes which taken alone do not establish regional significance, but which can add to the value of bushland and enhance it contribution to Bush Forever

Criteria not used by the Government of Western Australia (2000) in determining regional significance were:

- recreation values;
- sites of historical significance (post-European settlement);
- sites of significance for Aboriginal people;
- social values; and
- aesthetic value such as a notable landscape feature or viewpoint.

The City of Melville occupies 1.8 % of the total Bush Forever area and contains nine (3%) of the 287 sites identified by the Government of Western Australia (2000).

Reserves that are listed as Bush Forever Sites are of Very High value, and their regional significance is summarised in Table 8 by the section criteria met by the reserves.

Table 8 Very High Value Reserves

Bush Forever Site		Bush Forever Selection Criteria						
Site Number	Site Name	Representation of ecological communities	Diversity	Rarity	Ecological processes or natural systems	Scientific or evolutionary importance	General criteria for the protection of wetland and coastal vegetation	Criteria not relevant to determination of regional significance
226	Harry Sandon Park, Attadale	√		√				√
229	Blue Gum Reserve, Brentwood/Mount Pleasant	√	√	√	√	√	√	√
245	Ken Hurst Park, Leeming	√	√	√		√	√	
329	Point Heathcote Foreshore, Applecross						√	√
331	Blackwall Reach, Point Walter, Alfred Cove and Adjacent Bushland, Bicton to Applecross (includes Attadale Reserve)	√		√	√	√	√	
336	Wireless Hill Park, Ardross	√		√		√		√
337	Booragoon Lake, Booragoon	√					√	√
338	Yagan Wetland and Adjacent Bushland, Rossmoyne to Bull Creek (Bateman Park, Bull Creek Park, Reg Bourke Park and Richard Lewis Park)	√		√			√	√
339	Piney Lake Reserve, Winthrop	√		√			√	√

3.2. Sites

3.2.1. Ecological Linkage Reserves

Ecological linkages can increase the effective size of flora populations and available habitat for individual animals, and help maintain genetic diversity for animals and plants by providing connections between groups of animals and plants in isolated bushland remnants.

In the NAAMP the values of reserves as parts of linkages was assessed as:

- Very high value if the reserve was included in a Regional Linkage identified by the Government of Western Australia (2000);
- High value if the reserve was included in a Regional Greenway by identified by Alan Tingay and Associates (1998);
- Medium value if the reserve is a natural area;
- Low value if not otherwise identified above (parkland and stands of native trees).

Due to extensive clearing the Government of Western Australia (2000) identified regional linkages in the Perth Metropolitan Area, and categorised these as either:

- regionally significant contiguous bushland/wetland linkage;
- regionally significant fragmented bushland/wetland linkage;
- regionally significant potential bushland/wetland linkage.

These are Very High value assets, and the actual and potential regional linkages identified by the Government of Western Australia (2000) are subject to non-statutory (policy) protection by the Government of Western Australia as discussed in Appendix 1.
High value linkage assets are the regional greenways identified by Alan Tingay and Associates

(1998). Regional Greenways were identified to connect areas of remnant vegetation, wetlands and walking trails within the Perth Metropolitan Region with priority given to:

- east west linkages which link the coast to freshwater and bushland habitats;
- linkages along foreshore areas;
- linkages between wetlands; and
- linkages large areas of bushland.

Some Regional Greenways coincide with Regional Linkages (in which case the regional linkage should take precedence in planning) as:

- this is consistent with an implied hierarchy in Bush Forever Volume 2 (Government of Western Australia, 2000) and
- linkages are more closely aligned with the objectives of the NAAMP (as linkages are primarily based on biodiversity values and connecting natural areas), whilst greenways include consideration of other values such as recreation and connect public open spaces.

The City of Melville's Green Plan (Alan Tingay and Associates, 1999) also identified 'biolinks' which connect bushland and parkland areas. These biolinks generally utilised existing road verges which had good canopy coverage or the potential for enhancement, and were categorised as:

- Significant biolinks of existing or proposed spaces of continuous canopy cover which provided a corridor of indigenous flora between significant areas of green space and created a safe passage and habitat for fauna, particularly birds and insects (these biolinks tended to have been incorporated into Regional Linkages and/or Regional Greenways identified by the Government of Western Australia (2000) and therefore have already been considered); and
- Minor, local biolinks that typically incorporated road reserves to link significant and/or smaller bushland or parkland areas. In some cases, minor biolinks may not be capable of functioning as major flora and fauna corridors but were identified to improve the network of existing linkages and enhance the amenity value of significant transport routes within suburbs. They are therefore not considered outside the scope of the NAAMP).

Medium value linkage assets are the reserves supporting remnant vegetation as these reserves can still function as "stepping stones" for the movement of some native species through an urban landscape.

The 13 reserves of Very High value and the 14 High Value as parts of ecological linkages (as shown in Map 4) are listed in Table 9.

Table 9 Reserves in Very High and High Value Linkages

Value	Reserves Containing Sites	Regional Linkage	Local Linkage
Very High	Heathcote	Swan River	Heathcote - Booragoon Lake
	Point Walter		Point Walter – Wal Hughes – Harry Sandon
	Blackwall Reach		-
	Attadale		
	Colleran	Beeliar Regional Park linkage	
	Harry Stickland		
	Len Shearer		
	Hatfield		
	Wireless Hill		
	Piney Lakes		Piney Lakes – Frederick Baldwin - Samson Park
	Booragoon Lake		Booragoon - Blue Gum - Bateman

	Quenda		
High	Blue Gum	-	Booragoon - Blue Gum - Bateman
	Harry Sandon		Harry Sandon – Wal Hughes – Point Walter
	Wal Hughes		
	Ern Stapleton		
	Bateman		Bateman – Bull Creek – Ken Hurst
	Richard Lewis		
	Reg Bourke		
	Bull Creek		
	Beasley		
	Bainton		
	Ken Hurst		
	Robert Weir		Quenda Wetland – Robert Weir – Dudley Hartree
	Peter Ellis		
	Dudley Hartree		

3.2.2. Ecological Communities

Ecological communities are defined by the DBCA as naturally occurring biological assemblages that occur in a particular type of habitat.

The DBCA has been identifying and informally listing Threatened Ecological Communities (TECs), ecological communities at risk of extinction through human action or inaction, since 1994. The DBCA also maintains lists of Priority Ecological Communities (PECs) for which there is insufficient information available for consideration as a TEC, or which are rare communities that are not currently threatened.

Some TECs are listed as Matters of National Environmental Significance and protected under the Commonwealth *EPBC Act 1999* (as described in Appendix 1). The *Biodiversity Conservation Act 2016* provides a statutory basis for the listing of threatened species, specially protected species, threatened ecological communities, critical habitat and key threatening processes.

There are 24 Threatened and 33 Priority Ecological Communities on the Swan Coastal Plain (DBCA, 2019), the categories for which are provided in Appendix 2. One TEC and three PECs are identified as occurring in the City (DBCA, 2010g). These TECs and PECs are very high value ecological communities.

Medium value ecological communities are those vegetation types that occur in few of the City's reserves. The most restricted vegetation associations in 27 of the City's reserves were identified by Ecoscape (2006). These are medium value ecological communities, and are listed along with the very high value PECs in Table 10.

Table 10 High and Medium Value Ecological Communities

Value	Reserve	Ecological Community	DBCA Code
Very High	City-wide	*Banksia Woodlands of the Swan Coastal Plain* are a Threatened Ecological Community listed as Endangered under the Environment Protection and Biodiversity Conservation Act 1999	
	Blackwall Reach/Point Walter	*Tuart Woodlands of the Swan Coastal Plain* are a Priority Ecological Community listed as Critically Endangered under the Environment Protection and Biodiversity Conservation Act 1999	Priority Three
	Blackwall Reach	Floristic Community Type (Swan Coastal Plain) No. 24 Northern Spearwood Shrublands and Woodlands	Priority Three
	Booragoon Lake	Wooded wetlands which support colonial waterbird nesting areas	Priority Two
Medium	Blackwall Reach	Saltwater Sheoak *(Casuarina obesa)* trees over sedges	
	Blackwall Reach	Shrublands on shallow soil overlying limestone	
	Point Walter	Shrublands on shallow soil overlying limestone	

NB: Ecoscape (2006) incorrectly listed 'Shrublands on shallow soil overlying limestone' as also being in Ron Carroll and Quenda reserves (DBCA, 2010k)

Ecological communities are defined by the DBCA as naturally occurring biological assemblages that occur in a particular type of habitat. The DBCA has been identifying and informally listing Threatened Ecological Communities (TECs), ecological communities at risk of extinction through human action or inaction, since 1994. The DBCA also maintains lists of Priority Ecological Communities (PECs) for which there is insufficient information available for consideration as a TEC, or which are rare communities that are not currently threatened.

3.2.3. Wetlands

Wetlands are defined in Schedule 5 of the *Environmental Protection Act 1986* as areas 'of seasonally, intermittently or permanently waterlogged or inundated land, whether natural or otherwise, and includes a lake, swamp, marsh, spring, dampland, tidal flat or estuary' and wetlands can be categorised on the basis of landform and water permanence in accordance with Table 11.

Table 11 Wetland Types

WATER LONGEVITY	LANDFORM				
	BASIN	CHANNEL	FLAT	SLOPE	HIGHLAND
Permanent Inundation	Lake	River	-	-	-
Seasonal Inundation	Sumpland	Creek	Floodplain	-	-
Intermittent Inundation	Playa	Wadi	Barlkarra	-	-
Seasonal Waterlogging	Dampland	Trough	Palusplain	Paluslope	Palusmont

Source: Government of Western Australia (2000)

The Environmental Protection Authority (2004) identified the significant environmental values and functions of wetlands as:

- Primary production of organic matter in a nutrient-poor landscape;
- Recreational and landscape amenity;
- hydrological balance including flood control and stormwater detention;
- water quality protection by filtering pollutants; and
- wildlife habitat.

All wetlands on the Swan Coastal Plain are subject to at least some non-statutory (policy) protection by the Government of Western Australia.

The City of Melville contains one, and is contiguous with another, of the 698 wetlands of national importance. Environment Australia (2001a) lists wetlands in Australia as nationally important if they meet at least one of the following criteria:

1. It is a good example of a wetland type occurring within a biogeographic region in Australia;
2. It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex;
3. It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail;
4. The wetland supports 1% or more of the national populations of any native plant or animal taxa;
5. The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level; or
6. The wetland is of outstanding historical or cultural significance.

At a regional level wetlands on the Swan Coastal Plain dataset are assigned to one of the following three management categories, with Very High value wetlands being listed by the DBCA as being either:

- **Conservation Category**
  Wetlands recognised at the international, national or regional level for which the appropriate management regime has the objective of preserving their natural attributes and functions
- **Resource Enhancement**
  Wetlands for which the appropriate management regime has the objective of restoration through maintenance and enhancement of natural attributes and function

The Very High Value wetlands in reserves are listed in Table 12.

Table 12 Very High Value Wetlands

Reserve	Nationally Important Wetland (Identifier)[1]	Wetland Type (DBCA Identifier)	DBCA wetland classification
Attadale Reserve	Swan – Canning Estuary (WA091) NB These reserves adjacent to, rather than include, estuary		
Heathcote Reserve			
Bateman Park			
Bull Creek Park		Sumpland (6865) Dampland (6871)	Conservation Resource Enhancement
Point Walter Reserve			
Booragoon Lake	Booragoon Lake (WA073) meets criteria 1, 2, 3, 6	Lake (6502)	Conservation
Brockman Park			Conservation
Richard Lewis Park		Sumpland (6445)	Conservation
Piney Lakes Reserve		Sumpland (6503) Sumpland (6504)	Conservation Conservation
Quenda Wetland		Sumpland (6512)	Conservation
Blue Gum Reserve		Sumpland (6507)	Conservation
Trevor Gribble Park		Dampland (6873)	Resource
Ken Hurst Park		Dampland (6776) Dampland (6777)	Conservation Conservation
Reg Bourke Park		Sumpland (6646)	Resource Enhancement

1. *Environment Australia* (2001a)

The remaining two recorded wetlands in the City are considered to be of High value as:

- approximately 80% of wetlands on the Swan Coastal Plain have been cleared, and most of the remaining wetlands have been heavily modified (EPA, 2004); and

- a number of the fauna species in the City are wetland dependent, including a number of frogs, the Mourning Skink (*Egernia luctuosa*) and the Western Petalura (*Petalura hesperia*).

One of these two wetlands is not mapped by the DBCA and the other is listed by the DBCA as being:

- **Multiple Use**
  Wetlands most appropriately managed for their use and development in the context of water, town and environmental planning.

The High value wetlands in the City are listed in Table 13.

Table 13 High Value Wetlands

Reserve	Nationally Important Wetland (Identifier)[1]	Wetland Type (DBCA Identifier)	DBCA wetland classification
Reg Bourke Park		Sumpland (6868)	Multiple Use
Douglas Freeman		Sumpland (-)	NA (not mapped by DBCA)

3.2.4. Fauna Habitats

Fauna habitats not captured as ecological communities need specific consideration. Habitat (large and very large) trees are a critical habitat requirement for some fauna and in the City of Melville, these are of specific value to birds and bats:

- many birds rely on tree hollows (Birdlife Australia, 2013); and
- roost sites are a critical (and potentially limiting) habitat requirement for bats (Hosken, 1996).

Hollows only form in old trees (at least 100 years old) (Birdlife Australia, 2013), and in eucalypts ultimately form where branches or the trunk break off due to natural shedding or wind damage and decayed wood is removed by animal wood or fire also decay causing fungi acting on injury sites (Rhodes et al. 2006).

A number of factors determine the likelihood of hollow formation in trees, including species, age and size (trunk diameter and tree height) and tree health (including whether dead or not) (Gibbons and Lindenmayer, 2002). For the purposes of the NAAMP, habitat trees are:

- greater than 50 cm diameter over bark at breast height (approximately 1.5 m above ground level). There is a positive correlation between diameter and the presence of hollows (Gibbons and Lindenmayer, 2002).
- regardless of tree species. Eucalypt trees will be most important for birds as Banksia trees rarely form hollows (How and Dell, 1989), and neither do sheoak trees. Other species with rough/flaking bark (e.g. banksias, sheoaks and paperbarks) may be important for bats;
- categorised as very large (greater than 50 cm diameter) as:
  - larger, older trees tend to have a greater density of hollows per tree (Gibbons and Lindenmayer, 2002);
  - the number of trees decreases with size tree (Gibbons and Lindenmayer, 2002); and
  - larger hollows only form in very large trees, and therefore larger species which require larger hollows can only nest in very large trees (Red-capped Parrots and Australian Ringnecks require trees greater than 50 cm diameter and the Pacific Black Ducks require trees greater than 60 cm (Abbott and Whitford, 2002);

- although none of the three Black Cockatoo species are recorded breeding in the City, the Department of Sustainability, Environment, Water, Populations and Communities, Public Affairs (2012) defines 'breeding habitat' for Black Cockatoos as 50 cm diameter for most tree species, and

- categorised as either live or dead, as both provide hollows but the size and persistence of hollows can vary between these categories (Gibbons and Lindenmayer, 2002) and dead may be more important for bats which can may roost under loose bark.

Table 14 High Value Habitat Sites

Value		Reserves Containing Sites	Number of Trees
High	Very Large Tree (> 50 cm diameter)	Wireless Hill	122
		North West Reserves	407
		Central Reserves	41
		Heathcote Reserve	4
		Piney Lakes Reserve	59
		Ken Hurst Park	378
		Estuarine Reserves	496
		Bull Creek Reserves	251
		Quenda Wetland	9
		South Eastern Reserves	129
		Eastern Reserves	54
		Booragoon Lake	
		Blue Gum Lake	
		Modified Reserves*	172

- *denotes Habitat trees surveyed >60cm

3.2.5. Registered Heritage Sites and Places

The Very High value heritage sites are those specifically protected under the EPBC Act 1999, Aboriginal Heritage Act 1972 and/or Heritage of Western Australia Act 1990 (which are summarised in Appendix 1).

Whilst a number of heritage sites are identified for reasons other than biodiversity (e.g. Registered Aboriginal Sites) they are considered in the NAAMP framework because maintaining and enhancing the naturalness of the site contributes to maintaining and enhancing their historic value.

The Very High value heritage sites in natural area reserves are listed in Table 15.

Table 15 Very High Value Heritage Sites

Reserve	Register of the National Estate	Registered Aboriginal Heritage Site	WA Heritage Register
Alfred Cove	**Natural Site 17818**		**Place 06052**
Blue Gum	**Natural Site 10643**		
Ken Hurst	Natural Site 100375		
Wireless Hill	Historic Site 10645		**Place 17795**
Booragoon Lake	Natural Site 14862	**Site 3298**	
Piney Lakes	Natural Site 14862	Site 21469, Site 3297	
Attadale		**Site 4104, Site 4105, Site 3536**	
Heathcote		**Site 16904, Site 3536**	
Blackwall Reach		**Site 3650, Site 3536**	
Bull Creek		**Site 3536, Site 3538, Site 3299,** Site 4355	

Bold = Permanent or Stored Not Bold = Interim or Indicative Listing

High value heritage sites would be those on a municipal heritage inventory. The City has compiled such an inventory, as local government is required under the Heritage of Western Australia Act 1990, but there are no heritage sites on the City's Heritage Register in natural areas additional to those mentioned above (Wynn, 2010)

3.2.6. Community Interest Sites

The community has an interest in all reserves being managed on their behalf by the City of Melville. The recognition of sites in natural areas of particular community interest is appropriate in the context of the City's commitments to involve stakeholders in decision–making and the community's substantial role in extending the knowledge, enthusiasm and human resources for the management of natural areas.

The City of Melville's *People Places Participation - A Community Plan for the City of Melville 2007-2017* (City of Melville, 2007b) recognises planning with local communities builds a sense of community spirit and provides a commitment to consider public opinion in the development of future strategic and planning directions of the City provide an opportunity for participation by the community in decision-making processes on activities to be undertaken by stakeholder groups.

Community groups and schools provide in the order of 5000 hours (the equivalent of more than 3 full-time positions) of unpaid work to bushland management in the City (Fowler, 2018) in the form of:

- weed removal;
- guided walks;
- monitoring;
- raising awareness;
- tree and shrub plantings;
- seed collection; and
- rubbish collection.

The High value community interest sites are those reserves in which:

- a consortium of management agencies have interests; and
- these interests are recognised in a regional park plan which seeks to integrate management of a broader area in a co-operative manner.

Regional parks are regional open spaces with regionally significant conservation, landscape and recreation values (CALM, 2006). The Beeliar Regional Park is a park that was created primarily to manage two chains of wetlands as a single entity, with the intention that DBCA (previously CALM) co-ordinate the management of the numerous disjunct land holdings (CALM, 2006). Three reserves in the City are included in Beeliar Regional Park

The Medium value sites have been identified as those in which:

- community interest is expressed in the form of active community groups or individuals; and
- intensive revegetation works are being undertaken, as these are often the 'public face' of natural area management, and community groups are often directly involved at some point of their management.

The High and Medium value community interest sites are listed in Table 16.

Table 16 High and Medium Value Sites Indentified by Community Interest

Value	Reserves Containing Sites	Regional Park	Active Community Groups
High	Piney Lakes	Beeliar Regional Park	Piney Lakes Bushcrew
	Blue Gum		Friends of Booragoon and Blue Gum Lakes
	Booragoon Lake		
	Quenda Wetland		Murdoch University Environmental Students Association (MUEnSA)
Medium	Attadale		Friends of Attadale Foreshore
	Blackwall Reach		Bicton Environmental Action Group
	Bull Creek		Friends of Bull Creek Catchment
	Harry Sandon		Friends of Harry Sandon
	Ken Hurst		Friends of Ken Hurst
	Peter Ellis and Robert Weir		Greening Leeming
	Red Gum		Friends of Red Gum Reserve
	Wireless Hill		Friends of Wireless Hill
	William Hall		Friends of William Hall
	Reg Seal		Reg Seal Regeneration Group
	Bill Brown		Friends of Bill Brown
	Hatfield Park		Friends of Hatfield Park
	Wal Hughes		Friends of Wal Hughes
	Estuarine Reserves (Blue Wren)		Swan Estuary Reserves Action Group

NB: Not all revegetation sites to be included in this table have been collated at this time.

3.2.7. Scientific Reference Sites

Reference sites provide numerous opportunities for ongoing research and monitoring. For example, conducting a taxonomic review of plants (i.e. the classification of plants can be reviewed by collecting DNA material from sites where specimens were previously collected), and measuring changes in vegetation at a specific location over time in response to climate change or the establishment of invasive species.

Bush Forever Reference sites established as part of a regional survey are high value sites, and those established for local surveys are of medium value. The value of fauna sites is rated lower than flora sites as the interpretation of long-term trends can be invalidated by any relocation of flora sites, but fauna sites in the immediate vicinity should yield equivalent presence/absence results given that animals are mobile.

The Bush Forever Reference sites, in reserves in the City, which were established as part of A Floristic Survey of the Southern Swan Coastal Plain (Gibson et al., 1994) are listed in Table 17.

Table 17 Medium Value Scientific Reference Sites

Value	Reference Sites	Reserves	Survey
High	PTWALT-1	Blackwall Reach	*A Floristic Survey of the Southern Swan Coastal Plain* (Gibson et al., 1994)
	HURST01 HURST02 HURST03 HURST04	Ken Hurst	
	Sand 01	Harry Sandon	*System 6 and Part System 1 Update Programme* (DEP, 1996)
Medium	ErSt02C	Ern Stapleton	*Flora And Vegetation Survey - Ern Stapleton And Wal Hughes Reserves, Attadale* (Waters, 2013)
	WaHu02D'	Wal Hughes	

The Bush Forever Reference sites of Gibson et al. (1994) were not established as long term monitoring sites but most (>95%) of the 509 sites established have had data collected on at least two occasions and given the comprehensiveness of data collection, there is potential for them to be used to determine changes in vegetation over time.

3.3. Species

3.3.1. Native Flora

The Government of Western Australia (2000) considers native plant species to be of conservation significance if they are:

- rare;
- poorly known;
- restricted in distribution (including populations disjunct from their natural distribution, at the southern or northern end of their geographic range); or
- have some distinctive feature.

Vascular Plants

The vascular flora of the City is documented in Appendix 3, with updates from more recent flora surveys undertaken as part of management plan updates. The overall inventory can be considered comprehensive.

There are 474 native vascular plant species recorded in the City and to place this in perspective, there are:

- 324 native plant species in the 346 ha of bushland in Kings Park (Botanic Gardens and Parks Authority, 2010b);
- 310 native plant species recorded in the 437 ha of bushland in Bold Park (Botanic Gardens and Parks Authority, 2010a);
- greater than 1,200 native vascular plant taxa on the Swan Coastal Plain portion of the Perth Metropolitan Region (Government of Western Australia, 2000);
- 5,700 native vascular plant taxa in the South–West Botanical Province between Shark Bay and the Great Australian Bight (Beard, Chapman and Gioia, 2000); and
- approximately 12,000 native vascular plant taxa in Western Australia (Western Australian Herbarium, 2010).

It is also worth noting that:

- 79% of native vascular plant taxa species in south-west Western Australia are endemic (i.e. occur nowhere else in the world) (Beard, Chapman and Gioia, 2000); and
- new plant taxa are being discovered and described continuously in Western Australia.

The Department of Biodiversity, Conservation and Attractions identified 371 vascular plant taxa of conservation significance Swan Region, and 4 of these have been recorded in the City. These Very High value species are listed in Table 18.

The Grand Spider Orchid (*Caladenia huegelii*) is listed as Declared Rare Flora, and as a Matter of National Environmental Significance. It is thereby directly protected under the Commonwealth *EPBC Act 1999* and the Western Australian *Biodiversity Conservation Act 2016* as discussed in Appendix 1. All other species are also protected under the Western Australian *Biodiversity Conservation Act 2016* but in practice occurs indirectly through non-statutory (policy) processes.

Table 18 Very High Value Plant Species

DBCA Conservation Code[1]	Bush Forever Listing[1]	Species
T	p,s,e	*Caladenia huegelii*
P4	p,s,e	*Dodonaea hackettiana*
P4	p,s,E,e	*Jacksonia sericea*
P2		*Stylidium squamellosum*

Non-vascular Plants

The 159 different species of non-vascular plants (fungi and rusts) that have been recorded in 14 reserves are documented in Table 41 in Appendix 3. Four are listed as being of conservation significance by the DBCA (2019).

- *Amanita drummondiii* (Priority 3)
- *Amanita fibrillopes* (Priority 3)
- *Amanita preissii* (Priority 3)
- *Amanita wadjukiorum* (Priority 3)

3.3.2. Native Fauna

The Government of Western Australia (2000) considers native animal species to be of conservation significance if they are:

- rare;
- poorly known;
- restricted in distribution (including populations disjunct from their natural distribution, at the southern or northern end of their geographic range); or
- have some distinctive feature.

Vertebrates

How and Dell (2000) found that for vertebrate fauna (animals with backbones) on the Swan Coastal Plain that:

- reptile assemblages are different significantly between landforms (i.e. between the Spearwood and Bassendean dune systems);
- reptile assemblages are different significantly north and south of the Swan and Canning Rivers (i.e. the City of Melville is the northern extent of assemblages south of the rivers);
- reptile diversity decreases from 52 species on near-coastal dunes on the west of the Swan Coastal Plain to 35 species on the Darling Plateau to the east;
- the diversity of reptile and the size of bushland remnants is correlated for all reptiles, except skinks; and
- amphibians are associated with wetlands rather than geographical location.

The vertebrate fauna of the City is documented in Appendix 4-Native Fauna Inventory. The diversity and significance of this fauna is placed in context in Table 19.

Table 19 Regional Context for Native Vertebrate Fauna Diversity

Fauna Group	Species in Bush Forever Area[1]	Significant Species in Bush Forever Area[1]	Species in City of Melville	Significant Species in City of Melville
Birds[2]	311	78	189	40
Mammals	18	7	23	4
Reptiles	64	4	43	2
Amphibians	13	0	9	0
Total	**406**	**89**	**264**	**46**

1. Government of Western Australia (2000b)
2. Includes seabirds and trans-equatorial migrants

A comprehensive inventory would require more intensive targeted fauna surveys than have previously been undertaken in the City. In trapping in Bold Park by How(1998) over a total of 398 days (2388 pit-days) in 7 years, on average 79% of the herpetofauna (reptile and amphibian) species were caught each year and in no single year were all species caught. On this basis How (1998) estimated that between 250 and 300 individual reptiles/amphibians need to be captured prior to 80% of species being recorded in the area.

The significant vertebrate fauna species recorded in the City are listed in Table 20 and 21.

Table 20 Very High Value Vertebrate Fauna Species

EPBC Act Listing	DBCA Listing	Bush Forever	Fauna Group	Species	
√	MI	2		*Actitis hypoleucos*	Common Sandpiper
√	MI	2		*Arenaria interpres*	Ruddy Turnstone
√	MI	2		*Calidris alba*	Sanderling
√		2		*Calidris acuminata*	Sharp-tailed Sandpiper
√	EN	2		*Calidris canutus*	Red Knot
√	CR	2		*Calidris ferruginea*	Curlew Sandpiper
√	MI	2		*Calidris melanotos*	Pectoral Sandpiper
√	MI	2		*Calidris ruficollis*	Red-necked Stint
√	MI	2		*Calidris subminuta*	Long-toed Stint
√	CR	2		*Calidris tenuirostris*	Great Knot
√	VU	2		*Charadrius leschenaultii*	Greater Sand Plover
√	MI	2		*Limicola falcinellus*	Broad-billed Sandpiper
√	MI (&CR or VU)	2		*Limosa lapponica*	Bar-tailed Godwit
√	MI	2		*Limosa limosa*	Black-tailed Godwit
√	CR	2		*Numenius madagascariensis*	Eastern Curlew
√		2		*Numenius phaeopus*	Whimbrel
√	MI	2		*Philomachus pugnax*	Ruff
√	VU			*Sterna nereis*	Fairy Tern
√	MI & P4	2		*Tringa brevipes*	Grey-tailed Tattler
√	MI	2		*Tringa glareola*	Wood Sandpiper
√	MI	2		*Tringa nebularia*	Common Greenshank
√	MI	2	*Bird*	*Tringa stagnatilis*	Marsh Sandpiper
√				*Apus pacificus*	Fork-tailed Swift
√				*Ardea alba*	Great Egret
√				*Ardea ibis*	Cattle Egret
√				*Haliaeetus leucogaster*	White-bellied Sea-Eagle
√				*Merops ornatus*	Rainbow Bee-eater
√	MI			*Pandion haliaetus*	Osprey
√	MI			*Pluvialis squatarola*	Grey Plover
√	MI			*Hydroprogne caspia*	Caspian Tern
√	VU			*Calyptorynchus banksia naso*	Forest Red-tailed Black Cockatoo
√	EN	I, 4		*Calyptorhynchus baudinii*	Baudin`s Cockatoo
√	EN	I, 4		*Calyptorhynchus latirostris*	Carnaby`s Cockatoo
	P4	3		*Oxyura australis*	Blue-billed Duck
	P4			*Thinornis rubricollis*	Hooded Plover
	OS	I, 4		*Falco peregrinus*	Peregrine Falcon
	P3		Lizard	*Lerista lineata*	Perth Slider/Lined Skink
	P3		Snake	*Neelaps calonotos*	Black-striped Snake
	P4		Bat	*Falsistrellus mackenziei*	Western False Pipistrelle
	P4		Water Rat	*Hydromys chrysogaster*	Rakali

EPBC Act Listing	DBCA Listing	Bush Forever	Fauna Group	Species	
	P4		Wallaby	*Macropus irma*	Western Brush Wallaby
	P4		Bandicoot	*Isoodon obesulus fusciventer*	Quenda

Table 21 High Value Fauna Species

Noted in Bush Forever	Fauna Group	Species	
√	Birds	*Erythrogonys cinctus*	Red-kneed Dotterel
√		*Acanthiza apicalis*	Broad-tailed Thornbill
√		*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill
√		*Acanthiza inornata*	Western Thornbill
√		*Anas rhynchotis*	Australasian Shoveler
√		*Aythya australis*	Hardhead
√		*Biziura lobata*	Musk Duck
√		*Climacteris rufa*	Rufous Treecreeper
√		*Gallinula tenebrosa*	Dusky Moorhen
√		*Malacorhynchus membranaceus*	Pink-eared Duck
√		*Malurus splendens*	Splendid Fairy-wren
√		*Phaps chalcoptera*	Common Bronzewing
√		*Sericornis frontalis*	White-browed Scrubwren
√		*Smicrornis brevirostris*	Weebill
√		*Accipiter cirrocephalus*	Collared Sparrowhawk
√		*Accipiter fasciatus*	Brown Goshawk
√		*Aquila audax*	Wedge-tailed Eagle
√		*Aquila morphnoides*	Little Eagle
√		*Falco berigora*	Brown Falcon
√		*Haliastur sphenurus*	Whistling Kite
√		*Nycticorax caledonicus*	Rufous Night Heron
√		*Turnix varia*	Painted Button-quail
√	Lizard	Three-lined Skink	*Acritoscincus trilineatum*
√		Mourning Skink	*Egernia luctuosa*

Invertebrates

The assemblages of invertebrate fauna (animals without backbones such as insects and spiders) on the Swan Coastal Plain are exceptionally diverse:

- invertebrates differ in relation to vegetation and landform, and are more diverse and abundant in larger bushland remnants (Harvey et al., 1997); and
- Harvey *et al.* (1997) recorded 181 species from 15 sites over 12 months and Tassone and Majer (1997) collected 7105 individual insects from 20 orders (high level taxonomic groups) from just 54 tree canopies in bushland at Jandakot Airport.

There have not been comprehensive surveys of invertebrates in the City's reserves. There are two conservation significant invertebrates recorded by the DBCA (2010i) in the City but neither of these (Synemon gratiosa, the Graceful Sunmoth (P4) nor Leioproctus contrarius, a native bee (P3) have been recorded in the City's reserves.

The one conservation significant invertebrate that has been confirmed in a reserve in the City is listed in Table 21.

Table 22 High Value Invertebrate Fauna Species

Noted in Bush Forever	Fauna Group	Species	
No but consistent with principles	Dragonfly	Western Petalura	*Petalura hesperia*

The Western Petalura dragonfly (*Petalura hesperia*) is not listed as a priority species but appears to be of regional significance as it is restricted in distribution and abundance. Nineteen populations are recorded between Nannup and Mundaring, with one believed extinct and four under threat (Barrett and Williams, 1998). This species was previously confirmed at Bull Creek but a survey by the City was unable to relocate any specimens, although anecdotal evidence from the Friends of Bull Creek indicated the presence of the dragonfly some years ago (Wynn 2010).

4. THREATS

4.1. Physical Disturbance

4.1.1. Trampling

The effects of trampling by large numbers of people can include:

- damage to understorey vegetation (Scheltema, 1995b) and loss of plant cover and biomass (Newsome, Moore and Dowling, 2002);
- changing understorey plant composition (Hamberg et al., 2008) including loss of sensitive species (Newsome, Moore and Dowling, 2002) and establishment of weeds (Newsome, Moore and Dowling, 2002);
- the creation of tracks, which Keighery (1989) found to act as major conduits for spreading weeds;
- reduction in the height of vegetation (Newsome, Moore and Dowling, 2002;
- soil compaction (Newsome, Moore and Dowling, 2002);
- soil erosion (Scheltema, 1995b) (Newsome, Moore and Dowling, 2002); and
- reduction in insect abundance and distribution (Dixon et al., 1995).

Newsome, Moore and Dowling (2002) have noted that with trampling:

- impacts vary with the type and density of vegetation (grasses being less susceptible than woody and erect herbs), and soil texture, structure and infiltration;
- as few as 12 walk throughs could result in a 50% loss in vegetation cover in a eucalypt woodland as opposed to 1412 walk throughs in a grassland; and

- changes in soil and plant composition can occur before any detectable loss of vegetation cover as a result of compaction.

Trampling of vegetation is a significant issue in Melville with approximately half of all of the natural area reserves having informal paths created through them by pedestrian traffic, including almost half of the reserves with formal paths (Bloomfield, 2019). Any paths that are not part of the 'formal' network in a reserve are likely to require active management to ensure they do not become more established over time.

4.1.2. Vandalism and Rubbish Dumping

Vandalism reduces the visual amenity of natural areas and can result in unsafe infrastructure with associated liability risks for the City. In the 2018/2019 financial year, $10,000 was required for repairing specific damage due to vandalism, not including vandalism repaired as part of general maintenance (Bloomfield, 2019).

The dumping of garden rubbish is a mechanism for the spread of weeds (CALM, 1999a) and rubbish dumping and soil transportation were found to be major avenues for the introduction of weeds to 100 bushland sites surveyed between Mandurah and Moore River (Keighery, 1989). Rubbish can also reduce the visual amenity of natural areas and constitute a fire hazard.

Rubbish dumping is a significant issue in Melville. Clearing dumped rubbish takes up 2,900 person hours per annum (which equates to 40% of the time for the 4 full time equivalent positions for bushland maintenance) (Bloomfield, 2019).

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4.1.3. Tree Poisoning, Illegal Clearing and Firewood Collection

Illegal clearing and tree poisoning and illegal clearing can reduce the ecological functioning and visual amenity of natural areas. Illegal clearing and tree poisoning in Melville mainly involves foreshore vegetation, but occasionally occurs in natural area reserves. Since 2010 illegal clearing and poisoning has continued, most notably in the Bull Creek and Attadale Foreshore reserves. The City has expended thousands of dollars and many staff and volunteer hours remediating these activities

Firewood collection can result in the loss of coarse woody material which provides habitat for a range of fauna, and additional trampling (Newsome, Moore and Dowling, 2002). Firewood collection is not a significant issue in Melville(Bloomfield, 2019).

4.2. Fire

The long-term effects of fire on ecosystems varies according to sequences of fire events, rather than to a single fire event (DBCA, 2010c). The DBCA (2010c) characterises sequences of fire events (fire regimes) in terms of:

- intensity (how severe fires are);
- frequency (how often fires occur);
- season (the time of year fires occur); and
- scale (how extensive each fire is and the patchiness of the burnt and unburnt mosaic).

Altered fire regimes are considered a major threat to 17 endangered plant species in Australia (EPA, 2000). Muir (1987) noted that altered fire regimes can:

- permanently alter the floristic diversity;
- exacerbate weed invasion; and
- eliminate fire-sensitive species.

The impacts of fire can be both positive and negative but the negative impact of fire can be greater in small urban bushland remnants than large tracts of uncleared vegetation. Negative impacts from fire in bushland in and near Perth have included:

- A simplified vegetation structure with the successive replacement of a Eucalyptus-Sheoak forest by a Sheoak-Banksia woodland and then a Sheoak woodland (Bell et al., 1992);
- A severe summer wildfire in Kings Park killing two thirds of the Banksia, Sheoak and Eucalyptus trees that were burnt, despite their general resilience to fire (Bell et al., 1992);
- A decline in Tuart trees in frequently burnt remnants despite Tuart being resistant to fire and predominately relying on fire to recruit seedlings (Ruthrof, Yates and Loneragan, 2002), possibly because:
    - seedlings do not produce any resistance to fire until after 3 to 4 years of age; and
    - adult Tuart trees that survive a fire may take considerable time to recover and a decade after a fire a considerable portion of the population may still not be producing seed
- The elimination of fire sensitive species such as Acacia pulchella and Gompholobium tomentosum after repeated fires (Baird, 1977);
- An association between weeds and disturbed sites that have been frequently burnt (Keighery, 1989);
- A reduction in lizard diversity in a number of urban bushland remnants in Perth after intensive fires (How and Dell, 2000);
- Predation of reptiles by Australian Ravens after recent fire removed the understorey (How and Dell, 2000);
- Small resident birds, especially insectivores, being disadvantaged (How and Dell, 1989); and
- Abundances of the Western Banjo Frog (Limnodynastes dorsalis) and, to a lesser extent, the Turtle Frog (Myobatrachus gouldii) being reduced in recently burnt areas (Bamford, 1992).

There was an average of one fire in bushland reserves each year in Melville over the last 13 years, as shown in Table 23.

Table 23 Fire History 2005-2010

Year	Reserves	Approximate Bushland & Wetlands Burnt	
		Percent in Reserve	Hectares
2005	Booragoon Lake Peter Ellis Bull Creek	6% 50% 4%	0.8 ha 5.0 ha 0.3 ha
2006	Blue Gum Bull Creek Hatfield Peter Bosci Rob Weir	50% <1% 8% <5% 5%	3.2 ha<0.1 ha 0.1 ha <0.1 ha 0.1 ha
2007	None Documented		
2008/09	Wireless Hill George Welby	33% 13%	11.9 ha 0.3 ha
2009/10	Harry Sandon Reg Bourke Ron Carroll	25% 25% 33%	1.0 ha 0.8 ha 1.9 ha
2010/14	Wireless Hill Piney Lakes	3%	2 ha
2014/18	Wireless Hill Peter Ellis Richard Lewis	<1% <1% 90%	1.32 ha <0.1 ha 3.6ha
2005 - 2018			
	Total	**N/A**	**31.72 ha**

(Bloomfield, 2019)

Whilst biodiversity, can be enhanced by the maintenance of a diversity of post-fire ages and fine- scale mosaics of fire history, two fire scenarios that are potential triggers for permanent loss of susceptible species from individual reserves. These are:

- Large Fires (single fire events that burn large portions of a reserve):
  - These could lead to local extinctions of animal species that are not highly mobile and cannot recolonise from nearby but fragmented unburnt reserves (e.g. reptiles);
- Repeat Fires (multiple fires burning the same portions of reserves at high frequency)
  - These could lead to local extinctions of fire sensitive plant species that require time between fires to re-establish a seed store. The most susceptible species are (long- lived perennials (trees and shrubs) that are killed by fire causing 100% canopy scorch
  - and regenerate only from seed and the seed is stored on the plant (rather than in a soil seed bank).

The species listed in City of Melville natural areas that are most susceptible to fires are listed in Table 24.

Table 24 Species Suitable for Monitoring Response to Fire

Most Susceptible to Large Fires Mammals and Reptiles that are bushland-dependent and ground-dwelling and non-burrowing	Marsupials	*Macropus fuliginosus*	Western Grey Kangaroo
		Macropus irma	Western Brush Wallaby
	Front-fanged Snakes	*Demansia psammophis*	Yellow-faced Whip Snake
		Pseudonaja affinis	Dugite
		Rhinoplocephalus gouldii	Gould's Hooded Snake
		Notechis scutatus	Western Tiger Snake
	Goannas	*Varanus gouldii*	Gould's Sand Goanna
	Legless Lizards	*Delma fraseri*	Fraser's Legless Lizard
		Delma grayii	Gray's Legless Lizard
		Lialis burtonis	Burton's Snake-Lizard
		Pletholax gracilis	Keeled Legless Lizard
		Pygopus lepidopodus	Common Scaly-Foot
	Skinks	*Acritoscincus trilineatum*	Three-lined Skink
		Ctenotus australis	Western Limestone Ctenotus
		Ctenotus fallens	Striped Skink
		Ctenotus impar	Odd-striped Skink
		Ctenotus lesueurii	Striped Skink
		Egernia luctuosa	Mourning Skink
		Lerista lineata	Lined Skink
		Morethia lineoocellata	Western Pale-flecked Morethia
		Morethia obscura	Shrubland Pale-flecked Morethia
		Tiliqua occipitalis	Western Bluetongue
		Tiliqua rugosa rugosa	Bobtail
Most Susceptible to Multiple Fires Trees and Shrubs killed by 100% fire scorch and store seeds in canopy	Plants	*Acacia pulchella*	Prickly Moses
		Banksia sessilis	Parrot Bush
		Beaufortia elegans	
		Hakea trifurcata	Two-leaf Hakea
		Jacksonia sternbergiana	Stinkwood, Kapur
		Kunzea glabrescens	Spearwood, Pondil

(Wilson and Valentine, 2009), (Hopkins and Griffin, 1989). (DBCA, 2007)

The plant species in City of Melville natural areas that are susceptible to repeated fires are listed in Table 24.

4.3. Introduced Flora

The Environmental Weed Strategy for Western Australia (CALM, 1999a) characterised the impacts of environmental weeds on ecosystem function as including:

- resource competition;
- prevention of seedling recruitment;
- alteration of geomorphological processes;
- alteration of hydrological cycle;
- alteration of soil nutrient status;
- alteration of fire regime;
- genetic changes; and

- alterations to the abundance of indigenous fauna (for example weeds that occupy extensive areas between shrubs, or have dense rooting patterns can inhibit reptile movement and foraging (How and Dell, 1989).

The impacts of environmental weeds at the ecosystem level can be major and long lasting. (CALM, 1999a), and in Australia weed competition has contributed to the extinction of four plant species and is considered a major threat to 57 endangered plant species (EPA, 2000).

Weeds can also have significant at level (e.g. high medium or low) and this should take into account both the direct impacts (e.g. whether the species forms a monoculture excluding all native plants) and indirect impacts, (examples of which are provided in Table 25).

- Water can be a limiting factor for the growth and survival of plants and weeds can have a significant impact on water availability for native plants. Plant water requirements can lead to exhaustion of soil moisture reserves above the water table by late summer in Perth (Dodd and Heddle, 1989a) and some weeds extract very large volumes of water. Pine trees deplete soil water faster and to a greater degree than native plants on the Swan Coastal Plain, and pine plantations can use 5 times the water of remnant vegetation (Salama et al., 2002). There is also evidence that trees in general can extract considerable moisture up to a distance from the edge of their canopy of 3-4 times their height (Hamilton, 1996).
- Weeds can significantly increase fuel loads and therefore fire risks in bushland. The control of Veldt Grass (a highly flammable and major weed) with herbicides has contributed to a reduction in the intensity and rate of spread of fires in Kings Park bushland (Dixon et al., 1995).

Table 25 Indirect Impacts to be Considerations in Prioritisation of Weeds for Control

Indirect Impacts	Comment
Altered groundwater	Water can be a limiting factor for the growth and survival of plants and weeds can have a significant impact on water availability for native plants. Plant water requirements can lead to exhaustion of soil moisture reserves above the water table by late summer in Perth (Dodd and Heddle, 1989a) and some weeds extract very large volumes of water. Pine trees deplete soil water faster and to a greater degree than native plants on the Swan Coastal Plain, and pine plantations can use 5 times the water of remnant vegetation (Salama et al., 2002). There is also evidence that trees in general can extract considerable moisture up to a distance from the edge of their canopy of 3-4 times their height (Hamilton, 1996). The priorities for the control of high water use weed control can be further prioritised on the basis of sites and the relative dependence of the vegetation on groundwater. Rutherford, Roy and Johnson (2005) classified the dependence of vegetation on groundwater as: • high groundwater dependency (watertable 0 to 5 m below ground level); • moderate groundwater dependency (watertable 5 to 10 m below ground level); • low groundwater dependency (watertable 10 to 20 m below ground level); and • little or no groundwater dependency (watertable greater than 20 m below ground).

Fire	The details of the strategy for weed control are documented in *The Bushfire Management Strategy* (City of Melville, 2016a). The reduction in the abundance of some weeds can significantly reduce fuel loads in bushland. The control of Veldt Grass (a highly flammable and major weed) with herbicides has contributed to a reduction in the intensity and rate of spread of fires in Kings Park bushland (Dixon et al., 1995).

Of the vascular plant species recorded in the natural areas in the City, 35.8 % (247 of 690 species) are weeds. To place this in perspective, weeds constitute:

- 42.8% (232 of 542) of the plant species in bushland in Bold Park (Botanic Gardens and Parks Authority, 2010a);
- 31.6% (150 of 474) of the plant species in bushland in Kings Park (Botanic Gardens and Parks Authority, 2010b);
- 11.5% (172 of 1485) of plant species recorded in 509 sites on the Southern Swan Coastal Plain (Gibson et al., 1994); and
- 9.0% (1209 of 13381) of vascular plant taxa in Western Australia (Western Australian Herbarium, 2010).

The weeds impact ratings for weeds under the NAAMP of regional and/or national significance recorded in the City, (taking into account invasiveness, impacts and current and potential distribution,) are listed in Table 26.

Table 26 Weeds of Regional and/or National Significance recorded in the City of Melville

Impact	Weed	Declared Plant in City of Melville[1]	Declared Plant outside of City of Melville[1]	Weed of National Significance[2]	National Environmental Alert List[2]	DPAW Impact Rating for Swan Coastal Plain
Very High	Bridal Creeper *Asparagus asparagoides*	√		√		H
	Lantana *Lantana camara*	√		√		M
	Tamarisk *Tamarix aphylla*	√		√		H
	Paterson's Curse *Echium plantagineum*	√				H
	Arum Lily *Zantedeschia aethiopica*	√				H
	Blackberry *Rubus laudatus*	√		√		H
	One Leaf Cape Tulip *Moraea flaccida*		√			H
	Asparagus Fern *Asparagus aethiopicus*			√		L
	Golden Dodder *Cuscuta campestris*			√		M
	Madeira Vine *Anredera cordifolia*			√		M
	African Love Grass *Eragrostis curvula* (to be mapped and reported with other perennial clumping grasses such as Perennial Veldt Grass)			√		H
	Brazilian Pepper *Schinus terebinthifolius*			√		H
	Soldiers *Lachenalia reflexa*				√	H

High	Annual Clumping Grasses					
	Perennial Running Grasses					
	Clumping Geophytes					
	Giant Grasses					
	Trees and Shrubs All not listed above					
Medium	All other perennial weeds					
Low	All other annual weeds					

Weed	Declared Plant[1] 96 weed species requiring management and/or control	Weed of National Significance[2] 71 weed species already causing significant agricultural, forestry and environmental damage	National Environmental Alert List[2] 28 weeds in the early stages of establishment with potential to become a significant threat to biodiversity if not managed and amenable to eradication or containment
Bridal Creeper *Asparagus asparagoides*	P1 Movement Prohibited	√	
Lantana *Lantana camara*	P1 Movement Prohibited	√	
Tamarisk *Tamarix aphylla*	P1 Movement Prohibited	√	
Paterson's Curse *Echium plantagineum*	P1 Movement Prohibited		
One Leaf Cape Tulip *Moraea flaccida*	P1 Movement Prohibited		
Arum Lily *Zantedeschia aethiopica*	P1 Movement Prohibited P4 Containment Required		
Blackberry *Rubus laudatus*	P1 Movement Prohibited	√	
Yellow Soldier *Lachenalia reflexa*			√

1 Western Australian Agricultural and Related Resources Protection Act 1976
2 Australian Department of the Environment, Water, Heritage and the Arts

A summary of requirements of the *Agricultural and Related Resources Protection Act 1976* is included in Appendix 1 and the details of codes used under the legislation are in Appendix 2.

4.4. Habitat Loss

The loss and fragmentation of habitat as a result of land clearing is a significant threat to the long-term viability of some species in urban areas. The Government of Western Australia (2000) found that since European settlement of the Swan Coastal Plain:

- approximately half (15 of 33) of the mammals have become locally extinct, including all the insectivorous mammal species;
- just under half of the resident birds (excluding seabirds and trans-equatorial migrants) have decreased, in particular those associated with wetlands, or that have diets based largely on insects and nectar (as a direct result of vegetation clearing); and
- Reptiles have been least affected by urbanisation and Perth has retained one of the riches reptile faunas in any major urban area in the world, although with significant reductions in the larger predators (e.g. goannas and snakes).

Fragmentation of bushland can result in the long-term decline in species diversity as well as an immediate loss of species diversity:

- long-term declines may result from populations of animals becoming more susceptible to the deleterious effects of threats such as fire and introduced fauna because of limited opportunities for immigration from nearby unaffected areas. Remnants as small as one hectare can support viable populations of many reptile species but this requires active management of fire and predators (How and Dell, 2000); and
- some fauna species may be recorded in remnants for some time after surrounding areas are cleared due to the longevity of individuals, but may not persist in perpetuity due an inability to produce sufficient offspring. The reptile recorded in the highest number of reserves in the City, the Bobtail (Tiliqua rugosa rugosa), is an example of a species that persists in bushland remnants for some time after urban development but may not be able to in the long term (How and Dell, 1994).

The extent of clearing of the vegetation complexes in the City in 2010 are summarised in Table 27.

Table 27 Retention of Vegetation Complexes in the City of Melville

	Cottesloe Complex-Central And South	Karrakatta Complex-Central And South	Herdsman	Bassendean Complex-Central And South
Total pre-1750 extent	333 ha	2640 ha	23 ha	2266 ha
Remaining extent in Bushland Reserves	0.1 ha	107 ha	0 ha	143 ha
Remaining proportion in Bushland Reserves	0.0%	4.1%	0%	6.3 %

The sizes and distribution of reserves are shown in Map 4.

The critical amount and type of habitat required varies between species. For example:

How and Dell (1994) identified the following species as utilising urban gardens and inner city areas as part of their habitat:

- Fence Skink (Cryptoblepharus plagiocephalus);
- Two-toed Earless Skink (Hemiergis quadrilineata);
- West coast Four-toed Lerista (Lerista elegans):

- Common Dwarf Skink (Menetia greyii); and
- Marbled Gecko (Phyllodactylus marmoratus).

The threshold core habitat requirement for sensitive bird species on the Swan Coastal Plain is 61% total vegetation cover within a 2 km area, and this vegetation can exist in a number of separate areas rather than as one large area (Brown et al., 2009).

Loss and fragmentation of habitat due to land clearing is managed through a number of strategic processes outside the scope of the NAAMP such as:

- land use planning processes (the City of Melville has little uncleared remaining in 2019);
- the City of Melville's Green Plan (Alan Tingay and Associates, 1999) which provided direction for the maintenance and enhancement of 'biolinks' through vegetation management outside of natural areas (e.g. parkland and road verges);
- the City of Melville Streetscape Strategy;
- the City of Melville Public Open Space Strategy; and
- regional ecological linkages identified by the WAPC (as shown in Map 4).

Within natural areas, habitat loss and fragmentation can also occur in terms of:

- cleared or bare areas within bushland;
- decline in bushland condition;
- loss of specific structural or floristic components of bushland (e.g. hollows in trees

Cleared/bare areas that may require active management (including recently burnt areas), are where:

- there are no native plants or natural litter over areas greater than 100m2 (in which a rectangle with a minimum side of 2 metres can fit); or
- the combined cover of weeds and bare ground (bare ground does not include large rocks or natural litter) is greater than 25% for an area greater than 250m2 (in which a rectangle with a minimum side of 2 metres can fit).

This is consistent with being just below:

- the definition of 'native vegetation' as being 'vegetation in which native species constitute more than 70% of the plant cover' in relation to land clearance as a key threatening process under the EPBC Act 1999 (DSEWPC, 2013)
- the risk from water erosion typically significantly increasing where bare ground is more than 30% (Moore, 2004);
- 30% weed cover, where the balance is tipping towards weeds (Casson, Downes and Harris, 2009);
- elevated fire risk associated with dense grass infestations. The hazard rating is 'very high' for 40-60% cover of grasses, of which 20-50% is dead (3.5 tonnes/hectare) (Gould et al., 2007).

Bushland condition is a measure of vegetation composition, structure and function relative to a reference state (i.e. within the context of the presence or absence of threatening processes) at a patch or landscape (community or ecosystem) scale (Casson, Downes and Harris, 2009). Under the NAAMP framework, bushland condition can be used to prioritise works within reserves (e.g. revegetation of 'Very Poor' areas adjacent to 'Very Good' areas may be prioritized over of 'Very Poor' areas adjacent to 'Poor' areas). However, bushland condition is not used as a monitoring index for habitat because:

- Other more direct quantitative, less subjective and finer scale measures are made (e.g. weed cover);
- Rapid assessment of bushland condition is a qualitative measure (that incorporates numerous factors in producing a single rating out of 5 to 6 categories) that is prone to discrepancies where assessors have varying experience and familiarity with the range of vegetation types and ecological processes in an area;
- The appropriate spatial scale for measuring bushland is likely to often be larger than the scale of natural area management in the City of Melville. In the southwest of WA, condition ratings have been routinely applied to the 10 m x 10 m quadrats (as flora data was captured at this scale), but the DBCA has moved towards assessing condition at a larger scale of 25 m x 25 m areas (Casson, Downes and Harris, 2009). This better reflects natural heterogeneity in vegetation structure and the scale of ecological process being captured.

Tree hollows are a structural component of bushland that are critical to a number of species. Fauna maybe classified as either obligate or opportunistic hollow-users, but it can be difficult to determine which species belong because this can depend upon geographic location, climate and season (with many species only using hollows for breeding) (Gibbons and Lindenmayer, 2002). The species most sensitive to loss of habitat trees in the City were those using tree hollows for nests and considered to be resident and/or breeding in the City (and excluding species that seasonally migrate into the City but breed elsewhere or are considered vagrants/infrequent visitors/locally extinct). The focus on species that breed locally aligns with advice from DBCA (2011) Carnaby's Cockatoo is unlikely to use artificial hollows outside its breeding area (and improving feeding/roosting habitat is more important in these areas). Data is available on birds likely to be breeding in the City. However, few studies have been undertaken of bats on the Swan Coastal Plain (Wilson and Valentine, 2009). For the purposes of the NAAMP, all but one bat is assumed to breed in the vicinity (if present) as many are likely to be resident all year-round given that many microbats hibernate during winter (Nevill, 2005). The White-striped Bat is not assumed to breed locally; it does not hibernate (Kitchener and Hudson, 1982) and migrates up to 1200 km north over winter (Bullen and McKenzie, 2005).

The animal species listed in City of Melville natural areas that are most susceptible to habitat loss are listed in Table 28.

Table 28 Species Suitable for Monitoring Response to Habitat Loss

Characteristics	Group	Species	
Requiring relatively large bushland remnants	Marsupials	Western Grey Kangaroo	*Macropus fuliginosus*
		Western Brush Wallaby	*Macropus irma*
	Mammals	Southern Brown Bandicoot	*Isoodon obesulus fusciventer*
		Bush Rat	*Rattus fuscipes*
		Honey Possum	*Tarsipes rostratus*
		Brush-tailed Possum	*Trichosurus vulpecula*
	Birds	Common Bronzewing	*Phaps chalcoptera*
		Red-capped Parrot	*Purpureicephalus spurius*
		Splendid Fairy-wren	*Malurus splendens*
		Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
		Scarlet Robin	*Petroica boodang*
		Inland Thornbill	*Acanthiza apicalis*
		Western Thornbill	*Acanthiza inornata*
		Grey Shrike-thrush	*Colluricincla harmonica*
		Tree Martin	*Hirundo nigricans*
		New Holland Honeyeater	*Phylidonyris novaehollandiae*
		Western Spinebill	*Acanthorhynchus superciliosus*
		Western Wattlebird	*Anthochaera lunulata*
	Snakes	Common Beaked Blind Snake	*Ramphotyphlops waitii*
		Southern Blind Snake	*Ramphotyphlops australis*
		Black-naped Snake	*Neelaps bimaculatus*
		Black-striped Snake	*Neelaps calonotos*
		Western Tiger Snake	*Notechis scutatus*
		Yellow-faced Whip Snake	*Demansia psammophis*
		Dugite	*Pseudonaja affinis*
		Gould's Hooded Snake	*Rhinoplocephalus gouldii*

Characteristics	Group	Species	
Species that are resident and/or breed in City and require tree hollows or loose bark for nesting and/or roosting	Bats	Gould's Wattled Bat	*Chalinolobus gouldii*
		Chocolate Wattled Bat	*Chalinolobus morio*
		Western False Pipistrelle	*Falsistrellus mackenziei*
		Lesser Long-eared Bat	*Nyctophilus geoffroyi*
		Gould's Long-eared Bat	*Nyctophilus gouldii*
		Greater Long-eared Bat	*Nyctophilus major*
		Southern Forest Bat	*Vespadelus regulus*
	Birds	Australasian Shoveler	*Anas rhynchotis*
		Australian Ringneck	*Platycercus zonarius*
		Galah	*Cacatua roseicapilla*
		Little Corella	*Cacatua sanguinea*
		Pacific Black Duck	*Anas superciliosa*
		Pink-eared Duck	*Malacorhynchus membranaceus*
		Rainbow Lorikeet	*Trichoglossus haematodus*
		Red-capped Parrot	*Platycercus spurius*
		Sacred Kingfisher	*Todiramphus sanctus*

		Striated Pardalote	*Pardalotus striatus*
		Tree Martin	*Hirundo nigricans*
Species recorded only once in natural area, and that reserve being small, largely not bushland	Plants	Limestone Marlock	*Eucalyptus decipiens subsp. decipiens*
			Acacia ?tetragonocarpa
		Woody Pear	*Xylomelum occidentale*

Within natural areas, the threat from habitat loss and fragmentation can be managed through a Revegetation Strategy (see section 5.4) that:

- increases the size of meta-populations (groups of spatially separated subpopulations of animals or plants that may function as a single population due to occasional interbreeding through migration of individuals or dispersal of seed or pollen) for plants and animals with restricted distributions and abundance;
- introduces redundancy by establishing additional individuals or populations for plants and animals with restricted distributions and abundance;
- increases the effective size of core habitat of and/or size of populations by increasing the proportion of better condition vegetation in reserves; and
- provides substitutes for specific habitat components (e.g. the provision of nest boxes in the absence of an adequate tree hollows).

4.5. Introduced Fauna

The impacts of introduced animals upon biodiversity that have been identified by Scheltema (1995a and/or the Western Australian Environmental Protection Authority (2007) include:

- predation of native fauna;
- competition with native fauna for food and habitat;
- degradation of watercourses/waterholes;
- grazing of native flora/seeds;
- spread of weeds, disease and pathogens; and
- soil disturbance through trampling and digging/degradation of soil structure.

The impacts of feral animals are significant:

- foxes, cats and sometimes rabbits have been implicated as a cause in most of the 22 mammal extinctions in Australia (Low, 1996);
- foxes are considered a threat in Australia to 14 species of birds, 48 mammals, 12 reptiles and 2 amphibians (DEWHA, 2008c);
- competition and land degradation by rabbits may affect 156 threatened species in Australia including 13 mammals, 19 birds, 2 reptiles, 121 plant species and 1 insect species (DEWHA, 2008a);
- feral cats are considered a threat in Australia to 35 species of birds, 36 mammals, 7 reptiles and 3 amphibians (DEWHA, 2008b);
- Rainbow Lorikeets, which are bigger and markedly more aggressive than the native Western Rosella, are likely to outcompete and displace Western Rosellas in south-western Australia (Olsen, Silcocks and Weston, 2006).

The Very High impact of introduced fauna (of regional and/or national significance) recorded in the City, are listed in Table 29.

Table 29 Very High Impact Introduced Animals

Animal	Declared Animal (253 species requiring control or management)	Key Threatening Process (19 processes subject to Threat Abatement Plans)	Vertebrate Pest Animal of National Significance (11 species)
Feral Cat *Felis catus*	Excluded from Declaration.	Predation by Feral Cats	√
European Wild Rabbit *Oryctolagus cuniculus*	A5 - Reduce / control (when at large/ running wild)	Competition and land degradation by rabbits	√
Fox *Vulpes vulpes*	A5 - Reduce / control	Predation by European Red Fox	√

The High impact of introduced fauna (of regional and/or local significance) recorded in the City, are listed in Table 31.

Table 30 High Impact Introduced Animals

Animal	Rationale for Listing as High Impact
European Bee *Apis mellifera*	Feral bees have become an increasing threat to our native hollow-dwelling fauna, particularly black cockatoos, through competition for suitable hollows, and possibly also competition for nectar (Western Australian Museum, 2010).
One-spot Livebearer *Phalloceros caudimaculatus*	This fish is native to fresh/estuarine water of central-eastern seaboard of South America. Worldwide it is not common and has only become well-established in south-western Australia (Maddern, 2008). One-spot Livebearers are not listed in Western Australia but are listed as a noxious species in New South Wales.

A total of four foxes were trapped in 2018-19 control program .Foxes were caught in Ken Hurst and Blackwall Reach Reserves. A low density of foxes are in Ken Hurst, Piney Lakes and Point Walter/Blackwall Reach Reserves and they are moving in and out of these reserves. They infrequently visit Quenda, Booragoon Lake, Blue Gum Lake and Bull Creek reserves. No active fox dens were recorded. (Terrestrial Ecosystems 2019)

Cats were present in reasonable densities in Blue Gum Lake, Bull Creek Reserve, Booragoon Lake, Wal Hughes and Harry Sandon Reserves. Many of these cats are owned and are allowed to roam beyond the owners'residences. Management of free-ranging domestic cats will continue to be an issue without stronger enforcement of the Cat Act 2011 by the City. (Terrestrial Ecosystems 2019)

In 2010, Wynn (2010) has noted that rabbits are present and subject to control by the City in the following four reserves:

- Ken Hurst
- Piney Lakes
- Quenda Wetland
- Wireless Hill

The release of RHDV2 K5 in spring 2018 has had a localised impact on the abundance of rabbits in the City of Melville reserves, but a low density of rabbits is still present in Piney Lakes and Blackwall

Reach Reserves. These rabbits are living above the surface (i.e. under vegetation) instead of digging and living in warrens.(Terrestrial Ecosystems 2019)

The nine introduced birds in Perth listed by Van Delft (Van Delft, 1997), which were established as early as 1897, are:

- Laughing Kookaburra
- Rock Dove
- Laughing Turtle-Dove
- Spotted Turtle-Dove
- Long-billed Corella
- Sulphur-crested Cockatoo
- Rainbow Lorikeet
- Red-browed Finch
- Chestnut-breasted Mannikin.

Of these, the four birds that would compete with native birds for use of tree hollows for nests are:

- Laughing Kookaburra
- Long-billed Corella
- Sulphur-crested Cockatoo
- Rainbow Lorikeet

A total of 64 bee hives were located and removed by contractors to the City in the 2018-2019 treatment year (NatsyncEnvironmental, 2019). The following reserves were monitored for hives:

- Attadale Reserve (West)
- Bateman Park
- Blue Gum Lake
- Booragoon Lake
- Bull Creek Park
- Carawatha Bushland
- Dudley Hartree Park
- Douglas Freeman Park
- Esplanade Foreshore and Thomas Middleton Reserve
- George Welby Park
- Harry Sandon Reserve
- Harry Stickland Park
- Ken Hurst Park
- Peter Bosci Park
- Phillip Jane Park
- Piney Lakes
- Heathcote Reserve
- Point Walter/Blackwall Reach Reserve
- Quenda Wetland
- Reg Bourke Park
- Richard Lewis Park
- Robert Weir/Peter Ellis Park
- Ron Carroll
- Wal Huges Park
- Wireless Hill

One-spot Livebearers are introduced fish that are widely distributed in waterways of the Perth Metropolitan Area having been recorded along the Swan, Canning and Wungong Rovers between Bull Creek, Bayswater, Lesmurdie Brook, Wungong Reservoir (Maddern, 2008). One-spot Livebearers are likely to displace native fish through direct competition rather than predation (Morgan et al., 2004) and an indication of the abundance of these fish can reach is that a total of 47,934 individuals were removed from Bull Creek, at a mean density of approximately 56 fish/m2, by Morgan and Beatty (2006).

Feral Dogs (Canis lupus familiaris) are mentioned in the management plans for some reserves, but are likely a lower risk than the other feral animals discussed above. There are no records of the prevalence of feral dogs in natural areas in the City (Bloomfield, 2019).

4.6. Diseases and Pathogens

4.6.1. Dieback

There are over 50 species of Phytophthora (microscopic water moulds) that occur around the world (Dieback Working Group, 2000) and 32 species are recorded in Australia (Environment Australia, 2001b). All Phytophthora species cause plant diseases (Dieback Working Group, 2000) including:

- Two species which are listed as prescribed diseases in the *Plant Diseases Regulations 1989* under the *Plant Diseases Act 1914* and therefore (unless specified in the Act otherwise) are not allowed entry into Western Australia under any circumstances. These species are *Phytophthora megasperma* f. sp. *glycinea* (Soybean Stem Rot) and *Phytophthora infestans* (Potato Late Blight)
- Nine *Phytophthora* species subject to intrastate control in Western Australia in accordance with Part 4 Division 2 of the *Plant Diseases Regulations 1989* under the *Plant Diseases Act 1914.* These being *Phytophthora fragariae, P. infestans, P. kernoviae, P. meadi, P. palmivora, P. porri, P. ramorum, P. sojae* and *P. syringae.*

Three of the fourteen Phytophthora species that have been recorded in the wild in Australia were identified by Environment Australia (2001) as causing significant damage to biodiversity. These being Phytophthora cinnamomi, P. cryptogea and P. megasperma. Subsequently an additional species, Phytophthora multivora, has been discovered in the wild in Western Australia that is believed to be involved in the decline of Tuart in the wild (Scott et al., 2009).

Phytophthora cinnamomi is:

- the Phytophthora species most frequently recorded in Western Australia (Shearer, 1994);
- listed as a Key Threatening Process under the EPBC Act 1999 and subject of a National Threat Abatement Plan (Environment Australia, 2001b) as discussed in Appendix 1;
- identified by the DBCA (2010e) 'alongside climate change and salinity, [as] one of the major threats to the biodiversity of Western Australia's ecosystems'; and
- can be a consideration in the assessment of Clearing Permit applications under the
- Environmental Protection Act 1986.

Phytophthora cinnamomi is a microscopic water mould that invades the cells of susceptible host and consumes root and basal stem tissue (Dieback Working Group, 2000). This results in lesions that weakens or kills the plants by reducing or stopping the movement of water and nutrients within the plant (Dieback Working Group, 2000). Shearer, Crane and Cochrane (2004) estimated that:

- of the 5710 described plant species in south-west Western Australia, 14% are highly susceptible and 40% are susceptible to Phytophthora cinnamomi; and
- of the plant species in the Banksia woodlands of the Swan Coastal Plain, 15% are highly susceptible and 30% are susceptible to Phytophthora cinnamomi.

Phytophthora cinnamomi has a widespread but discontinuous distribution in areas of the South West with an annual rainfall above 400 mm and has infested more than 20% of the remnant vegetation in the South-West Land Division (Podger, James and Mulcahy, 1996).

Phytophthora cinnamomi is widespread across the Perth Metropolitan Area. The Dieback Working Group (2010) identified Phytophthora cinnamomi infestations in 70% (35 reserves) of the 50 reserves they surveyed in the Perth Metropolitan Area including the following seven reserves:

- Ern Stapleton
- Harry Sandon
- Ken Hurst

- Peter Ellis/Peter Bosci
- Robert Weir
- Wal Hughes
- Wireless Hill

Four types of expressions of Phytophthora cinnamomi infestations are recognised by DBCA (2004). These are shown in Figure 5.

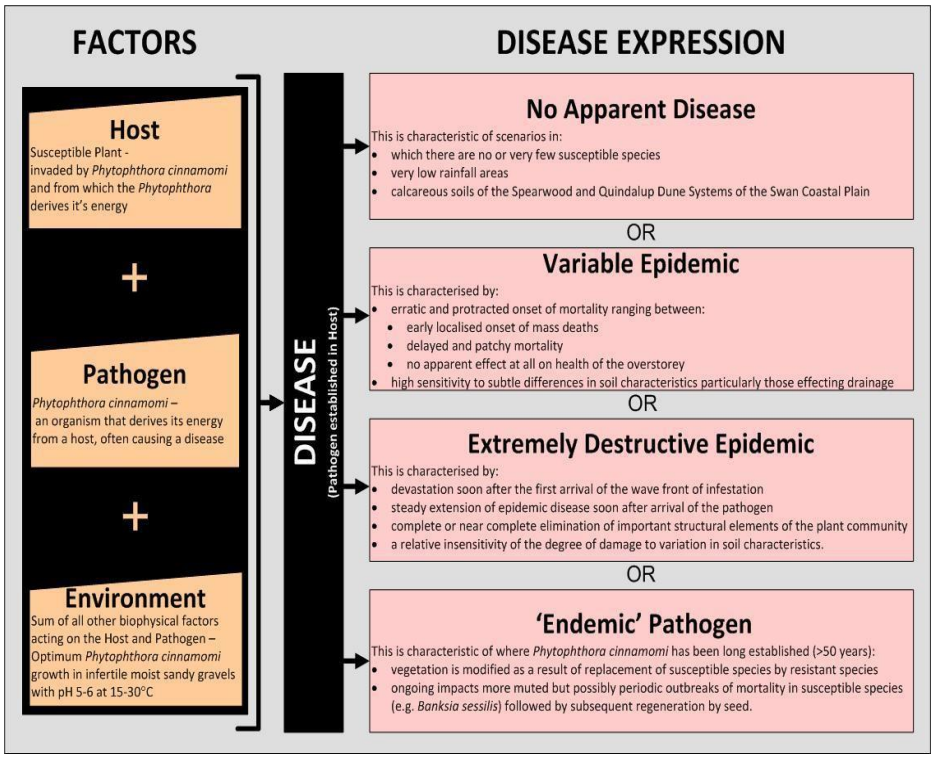

Figure 5 Typical Disease Expressions of *Phytophthora cinnamomi* infestations

The particular expression on a site is determined by the specific combination of the pathogen, host and environmental conditions and the expression can be more affected by soil type and climate than the plant species present. This is reflected in 50% of the species occurring in both Banksia woodland and Jarrah Forest exhibiting dissimilar susceptibilities in the two areas (Shearer, Crane and Cochrane, 2004).

The Dieback Working Group (2010) have noted that the expression of the disease in the Perth Metropolitan Area is largely correlated to soil types:

- the Bassendean sands and the lateritic Jarrah forest soils are highly conducive to the disease, leading to significant impacts of the native vegetation in these areas; and
- the Quindalup and Spearwood coastal dune soils to the west of the Swan Coastal Plain are not conducive to the disease, and impacts can be so limited that identifying infestations can be difficult.

In Banksia woodland on the Swan Coastal Plain infested sites have an average of 7 fewer plant species and a substantial loss of vegetation biomass (Shearer, 1994). Of the 435 native plant species recorded in the City of Melville 9% (39 species) are listed as highly susceptible to dieback on the Swan Coastal Plain by the DBCA (2010a). The loss of dominant and abundant species can lead to irreversible and conspicuous decline in biodiversity (Shearer, Crane and Cochrane, 2004) and infestations can be associated with the replacement of trees and shrubs by sedges and rushes (Wills and Keighery, 1994).

In the City, five of the ten species occurring in the most number of reserves are highly susceptible to

Phytophthora cinnamomi. These species are listed in Table 31.

Table 31 Widespread Native Plants in Melville that are Highly Susceptible to *P. cinnamomi*

Plant Species		Lifeform	Number of Reserves Recorded in
Slender Banksia	*Banksia attenuata*	Tree	44
Firewood Banksia	*Banksia menziesii*	Tree	43
Blueboy	*Stirlingia latifolia*	Shrub	40
Sheoak	*Allocasuarina fraseriana*	Tree	33
Yellow Buttercups	*Hibbertia hypericoides*	Shrub	32

4.6.2. Other Diseases and Pathogens

Shearer (1994) recorded that after the group of root rots that includes the *Phytophthora* species, thenext two most often reported diseases of native plants in Western Australia are:

- Rusts; and
- *Armillaria luteobubalina* root rot.

The other disorders observed in natural area reserves in the City by Bloomfield (2019) are:

- Cankers; and
- Mundulla Yellows.

Rusts

Rust pathogens are fungi that are widespread in south west Western Australia and probably endemic (Shearer, 1994). Their effects include growth deformities such as 'witches brooms' (the proliferation of small, accessory shoots at the end of branches), galls (swellings or elongated growth), early death of leaves, and reduced flowering, fertilisation and seed set, and the death of hosts in severe infections (Shearer, 1994). The plants affected, are frequently from the families of Acacia (MIMOSACEAE), Kangaroo Paws (HAEMODORACEAE) and orchids (ORCHIDACEAE) (Shearer, 1994).

The rust Uromycladium tepperianum was recorded by Davison (2010) on live Acacia saligna shrubs during 2008 and/or 2010 in the following nine reserves:

- Ern Stapleton Reserve
- Harry Sandon Reserve
- Richard Lewis Park
- George Welby Park
- Bull Creek Wetlands
- Booragoon Lake
- Piney Lake
- Blue Gum Lake
- Reg Bourke Park

Armillaria

Armillaria luteobubalina is an indigenous parasitic mushroom that is widespread in south west Western Australia that causes decay in roots and stems that can result in the death of the host plant (Shearer, 1994). The plants affected, are frequently from the families of Grevillea (PROTEACEAE), Eucalyptus (MYRTACEAE) and Acacia (MIMOSACEAE) (Shearer, 1994).

Shearer (1994) characterised the four possible expressions of Armillaria luteobubalina as being:

1. an expanding patch of dead and dying hosts;
2. dead hosts occurring frequently, but at random, in patches;
3. dead hosts occurring infrequently, but individually, or at random in patches;
4. small patches of dead and dying hosts occurring in young stands, but the patches of mortality fail to expand as the stand ages.

Armillaria luteobubalina occurs most frequently in coastal dunes and to the forests east of the Darling Scarp (Shearer, 1994). It does occur in the Spearwood Dune System (which is in the west of the City of Melville) but rarely in the more acidic Bassendean Dune system (which is in the east of the City of Melville) (Shearer, 1994). No occurrences of Armillaria luteobubalina have been documented in the City.

Mundulla Yellows

Mundulla yellows is a syndrome in which eucalypt trees decline or die, in association with a characteristic yellowing of leaves. It has been hypothesised that a phytoplasma or virus is involved (Keane et al., 2000).

Banksia Canker

Cankers are a fungus-disease which cause lesions (black patches and sunken or flattened areas) on stems. This disease is usually of only a minor nature, although plants may become stunted through the death of parts of a plant (Jones and Elliot, 1995).

4.7. Stormwater

Alteration of natural water regimes is now recognised as a major contributor to loss of biodiversity and functionality of aquatic and terrestrial ecosystems (EPA, 2007).

The Department of Environment (2004) listed the impacts of water runoff from changes in the volume and rate of water flow in urban environments as including:

- changes to vegetation and habitat loss;
- flooding; and
- erosion and sedimentation.

Kobryn (2001) listed the potential impacts from contaminants in stormwater as including:

- deposit of particulate matter from sediment;
- hygiene issues associated with bacteria and viruses;
- eutrophication from nutrients;
- chronic toxicity from heavy metals, pesticides, oils and surfactants;
- acute toxicity from degradation of organic carbon, pH, low oxygen levels and toxic substances; and
- compromised aesthetics from debris and rubbish accumulation.

There are no contaminated sites registered under the Contaminated Sites Act 2003 (as discussed in Appendix 1) in natural areas within the City (DBCA, 2010b) but contaminants have been recorded in waterbodies. There may however be potential contamination issues associated with former landfill and illegal dumping sites (Wynn, 2019).

The *City of Melville Stormwater Management Strategy* (City of Melville, 1997) cited previous reports documenting stormwater as a significant source of nutrients and heavy metals in Booragoon Lake.

A baseline study of contaminants in the Swan and Canning catchment drainage system (Nice et al., 2009) found that a number of contaminants exceeded ANZEEC guidelines in Bull Creek. These contaminants and their typical sources were identified by Nice et al (2009) as:

- **Microbial Levels (faecal coliforms and enterococci)**
  Their presence can be attributable to a variety of sources including sewer overflow and septic tanks;
- **Polycyclic Aromatic Hydrocarbons (PAHs)**
  PAHs are typical components of asphalts, fuels, oils, greases, creosote and roofing tar and are also formed during the incomplete burning of fuels, refuse and other organic substances;
- **Total Petroleum Hydrocarbons (TPHs)**
  TPHs originate from crude oil, are relatively volatile and are most likely to enter the environment as a result of road runoff containing vehicle fuel and oils);
- **Metals (Aluminium, Chromium, Copper, Iron And Zinc)**
  Metals are commonly found in road runoff containing fuel and oil combustion by-products, products of tyre and brake wear and roof runoff. Additionally, atmospheric emissions from oil and coal combustion and from smelting and mining activities can contribute metals to the environment; and
- **Nutrient Levels (Nitrogen in the form of Ammonium)**
  Natural sources of nutrients include weathering of rock, fixation of atmospheric nitrogen by plants, decomposition of biological material and leaching of soils. Anthropogenic nutrient sources include the application of fertilisers, use of domestic detergents and soaps and urban runoff.

4.8. Reticulation

The overspray of water from the reticulation of lawn areas can impact upon natural areas as additional water can facilitate the establishment and dominance of weeds.

Approximately 60% (30) of the natural areas reserves have lawn areas immediately adjacent to bushland areas.

4.9. Acid Sulfate Soils

Whilst Acid Sulfate Soils (ASS) are naturally occurring soils (most commonly occur in low-lying land

bordering the coast or estuarine and saline wetlands, and freshwater groundwater dependent wetlands), the disturbance of these soils can initiate chemical reactions between iron sulphides in the soil and oxygen and the DBCA (2009a) has documented that:

> *[t]he disturbance of ASS, and its exposure to oxygen, has the potential to cause significant environmental and economic impacts including fish kills and loss of biodiversity in wetlands and waterways; contamination of groundwater resources by acid, arsenic, heavy metals and other contaminants, loss of agricultural productivity, and corrosion of concrete and steel infrastructure by acidic soil and water.*

Areas of disturbed ASS, may be classified as contaminated sites under provisions of the Contaminated Sites Act 2003, as discussed in Appendix 1.

The WAPC has published maps of the preliminary risk from acid sulphate soils in Map 5 and sampling has confirmed that acidification of sediments is not currently an issue at Bull Creek but may potentially be of concern if disturbed, and complete oxidation occurred (Nice et al., 2009).

4.10. Climate Change

Regional groundwater levels are declining in the Perth Metropolitan Area due to a number of causes including the regional impact of the climate becoming hotter and drier (McHugh and Bourke, 2008). The annual rainfall in south-west WA has declined by about 10% since the mid 1970s (Hope and Foster, 2005).

On the Swan Coastal Plain, shallow unconfined aquifers provide water to a significant portion of the wetlands and vegetation, and McHugh and Bourke (2008) documented that declining water levels in shallow groundwater systems have been linked with:

- negative ecological changes and loss of biodiversity (due to lack of water); and
- increased risks associated with acid sulphate soils (ASS) (due to previously water saturated anaerobic soils becoming exposed to oxygen as a water table falls), which is discussed in Section 0.

There are a number of Department of Water groundwater monitoring bores for which changes in groundwater levels over significant timeframes can be assessed. Their locations are shown in Map 6.

The depths to groundwater in the City, in the proximity of the Swan-Canning Estuary, over an eight year period are shown in Figure 6.

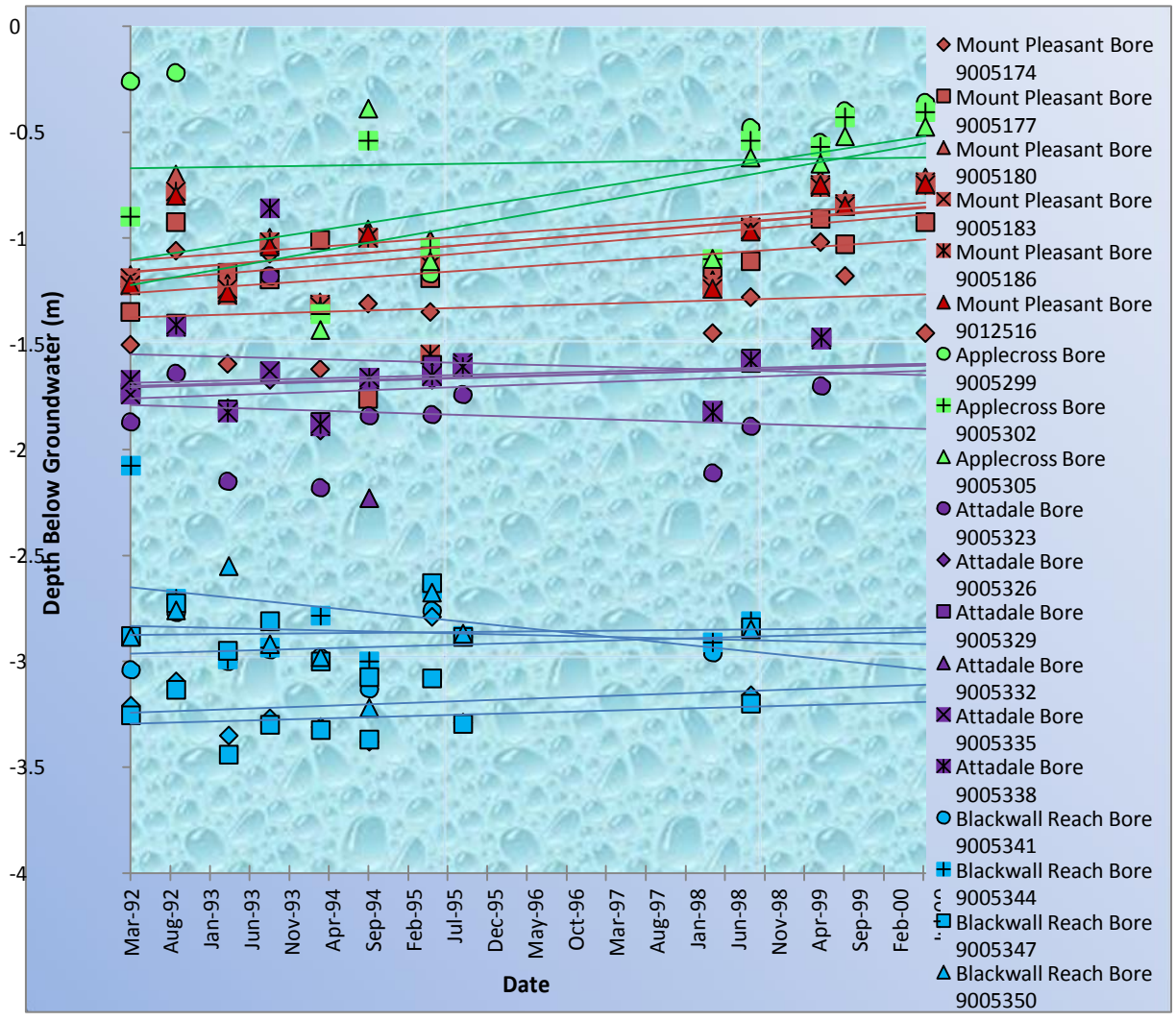

Figure 6 Groundwater Levels in Unconfined Swan Aquifer near Swan-Canning Estuary

The groundwater levels in the proximity of the Swan-Canning Estuary shown in Figure 7 remained constant over the eight year period reported. This would be expected as the conceptual models and imperial data of Westbrook *et al.* (2005) show that hydrodynamics result in water preferentially flowing from the groundwater aquifer into the estuary at the estuary's shoreline (water surface). The groundwater contours shown in Figure 7 show that the groundwater falls from approximately 25 m above sea level in Ken Hurst Park in the south-east of the City to sea level along the Swan-Canning Estuary along the north of the City.

The trends in the depth of groundwater elsewhere in the City are shown in Figure 7

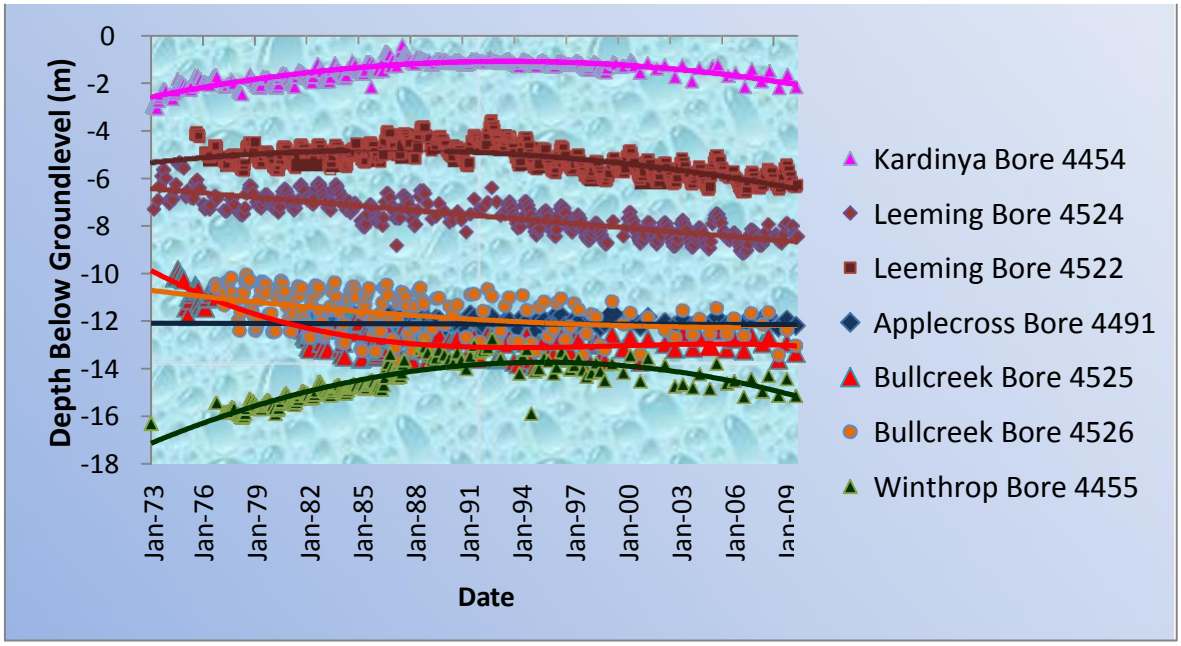

Figure 7 Groundwater Levels in Unconfined Swan Aquifer distant to Swan-Canning Estuary

In the two decades from 1973 onwards the groundwater levels at different sites exhibit different trends and this may reflect differences in localised changes in land use. McHugh and Bourke (2008) listed localised influences on groundwater levels as including land use, vegetation, urbanisation and groundwater abstraction.

From the early 1990s onwards, there appears to be a general downward trend in groundwater levels across the four bores that are some distance from the Swan-Canning Estuary (in the suburbs of Kardinya, Leeming and Winthrop).

Interactions between lakes and groundwater are site specific but most lakes and wetlands on the Swan Coastal Plain are connected to regional groundwater systems via the superficial aquifer (McHugh and Bourke, 2008) and water levels in Booragoon Lake were the lowest in recent history when reviewed by McHugh and Bourke (2008).

Vegetation requires access to a considerable amount of water. Studies in Western Australia have shown that the average amount of water extracted from the soil for a range of tree species and soil types is 663 mm per year, or 6.63 million litres per hectare (ML/ha) and that, where groundwater is shallow, tree plantations may extract 3-4 ML/ha per year from groundwater aquifers (Thompson, n.d.).

The impacts from changes to groundwater depth are generally proportional to the rapidity, magnitude and permanence of the change in depth (Dodd and Heddle, 1989a). The impact can range from reduced growth associated with stress through to death of plants. There appears to be a number of reserves in the City where the native vegetation is exhibiting stress from a lack of water (Bloomfield, 2019).

The impact of climate change can potentially be mitigated to some degree at the scale of the City, through managing impacts from a falling water table associated with a regional decline in rainfall. The City of Melville has limited capacity to directly manage groundwater because it is a regional issue and the Department of Water is the agency responsible for managing the state's water resources. The City of Melville however can limit some of the impacts of the threat of changes to groundwater levels through:

- a *Weed Control Strategy* that limits the degree to which weeds compete with native plants for groundwater (see section5.3); and
- a *Revegetation Strategy* that considers the susceptibility of plant species to cope with changes in groundwater levels (see section 5.4).

Other strategies within the City that can be used to reduce impacts on groundwater include the Streetscape Strategy and Public Open Space Strategy.

5. MANAGEMENT DOCUMENTS

5.1. Signage, Path and Barrier Guidelines

This guideline sets out guiding principles of access management. Patterns of public movement and activity in reserves can be modified (to manage physical disturbance and trampling) through signage, paths and barriers. It covers:

- Materials and specifications;
- Priority areas for access management; and
- Hygiene requirements in construction

5.2. Bushfire Management Guidelines

This guideline sets out the process for managing bushfire risk in bushland reserves, and covers:

- Ignition and fuel reduction;
- Wildfire suppression; and
- Assisted regeneration.

5.3. Weed Control Guidelines

This guidelines sets out the process to be undertaken for weed management across the City, guidelines for resource optimisation and weed control techniques applicable to different weed species. It assesses weed distribution, invasiveness and ecological impact when determining a priority list of weeds for management.

5.4. Revegetation Guidelines

Revegetation is a strategy to displace current or potential weed infestations by re-establishing native plants in a site, and to increase biodiversity. It can also be used as a tool to introduce habitat resources for endangered fauna. This guideline formalises the City's approach to revegetation with regard to:

- resource optimisation;

- revegetation techniques to use utilised; and
- success criteria and monitoring.

5.5. Feral Animal Control Strategy

This guideline formalises the City's approach to feral animal control. The impact of feral animals can be managed through:

- direct control of feral animals and techniques;
- limiting spread and reducing physical disturbance through Signage, Path and Barriers Guidelines and Revegetation Guidelines; and
- guidelines for resource optimisation across the City.

5.6. Disease and Pathogen Strategy

This guideline formalises the approach to disease and pathogen management, and strategies for minimising the impact. Reserves which have been assessed for presence of Phytophthora Dieback have been prioritised into areas of protectable and unprotectable reserves. This guidelines covers:

- containment / hygiene boundaries;
- priorities for hygiene implementation;
- treatment techniques for infected and potentially infected plants (e.g. with Phosphite); and
- priorities for treatment.

5.7. Stormwater Quality Management Guidelines

This guideline complements the City's Stormwater Environmental Management Plan (GHD, 2015), but goes beyond a capital works project plan to cover the City's approach to managing stormwater quality in receiving water bodies and other sensitive environments. This guidelines covers:

- general design approach;
- hydraulic design;
- pollution control design;
- catchment hygiene; and
- community education.

5.8. Reticulation Guidelines

The development of Reticulation Guidelines would formalise the City's operations that:

- maintain reticulation systems to limit water leaks;
- direct reticulation sprays away from bushland; and
- prioritisation of resources to optimise environment benefit.

5.9. Acid Sulfate Soil Guidelines

This guideline sets out the process for assessing and managing acid sulphate soils, with direct links to the application of Department of Environment and Regulation guidelines 2015:

- *Identification And Investigation Of Acid Sulphate Soils And Acidic Landscapes; and*
- *Treatment And Management Of Acid Sulfate Soils And Water In Acid Sulfate Soil Landscapes.*

5.10. Environmental Community Engagement Guidelines

Environmental Community Engagement Guidelines build upon two existing documents to formalise the involvement of parties such as friends groups, government agencies, universities and schools in partnerships and activities such as research.

- *A Strategic Community Plan for City of Melville: People Places Participation 2016-2026; and*
- *Friends Group Manual.*

6. MONITORING

6.1. Outcomes

To achieve the City's vision of 'Working together to achieve community wellbeing for today and tomorrow.' six community priority outcome areas have been identified as shown in Figure 8.

Figure 8 City of Melville Key Outcome Areas

These outcome areas have led to the creation of goals and the identification of how the City can best meet these goals. The City's performance will be monitored annually through an Outcome Reporting Dashboard and the Indicators identified in these dashboards will form the basis for monitoring natural areas.

To assist in reporting on these higher level indicators, leading and lagging indicators will be the measures used.

6.2. Review of Strategy Effectiveness

6.2.1 Leading Indicators (Trends in Threats)

To ensure that strategies are effective in maintaining and enhancing biodiversity (by limiting or reducing the impacts of threats) some direct monitoring of the extent and level of impacts and the extent, abundance and quality of assets is required. The data collection for these reviews is the function of the Strategic Reserve Plans.

Leading indicators (trends in threats) indicate whether guidelines and procedures are being effective in managing the risks to assets, and provide a feedback mechanism as to whether

guidelines and procedures need to be modified.

The direct monitoring of the degree to which threats are being limited or reduced will be finalised after the development of all the strategies, but indicative monitoring indices are is provided shown in Table 32.

Table 32 Indicative Monitoring of Threats Leading Indicators

Threat	Monitoring
Physical Disturbance	• Number , location and timing of occasions rubbish and garden waste material observationdumped • Number and lLength of informal tracks • Number of disturbances of heritage sites (e.g. artefact collection)
Fire	• Cause, timing, locationNumber of and extent of all large fires (fires that burn > 50% of a vegetation type in a reserve) • Number of multiple fires (fires burning the same area within eight years)
Weeds	• Inventories of weed species by reserves • The location, extent and and density ofdensity of specified weeds / groups of weeds* (which may be done for individual species, or groups of species depending upon significance, ease of monitoring and uniformity of control method)
Feral Animals	• Number and location of occasions feral animals are recorded in reserves • Number of occasions bird and bat boxes are occupied by feral animals
Diseases and Pathogens	• Location and eExtent of infestations
Stormwater	• Physio-chemical indicators for water qualityContaminants in wetlands
Reticulation	• Number of occasions sprinklers and shrubheads resulting in additional water in natural areas (via leaking/spraying)
GroundwaterClimate Change	• Changes in wWater table levels changes in terms of trend direction (rising or falling water tables), rates of change and total long-term change in height • Changes in water levels in wetlands
Acid Sulfate Soils	• Cause, timing, location and extentNumber of all ground disturbance potentially resulting in acid sulphate reactions in the soil
Habitat Loss	• Total extent of areas > 250m^2 where <75% of native plants or natural litter • Total extent of areas > 100m^2 where there are no native plants or natural litter
Habitat Loss	Percent of bushland in each category of Bushland Condition across selected (higher value) reserves and sites Percent of potential habitat and linkages, functionally appropriate for maintaining significant flora and fauna species

*Generally extent and density of geophytes and grass infestations recorded
Individual shrubs and trees (and whether flowering/seeding) recorded

6.3. Lagging Indicators (Trends in Assets)

Lagging indicators (trends in assets) indicate whether strategic goals of maintaining and enhancing biodiversity are being met. Reporting on trends in the abundance and quality of assets is the function of the Strategic Reserve Plans. The direct monitoring of the degree to which the management of threats is resulting in the maintenance or enhancement of biodiversity will be finalised after the development of all the strategies, but indicative monitoring is provided in Table 33.

Table 33 Monitoring Assets Lagging Indicators

Assets	MonitoringIndicator
Bush Forever Reserves	• Monitored in terms of sites and speciesContinued ability for each r eserve to meet Bush Forever Criteria for which reserveit was listed by WAPC under for Bush Forever policy (relevant criteria varies between reserves)
Ecological Community Sites	• Percent Extent of target bushlandsites* in each category of Bushland Condition across Priority Ecological Communities • Extent and intensity of grazing by feral herbivores (rabbits)
Fauna Habitat Sites	• Number of Very Large Trees • Persistence of habitat for target species*
Wetland Sites	• Physio-chemical indicators for water quality • Water levels in wetlands • Persistence of wetland-dependent specieswaterbodies
Heritage Sites	• Number of uncleared/undisturbed reference heritage sites available for surveys that are comparable to baseline (i.e. number of sites that remain uncleared)
Community Interest Sites	• Number and size of active community groups • Total area time volunteered by to which community groups are committing time
Reference Sites	• Number of relocatable uncleared/undisturbed reference sitesNumber of reference site available for surveys that are comparable to baseline (i.e. number of sites that remain uncleared)
Native Flora Species	• Persistence of habitat for target species*
Native Fauna Species	• Persistence of habitat for target species*
Native Flora Species	• Number of native species recorded in each reserve Continued presence, or number of individuals and/or populations and extent of: rare and priority flora fire susceptible species dieback susceptible species species with restricted occurrences in the City
Native Fauna Species	• Number of native species recorded in each reserve Continued Presence, or number of individuals and/or populations and extent of: threatened, specially protected and priority flora fire susceptible species species with restricted occurrences in the City

* Target species identified in risk assessment in Section 3**.**

7. IMPLEMENTATION

7.1. Strategic Reserve Plans

Priorities for management of natural areas and biodiversity are identified through the Strategic Reserve Management Plans. The reserves to be captured in the strategic reserve management plans are listed in Table 34 below.

Table 34 Proposed Strategic Reserve Plans

Strategic Reserve Plan	Reserves
Ken Hurst	Ken Hurst
Wireless Hill	Wireless Hill
Piney Lakes	Piney Lakes
Quenda Wetland	Quenda Wetland
Blue Gum Lake	Blue Gum Lake
Booragoon Lake	Booragoon Lake
Bull Creek	Bateman Bull Creek Reg Bourke Richard Lewis Trevor Gribble
Estuarine (Blackwall Reach to Heathcote)	Attadale Bushland Reserve Blackwall Reach Point Walter Jeff Joseph
Heathcote	Heathcote
North-west Reserves	Ern Stapleton Harry Sandon Wal Hughes
South-east Reserves	Douglas Freeman Dudley Hartree Peter Ellis PJ Hanley Peter Bosci William Hall Phillip Jane Robert Weir Beasley Reserve Bill Brown
Eastern Reserves	George Welby Ron Carroll Tom Firth
Central Reserves	Ken Ingram Connelly Park Harry Stickland Hatfield Park Len Shearer Reg Seal Al Richardson
Modified Natural Areas on Bassendean Soils	Alec Lambert Bainton Elizabeth Manion Fred Johnson Harry Baker Hugh Corbett Jim Ainsworth Norm Godfrey Red Gum Park Trevor Knowles
Modified Natural Areas on Karrakatta Soils	Harold Field Olding Park Art Wright Arthur Kay William Reynolds Bob Crawford

7.2. Operational Plans

Operational Plans will be developed annually to prioritise actions for the year from the Strategic Reserve Plans. They will detail on-ground, operational tasks to be undertaken for the financial year, in line with the annual budgeting process. Operational Plans incorporate the following:

- DFES Emergency Response Plans
- Bushland Reserve Check Lists
- Maintenance Schedules
- Capital Works projects
- Photomonitoring audits
- Nestbox audits
- Management Plan audits

7.3. Environmental Management System

The City of Melville has an Environmental Management System (EMS) in accordance with ISO14001.

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APPENDICES

APPENDIX 1: KEY LEGISLATION AND POLICIES

The outline of relevant legislation and government policies are included to draw attention to a number of important drivers for prioritising the management of assets and threats, such as statutory requirements to either undertake certain actions or avoid causing environmental harm. This is not intended to address every aspect or piece of the relevant legislation or policy. The City of Melville's Environmental Management System (EMS), which contains a legal register, is the mechanism through which the City assesses it's compliance with legal obligations.

AUSTRALIAN FEDERAL LEGISLATION AND POLICY

Environment Biodiversity Protection Act 1999

The objectives of the Environment Biodiversity Protection Act 1999 (EPBC Act 1999) are to:

- provide for the protection of the environment, especially matters of national environmental significance;
- conserve Australian biodiversity;
- provide a streamlined national environmental assessment and approvals process;
- enhance the protection and management of important natural and cultural places;
- control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife; and
- promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources.

Matters of National Environmental Significance

Under the EPBC Act 1999, actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Australian Government Minister for the Environment, Heritage and the Arts.

The eight matters of national environmental significance protected under the EPBC Act 1999 are:

- world heritage properties;
- national heritage places;
- wetlands of international importance (listed under the Ramsar Convention);
- listed threatened species and ecological communities;
- migratory species protected under international agreements;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park; and
- nuclear actions (including uranium mines)

Other matters protected:

- the environment, where actions proposed are on, or will affect Commonwealth land and the environment; and
- the environment, where Commonwealth agencies are proposing to take an action.

Key Threatening Processes

Under the EPBC Act 1999 the Commonwealth can establish threat abatement plans to establish a national framework to guide and coordinate Australia's response to key threatening processes.

A threatening process is defined as a key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community (e.g. if it could cause a native species or ecological community to become eligible for inclusion in a threatened

list (other than the conservation dependent category); or cause an already listed threatened species or threatened ecological community to become more endangered; or adversely affect two or more listed threatened species or threatened ecological communities).

Key threatening processes that have threat abatement plans under the EPBC Act 1999 include the:

- rabbit;
- European Red Fox;
- feral cat; and
- dieback caused by the root-rot fungus *Phytophthora cinnamomi*

WESTERN AUSTRALIAN LEGISLATION AND POLICY

Biodiversity Conservation Act 2016

The Biodiversity Conservation Act 2016 replaces the Wildlife Conservation Act 1950 and provides protection for species, threatened ecological communities, key threatening processes, and critical habitats. The Act also establishes recovery plans and other modern features of biodiversity conservation and management.

The Act imposes significant new fines. Penalties of up to $500,000 for individuals and $2.5 million for body corporates may be imposed for taking threatened flora, or taking, possessing or disturbing threatened fauna. These fines are a substantial increase from the previous $10,000 penalties under the Wildlife Conservation Act 1950 (WA).

Aboriginal Heritage Act 1972

The Aboriginal Heritage Act 1972 protects all places and objects in Western Australia that are important to Aboriginal people because of connections to their culture and the WA Department of Indigenous Affairs maintains a Register of Aboriginal Sites.

Part IV, section 17 of the Act makes it an offence, unless acting with the authorisation of the Registrar of Aboriginal Sites or the consent of the relevant Minister, to:

- excavate, destroy, damage, conceal or in any way alter any Aboriginal site; or
- in any way alter, damage, remove, destroy, conceal, or deal with in a manner not sanctioned by relevant custom, or assume the possession, custody or control of, any object on or under an Aboriginal site.

Part IV, section 16 and section 18, identify mechanisms for the excavation and use of Aboriginal Sites respectively.

Biosecurity and Agriculture Management Act 2007

The new BAM Act takes the place of 16 older Acts and 27 sets of regulations with one Act and nine sets of regulations.

The BAM Act 2007 purpose is to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering Western Australia.
- Manage the impact and spread of those pests already present in the state.
- Safely manage the use of agricultural and veterinary chemicals.
- Increased control over the sale of agricultural products that contain violative chemical residues.

The BAM Act 2007 classifies organisms based on the following categories, and their status can be searched on the Western Australian Organism List (WAOL). The Minister for Agriculture and Food may declare an organism to be one of the following:

- Permitted Organism – as a general rule these may to be brought into the State, but they must be imported in accordance with any relevant regulations.
- Prohibited Organism – the Minister may declare any harmful organism (including diseases other than human diseases) to be a prohibited organism or declared pest if it has, or may have, an adverse effect on any other organism; human beings; the environment or part of the environment; or agricultural, pastoral, or other primary industries such as forestry or aquaculture. While human diseases would not be covered under these arrangements, zoonotic diseases (diseases that affect both humans and animals) and insects that can carry or transmit human diseases may be declared.
- Unlisted Organism – all other organisms are considered to be unlisted and are restricted from entering the State except under permit. Pests that are unlisted may be categorised and placed on either the permitted, prohibited or declared pest list.
- Declared Pest – the Minister may declare harmful organisms that are present within an area of the State to be a declared pest. Declared pests can then be appropriately controlled and can be assigned to a control category to assist this. Control categories include:
    - C1 exclusion
    - C2 eradication
    - C3 management

The BAM Act 2007 is administered by the Department of Agriculture and Food (DAFWA). There is little change to the responsibilities from the previous Agriculture and Related Resources Protection Act (ARRP 1976).

Heritage of Western Australia Act 1990

The objectives of the Heritage of Western Australia Act 1990 are:

- to identify, conserve and where appropriate enhance those places within Western Australia which are of significance to the cultural heritage;
- in relation to any area, to facilitate development that is in harmony with the cultural heritage values of that area; and
- to promote public awareness as to the cultural heritage, generally.

The Act includes requirements and/or provisions for the State of Western Australia to:

- compile and maintain a Register of Heritage Places;
- enter into Heritage Agreements with the owner or occupier of a registered place;
- provide, or arrange for, financial, technical or other assistance to help in, or as an incentive for, the recording, conservation or presentation of a registered place; and
- provide special protection in the form of a Conservation Order (e.g. Stop Work Order) and/or Restoration Order.

Bush Forever WAPC Policy 2000

Bush Forever was a non-statutory policy of the Western Australian Planning Commission (WAPC) that applies to the Swan Coastal Plain portion of metropolitan Perth Metropolitan Region (PMR) and:

- identifies regionally significant bushland;
- seeks to conserve threatened ecological communities and to protect a target figure of at least 10 per cent of the 26 original vegetation complexes;

- has also been endorsed by the Western Australian Government and the Environmental Protection Authority (EPA) as a whole-of-government bushland protection policy;
- applies guidelines set by the World Conservation Union;
- fulfilled the Western Australian government's commitment to prepare a strategic plan for conservation as identified in the 1995 Urban Bushland Strategy;
- will contribute significantly to achieving the core objectives of the 1996 National Strategy for the Conservation of Australia's Biodiversity.

Bush Forever sites:

- are included under the definition of Environmentally Sensitive Areas, in Environmental Protection (Clearing of Native Vegetation) Regulations 2004; and
- will be given statuary protection upon the complementary statutory planning measures of the Metropolitan Region Scheme Omnibus Amendment No. 1082/33 (Bush Forever and related lands) and Bushland Policy For The Perth Metropolitan Region Statement Of Planning Policy 2.8 coming into effect.

Metropolitan Region Scheme Omnibus Amendment No. 1082/33 (Bush Forever and related lands)

The purpose of this major amendment, which has been endorsed by the Western Australian Planning Commission is to:

- to create Bush Forever Protection Areas over Bush Forever sites zoned and reserved in the Metropolitan Region Scheme; and
- reserve a number of Bush Forever sites and related lands for parks and recreation.

A Draft Bushland Policy for The Perth Metropolitan Region Statement Of Planning Policy 2.8

This policy, when finalised and endorsed, will provide a:

- a statutory policy and implementation framework for the protection and management of regionally significant bushland within a Bush Forever protection areas; and
- policy measures for other areas of native vegetation, outside Bush Forever protection areas, that support the preparation of local bushland protection strategies by all local governments in the Perth.

Contaminated Sites Act 2003

Areas of Acid Sulfate Soils (ASS), may be classified as contaminated sites under provisions of the Contaminated Sites Act 2003, where disturbance results in land, water or a site:

> *having a substance present in or on that land, water or site at above background concentrations that presents, or has the potential to present, a risk of harm to human health, the environment or any environmental value.*

Section 11 of the Contaminated Sites Act 2003 establishes a duty to report contaminated sites for persons including:

- an owner or occupier of the site; and
- a person who knows, or suspects, that he or she has caused, or contributed to, the contamination.

Section 19 of the Contaminated Sites Act 2003 requires that the CEO fo the Health Department keeps an accurate and up to date contaminated sites database containing a list of all sites classified as:

- contaminated — remediation required;
- contaminated — restricted use; or
- remediated for restricted use.

Section 25 of the Contaminated Sites Act 2003 establishes a responsibility to remediate a contaminated site by the Person who caused, or contributed to, contamination.

If Acid Sulfate Soils are not managed appropriately, environmental harm as defined in the EPBC Act 1986 may also result.

Swan and Canning Rivers Management Act 2006

The Swan and Canning Rivers Management Act 2006 sets out the conditions under which the Swan and Canning Rivers are managed, and the role and function of the Swan River Trust and Director General of Department of Biodiversity, Conservation and Attractions. This includes:

- The Swan Canning River Reserve remains vested with the Swan River Trust, but the waterway is managed on its behalf by the Department of Parks and Wildlife.
- Identification of a Development Control Area (DCA), incorporating the Riverpark and the Riverpark shoreline to the high water mark, as vested with Swan River Trust for overseeing development within the Riverpark.
- Permits and licencing associated with development within the Riverpark
- Identifying Schedule 5 Authorities for managing land adjacent to or within the DCA

APPENDIX 2: REGIONALLY SIGNIFICANT ASSETS

DBCA – Ecological Community Codes

Presumed Totally Destroyed (PD)

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B):

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats **or**

B) All occurrences recorded within the last 50 years have since been destroyed

Critically Endangered (CR)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more of** the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% **and either or both** of the following apply (i or ii):
   - i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to DBCAline such that total destruction of the community is imminent (within approximately 10 years);
   - ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):
   - i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);
   - ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;
   - iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):

   i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrencesare continuing to DBCAline such that total destruction of the community is likely in the short term future (within approximately 20 years);

   ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):

   i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

   ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

   iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community that has been adequately surveyed and is found to be DBCAlining and/or has DBCAlined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Priority One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:

(ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;

(iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.

(a) Rare Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

(b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(c) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

DBCA – Flora Codes

Declared Rare Flora - Extant Taxa

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

Declared Rare Flora - Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

Priority One - Poorly known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for DBCAlaration as 'rare flora', but are in urgent need of further survey.

Priority Two - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for DBCAlaration as 'rare flora', but are in urgent need of further survey.

Priority Three - Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for DBCAlaration as 'rare flora' but are in need of further survey.

Priority Four - Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

DBCA – Fauna Codes

Priority One: Taxa with few, poorly known populations on threatened lands

Taxa which are known from few specimens or sight records from one or a few localities on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to DBCAlaration as threatened fauna.

Priority Two: Taxa with few, poorly known populations on conservation lands

Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to DBCAlaration as threatened fauna.

Priority Three: Taxa with several, poorly known populations, some on conservation lands

Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to DBCAlaration as threatened fauna.

Priority Four: Taxa in need of monitoring

Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. **Priority Five: Taxa in need of monitoring (conservation dependent)**

Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

APPENDIX 3: FLORA INVENTORIES

Taxa	Total	Al Richardson	Alec Lambert	Attadale	Art Wright	Arthur Kay	Bainton	Beasley	Bill Brown	Blackwall Reach	Blue Gum Lake	Bob Crawford	Booragoon	Bull Creek	Carawatha	Colleran Park/Ken Ingram	Connelly	Douglas Freeman	Dudley Hartree	Elizabeth Manion	Ern Stapleton	Fred Johnson	George Welby	Harold Field	Harry Baker	Harry Sandon	Harry Stickland/LenShearer	Hatfield	Heathcote	Hugh Corbet	Jeff Joseph	Jim Ainsworth	Ken Hurst	Norman Godfrey	Olding	Peter Bosci	Peter Ellis	Phillip Jane	Piney Lakes	PJ Hanley	Point Walter	Quenda	Reg Seal	Red Gum (Ellis Rd)	Richard Lewis	Robert Crawford	Robert Weir	Ron Carroll	Tom Firth	Trevor Gribble	Trevor Knowles	Wal Hughes	William Hall	William Reynolds
Acacia applanata	3										1																																								1	
Acacia cochlearis	7	1								1		1															1	1	1																	1								
Acacia cyclops	12	1		1						1		1										1			1				1		1				1				1			1				1							
Acacia huegelii	11										1					1					1				1		1				1							1									1				1		
Acacia lasiocarpa	6				1					1	1																										1			1													
Acacia pulchella	32	1								1	1		1	1	1		1	1	1	1	1	1	1	1		1		1		1		1		1			1	1	1		1	1	1	C		1	1	1			1	1	
Acacia rostellifera	5									1																		1		1				1														1				
Acacia saligna	40	1	1		1					1	1	1	1	1	1	1	1		1		1	1	1	1		1	1	1	1		1	1	1		1	1			1	1	1	1			1	1	1	1	1		1		
Acacia saligna subsp. lindleyi	1												1																																								
Acacia sessilis	2																																																				
Acacia stenoptera	28	1					1	1			1		1	1	1	1	1	1	1							1	1	1				1			1	1	1	1	1	1			1		1		1	1	1			1		
Acacia tetragonocarpa	1																																					1															
Acacia willdenowiana	17	1					1	1			1			1			1									1	1									1		1	1		1				1		1						1	
Acacia xanthina	3									1																				1										1												
Acanthocarpus preissii	5									1																		1				1							1												
Actinostrobus pyramidalis	0																																																				
Actinotus glomeratus	1																															1																					
Adenanthos barbiger	1																									1																											
Adenanthos cygnorum subsp. cygnorum	35	1	1				1	1	1		1		1	1		1	1		1	1		1	1		1	1	1	1	1	1		1		1		1	1	1	1	1		1		C		1	1		1	1		1
Adenanthos obovatus	4													1																		1												C			1		1			
Agonis flexuosa	10									1	1									1	1				1	1			1					1						1										1			
Alexgeorgea nitens	3																									1																						1			1	
Allocasuarina fraseriana	36	1					1	1	1	1	1			1	1	1			1	1	1	1	1	1	1	1	1	1	1			1		1	1	1	1	1	1	1		1		C		1	1	1			1	1	
Allocasuarina humilis	32	1					1	1		1	1	1	1	1	1		1	1	1			1		1		1	1	1	1			1		1		1	1	1	1	1		1		C	1	1	1	1				
Alternanthera nodiflora	2										1		1																																								
Alyogyne huegelii var. glabrescens	1									1																																											
Alyxia buxifolia	1									1																																												
Amphipogon laguroides	0																																																				
Amphipogon turbinatus	6										1															1	1					1																					
Amyema linophylla	1																											1																									
Anigozanthos bicolor	1													1																															C									
Anigozanthos	1										1																																											

flavidus																																																					
Anigozanthos humilis subsp. humilis	12										1			1					1							1		1					1						1						C		1			1		1	
Anigozanthos manglesii	24	1						1			1	1		1			1		1	1						1	1	1					1			1	1	1	1	1		1			C	1	1	1				1	
Anogramma leptophylla	1																																														1						
Aotus cordifolia	2													1																									1						C								
Aotus procumbens	6													1																			1			1						1			C		1	1					
Apium prostratum	1									1																																											
Arnocrinum preissii	7							1														1											1				1										C	1					
Astartea scoparia	13								1		1		1	1				1					1		1								1			1			1			1			1			1					
Asteridea pulverulenta	4																									1							1																				
Astroloma ciliatum	2																																																				
Astroloma macrocalyx	4																									1																										1	
Astroloma pallidum	9								1																	1		1											1		1		1									1	
Astroloma xerophyllum	2							1																									1																				
Atriplex cinerea	1									1																																											
Rytidosperma occidentale	1																																1																				
Austrostipa compressa	5										1																						1															1					
Austrostipa elegantissima	2									1	1																																										
Austrostipa flavescens	2									1	1																																				C						
Austrostipa variabilis	1									1																																											
Babingtonia camphorosmae	0																																																				
Baeckea camphorosmae	1																																C																				
Banksia attenuata	45	1	1				1	C	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1		1	1		1	1	1	1	1	1	1	1	1		C	1	1	1	1		1	1	1
Banksia dallanneyi	2																					1																															
Banksia grandis	18								1	1	1		1				1		1				1		1	1			1										1	1	1	1					1					1	
Banksia ilicifolia	25	1	1				1		1		1			1				1	1				1		1	1							1			1	1	1	1			1			C		1	1	1		1		1
Banksia lindleyana	14	1								1						1					1					1	1		1				1								1	1	1									1	
Banksia littoralis	5										1		1																				1						1			1											
Banksia media	0																																																				
Banksia menziesii	49	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1		1	1	1	1	1	1	1	1			C	1	1	1	1		1	1	1
Banksia nivea	1																														1																						
Banksia prionotes	3					1																													1						1												
Banksia sessilis var. cygnorum	12	1		1						1						1											1		1		1				1				1		1												
Baumea articulata	5										1		1	1																									1			1			C								
Baumea juncea	6									1	1		1	1																									1			1			C								
Baumea preissii	2										1		1																																								
Beaufortia elegans	5																																1						1			1					1	1					
Beaufortia squarrosa	1																																			1																	
Billardiera fraseri	1																																																				
Billardiera fusiformis	7	1															1				1		1			1	1																									1	
Bolboschoenus caldwellii	2										1		1																																								
Boronia crenulata	4													1																			1			1									C		1						

Boronia dichotoma	1																																	1																						
Boronia ramosa	11								1									1	1				1											1			1						1					1						1
Bossiaea eriocarpa	35	1	1			1	1	1			1	1	1	1	1		1	1	1		1		1			1	1	1						1			1	1	1	1	1		1	1			1	1	1	1			1	1
Brachyloma preissii	6											1		1																									1					1	1		1						
Brachyscome iberidifolia	2																																																				
Burchardia congesta	35	1	1					1		1	1	1	1	1		1	1	1	1		1	1				1	1	1	1				1			1	1	1	1	1	1		1		C	1	1	1	1			1	1
Caesia micrantha	8									1											1					1															1						1					1	
Caladenia arenicola	5									1																								1								1												
Caladenia discoidea	4													1																				1													C								
Caladenia falcata	3																																	1																						
Caladenia flava	17	1									1	1		1			1				1					1						1							1		1	1			C	1	1	1				1	
Caladenia georgei	1																																																				
Caladenia huegelii	2																																	1																						
Caladenia latifolia	5																																	1								1												1	
Caladenia longicauda	4													1																				1													C								
Caladenia macrostylis	1																																	1																						
Caladenia paludosa	2													1																				1													C								
Caladenia reptans	1										1																																											
Calandrinia corrigioloides	3																																	1																						
Calandrinia liniflora	2																																																				
Calectasia narragara	9										1																1	1					1											1				1	1					
Callistemon sp.	1										1																																											
Callitris preissii	3																													1											1															1
Calothamnus lateralis	2																																	1						1														
Calothamnus quadrifidus	7	C								1	1					C														1							1						1	1								1			
Calothamnus sanguineus	0																																																				
Calytrix angulata	2																																	1														1						
Calytrix flavescens	12							1			1			1					1									1					1								1					C		1	1	1				
Calytrix fraseri	8							1																			1							1						1									1	1	1				
Carpobrotus virescens	3													1																																1					1			
Cartonema philydroides	1													1																																C								
Cassytha racemosa	12										1		1	1				1					1						1							1	1		1							1			1	1				
Cassytha sp.	1										1																																											
Casuarina obesa	10			1						1	1			1						1		1							1		1								1							C					1			
Centella asiatica	7			1							1		1	1																										1			1			1								
Centrolepis aristata	2																																	1															1				
Centrolepis drummondiana	3																																	1														1						
Chaetanthus aristatus	1																																						1															
Chamaescilla corymbosa	8													1							1												1													C		1	1				1	
Chordifex sinuosus	1																																																				
Clematis linearifolia	3									1	1																														1											
Comesperma calymega	4																																	1															1				
Conospermum triplinervium	6															1										1			1											1		1												

Conostephium pendulum	29	1					1	1			1	1			1		1		1		1		1			1	1	1						1			1	1	1	1	1	1		1			1	1	1	1			1	1
Conostephium preissii	12							1									1			1													1			1	1	1									1	1				1	
Conostylis aculeata	31	1	1				1		1	1	1			1	1		1	1	1	1	1	1	1		1		1	1						1		C	1		1	1	1			1		C		1	1	1				1
Conostylis aurea	4																																	1						1													
Conostylis candicans	10									1										1		1						1			1		1				1				1		1											1	
Conostylis juncea	12								1		1			1													1								1			1		1	C			1			C		1	1				
Conostylis setigera	19	1						1			1			1	1	1			1		1					1	1	1	1				1				1		C	1					C			1				1	
Corymbia calophylla	41	1	1		1	1			1	1	1	1		1		1		1		1	1	1	1	1	1	1	1	1	1			1	1		1		1	1	1	1	1	1		1	C	1	1	1		1	1	1	
Corynotheca micrantha	15							1		1	1			1							1					1		1	1										1		1				C				1			1	1
Craspedia variabilis	1																																																				
Crassula colorata	11		1							1	1											1												1						1			1						1					
Cyanicula gemmata	3																																	1																				
Cyanicula sericea	1																																															1								
Cyathochaeta avenacea	2													1																				1													C									
Cyperus gymnocaulos	1																													1																								
Cyperus polystachyos	1																															1																						
Dampiera linearis	26	1						1			1	1		1		1	1		1	1	1		1		1	1		1						1				1	1	1				1		C	1	1	1	1				1
Dasypogon bromeliifolius	34	1						1	1		1	1		1	1		1	1	1	1	1	1	1		1	1	1	1					1		C	1	1	1	1	1		1	1		C	1	1	1	1			1	1
Daucus glochidiatus	3								1	1	1																																										
Daviesia angulata	1										1																																										
Daviesia decurrens	9											1					1																	1						1							1	1	1						
Daviesia divaricata	10										1	1			1													1													1							1	1						1	
Daviesia nudiflora	19	1						1			1	1			1	1	1		1							1	1	1					1					1	1			1			1						1	
Daviesia physodes	16										1			1	1		1	1					1				1							1			1	1		1				1				1	1					
Daviesia triflora	26						1	1			1	1			1	1	1	1	1		1	1					1	1						1		C		1		1	1	1		1			1	1	1	1			1	
Desmocladus fasciculatus	14									1		1				1	1	1	1							1	1																	1			1		1				1	
Desmocladus flexuosus	33		1					1			1	1		1	1	1	1	1	1		1	1		1	1	1	1	1						1				1	1	1	1	1	1			C	1	1	1	1			1	1
Deyeuxia quadriseta	2																																	1										1											
Dianella revoluta	33	1	1		1	1				1	1	1	1	1	1	1			1		1			1		1	1	1	1				1		C	1			1		1	1	1		1	1		1		1		1	
Dichopogon capillipes	2																						1																								1							
Dielsia stenostachya	0																																																				
Diplopeltis huegelii subsp. huegelii	1									1																																											
Diuris corymbosa	9										1			1													1								1								1			C		1	1					
Diuris longifolia	6									1																		1												1	1															
Diuris magnifica	3																																	1																			1	
Dodonaea hackettiana	1									1			C																																							
Dodonaea sp.	2										1		1																																							
Drosera erythrorhiza	10									1				1											1							1				1				1			C		1	1					
Drosera gigantea	1																																							1													
Drosera glanduligera	7													1											1		1						1											1		C		1	1					
Drosera macrantha	7													1											1								1						1					C			1					
Drosera menziesii	9													1													1						1						1				1		C		1	1					

Drosera paleacea subsp. paleacea	3																																1																					
Drosera pallida	10								1				1													1	1					1			1	1	1							C									
Drosera paleacea	1																															1																					
Drosera porrecta	3																																							1		1											
Drosera stolonifera Endl.	1																																																				
Drosera zonaria	1																															1																					
Dryandra lindleyana	0																																																				
Elythranthera brunonis	3												1																			1						1						C									
Epilobium billardiereanum	2												1																															1									
Eragrostis (native)	1									1																																											
Eremaea asterocarpa	2																															1																				1	
Eremaea pauciflora	19	1									1	1						1	1							1	1		1				1			1	1			1			1			1	1	1	1					
Eremaea sp.	1									1																																											
Eremophila glabra subsp. albicans	1								1																			C																									
Eriochilus dilatatus	3																															1																					
Eriochilus scaber	1												1																															C									
Eryngium pinnatifidum	3																								1																												
Eucalyptus decipiens	0																																																				
Eucalyptus gomphocephala	9								1											1					1				1						1				1		1													
Eucalyptus marginata subsp. marginata	49	1	1		1	1	1			1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1		1	1	C	1	1	1	1			1	1	1
Eucalyptus sp.	1									1																																											
Eucalyptus rudis subsp. rudis	10						1			1		1	1																				1		1			1			1			1							1		
Eucalyptus todtiana	7						1	1					1				1															1							1					C		1							
Euchilopsis linearis	6							1																								1			1			1			1						1						
Euchiton sphaericus	2																															1															1						
Eutaxia virgata	3																															1						1			1												
Exocarpos sparteus	3									1		1																										1															
Ficinia nodosa	8			1					1	1										1									1		1							1			1												
Gahnia trifida	4			1					1				1																		1													C									
Gastrolobium capitatum	16						1						1			1	1			1					1	1	1					C					1	1			1			C		1		1			1		
Gastrolobium celsianum	1									1																																											
Gastrolobium ebracteolatum	6									1		1	1																									1						1									
Gastrolobium nervosum	1																								1							C																					
Gnephosis angianthoides	0																																													C							
Gompholobium aristatum	3								1				1																											1				C									
Gompholobium capitatum	1																										1																										
Gompholobium confertum	1																															1																					
Gompholobium scabrum	1																															1																					
Gompholobium tomentosum	40		1				1	1	1		1	1		1	1	1	1	1	1	1	1	1	1		1	1	1	1	1				1			1	1	1	1	1	1	1	1		1	1	1	1	1			1	1	

Gonocarpus pithyoides	6													1																			1						1			1			C								1
Goodenia filiformis	0																																																				
Grevillea crithmifolia	2																												1		1																						
Grevillea obtusifolia	2																															1									1											
Grevillea preissii	3									1																1															1												
Grevillea sp.	1																					1																															
Grevillea vestita	3			C						1																																											
Guichenotia ledifolia	0																																																				
Haemodorum brevisepalum	1																																																				1
Haemodorum laxum	3																																			1					1												
Haemodorum paniculatum	1																					1																															
Haemodorum spicatum	18								1	1	1		1	1	1			1	1				1			1							1			1		1							C		1	1				1	
Hakea laurina	2					1																																												1			
Hakea lissocarpha	5	1									1																		1		1								1														
Hakea petiolaris	1																																																1			
Hakea prostrata	28	1	1					1		1	1	1	1		1	1	1							1		1	1	1	1		1				1			1	1	1	1	1				1			1				1	
Hakea trifurcata	3			C							1																					1								1												
Hakea varia	2											1																		1																						
Halosarcia halocnemoides	0																																																				
Tecticordia indica subsp. bidens	1			1																																																	
Hardenbergia comptoniana	38	1		1		1			1	1	1	1	1	1	1	1	1			1	1	1	1	1		1	1	1	1		1		1		1			1	1	1	1	1	1		C	1	1	1		1		1	1
Hemiandra pungens	19	1						1		1	1			1	1				1	1			1			1							1			1			1			1			C		1	1	1				
Hensmania turbinata	3										1																					1																				1
Hibbertia cuneiformis	2										1																													1											
Hibbertia huegelii	24	1					1		1		1						1		1		1		1			1	1	1					1				1	1	1	1	1						1	1	1			1	1
Hibbertia hypericoides	35	1	1				1	1		1	1	1		1	1	1	1	1	1		1	1		1		1	1	1	C				1		C		1	1	1	1	1		1		1	1	1	1	1			1	
Hibbertia racemosa	21	1							1	1	1							1	1		1		1			1	1	1					1			1	1	1	1									1	1				1
Hibbertia stellaris	3																															1						1			1											
Hibbertia subvaginata	15							1	1		1							1							1								1			1	1	1	1		1	1					1	1					
Homalosciadium homalocarpum	4									1																						1															1					
Hovea pungens	8										1							1					1					1								1		1			1						1					
Hovea trisperma var. trisperma	20	1						1			1			1		1	1	1	1		1		1			1	1						1					1							C		1	1	1			1	
Hyalosperma cotula	2																															1																				1
Hybanthus calycinus	15								1	1			1			1				1					1	1	1					1						1		1				1							1	
Hypocalymma angustifolium	16	1										1		1			1	1					1				1		1		1		1						1		1		C		C	1		1					
Hypocalymma robustum	33	1									1	1	1		1	1	1	1	1	1	1	1		1		1	1	1	1				1		1		1	1	1	1	1		1		C	1	1	1	1			1	1
Hypolaena exsulca	26	1							1		1	1		1	1	1	1	1	1		1		1			1	1	1					1			1	1	1	1			1			C	1		1				1	
Isolepsis congrua	2										1		1																																							
Isolepsis marginata	1										1																																									
Isotoma hypocrateriformis	2																																																				
Isotropis cuneifolia	7									1				1														1					1								1				C								

subsp. cuneifolia																																																					
Jacksonia alata	0																																																				
Jacksonia furcellata	49	1	1	C	1	1		1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1		1		1		1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1
Jacksonia sericea	3																																					1														
Jacksonia sternbergiana	32	1			1					1	1	1	1	1	1	1			1	1	1	1				1	1	1	1		1		1		1	1			1		1	C	1		C	1	1	1	1			1	
Johnsonia acaulis	1																															1																				
Johnsonia pubescens	2																																																				
Juncus kraussii	6			1						1				1															1		1								1														
Juncus kraussii subsp. australiensis	1										1																																										
Juncus pallidus	12			1					1		1		1	1				1	1									1										1	1			1			1								
Juncus subsecundus	1																																																				
Kennedia prostrata	27	1								1	1		1	1	1	1	1	1	1		1					1	1	1	1				1			1	1		1		1	1			1		1			1		1	
Kunzea glabrescens	27		1								1		1	1		1		1	1			1				1	1		1				1		1	1	1		1	1		1			1		1	1		1	1	1	
Lachnagrostis filiformis	1																															1																				
Lagenophora huegelii	4								1				1																			C												C								
Latrobea tenella	1																																					1														
Laxmannia ramosa subsp. ramosa	5							1																	1		1					1															1					
Laxmannia sp.	1										1																																										
Laxmannia squarrosa	23	1								1	1			1			1	1	1			1					1	1					1			1	1		1	1	1						1	1	1			1	1
Lechenaultia expansa	2																															1															1					
Lechenaultia floribunda	21	1						1	1		1							1	1				1		1			1	1				1			1	1	1	1								1	1	1				1
Lechenaultia linarioides	4								1																1													1		1												
Lemna disperma	2										1		1																																								
Lepidobolus chaetocephalus	1																																																				
Lepidobolus preissianus	3										1																																										
Lepidosperma angustatum	11								1	1	1			1	C	C										1							1					1	1						C		1						
Lepidosperma calcicola	2					1														1																																	
Lepidosperma gladiatum	3								1																			1		1																						
Lepidosperma leptostachyum	2								1																		1																									
Lepidosperma longitudinale	10									1	1		1	1				1					1										1						1						1			1					
Lepidosperma pubisquameum	14		1								1							1		1	1	1		1	1								C			1	1											1	1			1	
Lepidosperma scabrum	13																1	1						C	1	1	1		1								1			1								1	1			1	
Lepidosperma sp.	3																																						1						1							1
Lepidosperma squamatum	7					C				1		C							C		1			C		1							1						1									1					
Lepidosperma tuberculatum	1																											1																								
Leptocarpus laxus	0																																																				
Leptomeria empetriformis	2										1																						1																				
Leptomeria pauciflora	1																															1																				
Lepyrodia muirii	1												1																			C												C								
Leucopogon	2																																					1				1										

australis																																																					
Leucopogon capitellatus	2																																					1															1	
Leucopogon conostephioides	12													1			1		1								1	1						1						1	1		1			C		1	1					1
Leucopogon oxycedrus	1																															1																				
Leucopogon parviflorus	3									1																1			1																									
Leucopogon polymorphus	1																															1																				
Leucopogon propinquus	16	1								1	1	1	1			1					1			1			1	1						1						1		1											1	
Leucopogon pulchellus	1																															1																				
Leucopogon racemulosus	3																															1																	1			
Leucopogon squarrosus	3																															1						1														1
Levenhookia pusilla	4																																		1	1												1						
Levenhookia stipitata	4																															1														1						
Lobelia anceps	5			1							1		1																													1					1						
Lobelia gibbosa	1																																																					
Lobelia tenuior	13								1		1												1			1						C			1	1	1			1	1					1	1					
Lomandra caespitosa	17							1		1	1				1			1			1		1				1							1						1	1		1					1	1			1	
Lomandra hermaphrodita	10										1						1				1						1						1															1	1					1
Lomandra integra	1																																																					
Lomandra maritima	4									1																		1	1																								1
Lomandra micrantha subsp. micrantha	7								1	1										1					1															1						1						1	
Lomandra nigricans	8								1												1												1								1						1						1	
Lomandra odora	5													1																				1												C			1					
Lomandra preissii	20						1	1		1	1	1		1			1		1		1						1	1						1			1				1		1			C		1						1	1
Lomandra suaveolens	6				1						1								1																																		1
Loxocarya cinerea	1																																															1					
Luzula meridionalis	3													1																															C							
Lyginia barbata	24	1	1					1			1	1		1					1	1		1	1		1							1			1		1		1		1			C	1	1	1	1				1
Lyginia imberbis	3										1																																			1							
Lyperanthus serratus	2																																																					
Lysinema ciliatum	2													1																								1						C							
Lysinema elegans	1																															1																				
Macarthuria apetala	1																																						1								C						
Macarthuria australis	5																									1														1														1	
Macrozamia fraseri	42	1	1		1	1		1		1	1	1	1	1		1	1	1	1	1	1	1	1	1		1	1	1	1				1	1	1		1	1	1		1	1	1	1	C	1	1	1			1	1	
Macrozamia riedlei	1										1																																									
Melaleuca cuticularis	1																														1																					
Melaleuca huegelii	2										1							C																							1											
Melaleuca lateritia	4																						1									1						1			1										
Melaleuca pauciflora	1																					1																														
Melaleuca preissiana	17								1		1		1	1				1	1	1			1		1							1			1		1	1			1			1		1	1					

Melaleuca rhaphiophylla	10			1							1		1	1				1											1										1			1			1					1			
Melaleuca scabra	3									1																							1								1												
Melaleuca seriata	17		1					1	1		1							1		1		1	1		1								1			1	1	1				1						1	1				
Melaleuca systena	8			C		1				1										1									1						1						1												
Melaleuca teretifolia	3										1		1																										1														
Melaleuca thymoides	12													1				1	1				1										1				1	1	1			1			C		1	1					1
Melaleuca trichophylla	1																																																				
Melaleuca viminalis	1										1																																										
Melaleuca viminea	1					1																																															
Mesomelaena pseudostygia	30	1			1	1	1	1		1	1	1		1	1	1	1		1		1			1		1	1	1	1				1		1				1		1		1		C	1			1			1	
Mesomelaena tetragona	2																																1						1														
Microtis media	19							1	1		1		1	1				1								1	1						1			1	1	1	1			1			C			1	1			1	
Monotaxis grandiflora	4																																						1			1											
Monotaxis occidentalis	2																																1																1					
Myoporum insulare	1									1																																											
Neurachne alopecuroidea	6										1															1							1								1												
Nuytsia floribunda	27	1						1			1	1	1	1			1	1	1			1	1		1	1							1		1		1	1	1	1		1			C	1	1	1	1				1
Olearia axillaris	2									1																			1																								
Olearia elaeophila	2																																																				
Opercularia hispidula	1																																1																				
Opercularia vaginata	16							1	1	1	1			1			1	1	1				1										1									1			1			1	1				
Ozothamnus cordatus	0																																																				
Paraserianthes lophantha	5													1					1					1		1													1						C								
Patersonia juncea	2										1		1																																								
Patersonia occidentalis	29				1			1	1	1	1			1			1	1	1	1			1			1							1			1	1	1	1	1		1	1		1		1	1	1			1	1
Pelargonium littorale	1																																C																				1
Pericalymma ellipticum	7													1									1										1			1			1			1			C			1					
Persicaria decipiens	3										1		1	1																															C								
Persicaria prostrata	1																																						1														
Persoonia saccata	21	1					1	1	1		1			1			1	1	1			1					1	1					1		C	1		1	1	1			1		C							1	
Petrophile linearis	30	1				1	1	1	1	1	1			1	1			1	1		1	1			1	1	1	1					1			1	1		1		1	1	1		C		1	1	1			1	
Petrophile macrostachya	11	1					1			1	1	1				1													1										1							1							
Petrophile media	4																				1					1										1															1	
Petrophile striata	1																																1																				
Pheladenia deformis	2																																																				
Philotheca spicata	15										1			1					1								1						1				1		1			1					1	1	1			1	1
Phlebocarya ciliata	28	1	1				1	1	1		1	1		1	1			1	1	1	1		1		1	1	1						1			1		1	1			1			C	1		1	1				
Phlebocarya filifolia	3																																1																				
Phyllangium paradoxum	2																																1																1					
Phyllanthus calycinus	8									1																1	1		1				1						1														
Pimelea imbricata	2																																1										1										

Pimelea leucantha	3									1															1											1																
Pimelea rosea	21	1							1	1		1	1				1	1					1		1	1						1			1	1		1		1	1			C		1	1					
Pimelea sulphurea	9									1								1		1						1	1					1															1					
Pithocarpa cordata	1																																																			
Pithocarpa pulchella	2																															1															1					
Pittosporum ligustrifolium	1								1																																											
Platysace compressa	6									1			1																			1										1		C			1					1
Platysace filiformis	1																																																			1
Platytheca galioides	3																															1									1					1						
Poa drummondiana	0																																																			
Poa porphyroclados	1									1																																										
Podolepis gracilis	2																								1																					1						
Podotheca angustifolia	3																															1																				
Podotheca chrysantha	2																																																			
Podotheca gnaphalioides	6							1																								1						1									1					
Poranthera microphylla	2																															1															1					
Prasophyllum hians	1																																																			
Prasophyllum macrostachyum	1												1																															C								
Prasophyllum ovale	1																															1																				
Prasophyllum parvifolium	3																															1																			C	
Prasophyllum plumiforme	2																																																			
Pteridium esculentum	4									1		1	1																									1						C								
Pterostylis aff.nana	1																																																			
Pterostylis barbata	1																																																			
Pterostylis pyramidalis	1																																								1											
Pterostylis recurva	4																															1															1				C	
Pterostylis sanguinea	4																									1						1																				
Pterostylis vittata	8												1			1											1					1								1				C			1					
Ptilotus drummondii	4								1																			C										1														
Ptilotus polystachyus	6								1																													1		1											1	
Pultenaea reticulata	2																															1						1														
Pyrorchis nigricans	7												1					1							1							1												C							1	
Regelia ciliata	7																					1					1					1							1								1		1			1
Regelia inops	13						1										1									1						1			1	1		1				C				1	1		1			1
Restionaceae sp.	1									1																																										
Rhagodia baccata	3								1											1								1																								
Rhodanthe chlorocephala	1																																																			
Rhodanthe chlorocephala subsp. rosea	4																								1														1								1					
Rhodanthe citrina	2																															1															1					
Ricinocarpos glaucus	2										1																											1														
Samolus repens	1								1																																											

Sarcocornia quinqueflora	2			1						1																																											
Scaevola anchusifolia	1									1																																											
Scaevola canescens	20	1								1	1	1		1			1				1					1	1	1	1				1						1		1		1		C	1						1	1
Scaevola nitida	2									1																			1																								
Scaevola repens	23	1					1	1		1	1	1		1	1				1							1	1	1					1				1		1	1			1		C	1		1	1			1	
Schoenoplectus validus	3			1							1		1																																								
Schoenus brevisetis	3																																1						1									1					
Schoenus clandestinus	5									1																1	1																									1	
Schoenus curvifolius	12													1							1					1							1				1	1		1					C		1	1	1				
Schoenus efoliatus	4										1			1																															1			1					
Schoenus grandiflorus	5													1				1					1																1						C			1					
Schoenus sp.	1										1																																										
Schoenus subfascicularis	9							1			1							1					1													1		1	1			1						1					
Scholtzia involucrata	18							1						1				1	1														1				1	1	1	1		1			C		1	1	1	1			1
Scholtzia teretifolia	2										1		1																																								
Senecio sp.	1										1																																										
Senecio pinnatifolius	9									1		1														1	1	1																		1		1					
Senecio quadridentatus	1																																1																				
Siloxerus humifusus	4																																1			1											1	1					
Sowerbaea laxiflora	11									1	1		1	1										1			1						1						1		1				C								
Sphaerolobium vimineum	1																																1																				
Sporobolus virginicus	3									1				1															1																								
Spyridium globulosum	2			C						1																1																											
Stackhousia monogyna	0																																																				
Stenopetalum gracile	1																																																				
Stenopetalum robustum	1																																																				
Stirlingia latifolia	37	1	1				1	1	1	1	1	1		1	1	1	1	1	1		1	1		C	C	1	1	1					1		1	1	1	1	1	1		C	1		C	1	1	1	1		1	1	1
Stylidium amoenum	2																																																				1
Stylidium brunonianum	9										1			1												1							1						1						C		1	1					
Stylidium caespitosum	1																																						1														
Stylidium carnosum	5																																1														1	1					
Stylidium divaricatum	1																																1																				
Stylidium junceum	3																																1						1								1						
Stylidium piliferum	6													1																			1												C		1	1					
Stylidium preissii	1																																1																				
Stylidium repens	8										1																						1									1					1	1	1				
Stylidium rigidulum	0																																																				
Stylidium schoenoides	7										1			1																			1												C		1	1					
Stylidium squamellosum	1																																1																				
Suaeda australis	1									1																																											
Synaphea spinulosa	11										1		1									1				1	1						1						1								1					1	

Taxandria linearifolia	4												1																																1							1					1				
Templetonia retusa	4	1								1																				1												1													
Tetragonia tetragonoides	1									1																																													
Tetraria octandra	13									1		1					1				1			1		1	1												1							1		1				1		
Thelymitra campanulata	2																																	1																						
Thelymitra crinita	2																																	1																						
Thelymitra macropylla	1																																																					
Threlkeldia diffusa	1									1																																													
Thysanotus arenarius	5									1															1																1													
Thysanotus manglesianus	13										1			1			1				1						1						1						1				C		1	1	1			1		
Thysanotus multiflorus	12								1						1									1										1			1		1	1			1	1		C		1	1						
Thysanotus patersonii	9										1	1									1													1						1							1		1						
Thysanotus sp.	1										1																																												
Thysanotus sparteus	9													1							1					1													1		1	1			C								1		
Thysanotus thyrsoideus	4																									1								1																						
Thysanotus triandrus	3																																	1																						
Trachymene pilosa	10										1											1				1								1					1									1	1	1				
Tribonanthes longipetala	1																																							1															
Tricoryne elatior	18							1		1	1		1													1	1	1						1			1	1	1	1		1						1	1					1		
Tricoryne humilis	0																																																					
Tricoryne tenella	2										1																						1																						
Tripterococcus brunonis	5																																	1						1									1						
Trymalium odoratissimum subsp. odoratissimum	1									1																																													
Typha domingensis	3										1		1	1																																								
Typha orientalis	2										1		1																																									
Verticordia densiflora var. densiflora	2																																																					
Verticordia drummondii	1																																	1																						
Viminaria juncea	8										1		1	1				1																							1			1			1					1				
Wahlenbergia preissii	1																																																					
Waitzia suaveolens	5																												1				1															1						
Xanthorrhoea brunonis	9										1									1			1	1								C		1								1					1						
Xanthorrhoea gracilis	2										1																						1																						
Xanthorrhoea preissii	50	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1		1	1		1		1	1	1	1	1	1	1	1	C	1	1	1	1		1	1	1	1
Xanthosia huegelii	14							1	1		1		1	1													1								1			1		1							C			1				1	1	
Xylomelum occidentale	1																																																		1			
TOTAL	3455	59	25	15	13	16	25	54	44	115	170	49	60	131	37	37	55	63	68	30	63	40	52	25	31	109	77	71	63	5	23	6	220	4	28	63	61	61	155	48	75	81	44	4	27	48	103	137	56	24	11	83	55	2

Table 36 Non-Vascular Flora Inventory

Species	Total	Bateman	Blue Gum	Booragoon	Bull Creek	Ern Stapleton	George Welby	Harry Sandon	Piney Lakes	Spectacle Wetland	Reg Bourke	Richard Lewis	Troy Park	Wal Hughes	Wirelless Hill
Agaricus sp.	2		1						1						
Agrocybe sp.	1		1												
Aleuria sp.	1									1					
Aleurina ferruginea	2								1	1					
Amanita conicobulbosa	4		1					1	1						1
Amanita drummondiii	1														1
Amanita eucalypti	2								1						1
Amanita fibrillopes	3	1							1	1					
Amanita sp. "grey-powdery"	2		1					1							
Amanita ochroterrea	1														1
Amanita preissii	3		1						1						1
Amanita rhoadsii	1								1						
Amanita sp.	4		1					1	1						1
Amanita umbrinella	3		1						1						1
Amanita wadjukiorum	1								1						
Amanita xanthocephala	4		1					1		1					1
Arcyria cinerea	3		1											1	1
Arcyria obvelata	4		1					1	1						1
Arachnopeziza aurata	1							1							
Austroboletus occidentalis	2	1								1					
Austroboletus sp.	1								1						
Austropaxillus muelleri	1								1						
Austropaxillus sp.	1								1						
Austropeziza sp.	2								1	1					
Badhamia sp.	1		1												
Badhamia macrocarpa	1														1
Banksiamyces sp.	1								1						
Bolbitius vitellinus	2			1											1
Boletus sp.	1							1							
Boletellus obscurecoccineus	1							1							
Campanella gregaria	1														1
Calocera guepinioides	8	1	1	1		1			1	1				1	1
Calvatia sp.	1								1						
Ceratiomyxa fruticulosa	5		1						1	1				1	1
Clavulina vinaceocervina	1							1							
Clitocybe semiocculta	2		1												1
Clitocybe kenkulunea	2							1							1
Coltrichia cinnamomea	2		1							1					
Colus hirudinosus	1		1												
Conocybe sp.	3		1					1	1						
Coprinus sp.	7		1	1		1			1				1	1	1

Species	Total	Bateman	Blue Gum	Booragoon	Bull Creek	Ern Stapleton	George Welby	Harry Sandon	Piney Lakes Reserve Wetland	Reg Bourke	Richard Lewis	Troy Park	Wal Hughes	Wirelless Hill
Coprinopsis stangliana	1		1											
Coprinellus flocculosus	1													1
Cortinarius archeri	3		1						1					1
Cortinarius australiensis	1								1					
Cortinaruius ochraceofulvus	1								1					
Cortinarius phalarus	1								1					
Cortinarius sp.	5		1					1	1	1				1
Creopus gelatinous	1		1											
Crepidotus eucalyptorum	4	1	1	1						1				
Crepidotus nephrodes	1			1										
Crepidotus sp.	4		1			1			1				1	
Cyathusolla	1											1		
Dacrymyces sp.	4		1					1	1					1
Dacrymyces stillatus	1							1						
Daldinia concentrica	1		1											
Dermocybe sp.	2							1	1					
Didymium bahiense	1													1
Didymium difforme	1													1
Didymium squamulosum	1													1
Exidia sp.	4		1					1	1				1	
Formitopsis lilacinogilva	1		1											
Fuligo candida	1		1											
Fuligo septica	2		1						1					
Galerina sp.	7		1			1		1	1	1			1	1
Geastrum sp.	2					1			1					
Gymnopilus allantopus	8	1	1			1		1	1	1			1	1
Gymnopilus purpuratus	6		1	1					1	1		1	1	
Gyoporus sp.	1													1
Hebeloma sp.	1								1					
Hemimycena sp.	1		1											
Henningsomyces candidus	2		1											1
Hjortstamia crassa	3		1			1			1					
Hjortstamia crassifolia	1		1											
Hohenbuehelia bingarra	3		1						1				1	
Hyphodonita arguta	2		1										1	
Hypoxylon sp.	2		1	1										
Inocybe sp.	4							1	1	1				1
Laccaria lateritia	1								1					
Laccaria sp.	6		1	1					1	1			1	1
Lactarius clarkea	1								1					
Lactarius sp.	1		1											
Lentinellus pulvinulus	1			1										
Leocarpus fragilis	1								1					

Species	Total	Bateman	Blue Gum	Booragoon	Bull Creek	Ern Stapleton	George Welby	Harry Sandon	Piney Lakes Wetland	Reg Bourke	Richard Lewis	Troy Park	Wal Hughes	Wirelless Hill
Lepiota sp.	3							1	1					1
Lichenomphalia chromacea	1								1					
Limacella pitereka	3								1	1				1
Lycogala epidendrum	3		1	1					1					
Lycoperdon sp.	2		1						1					
Lycophyllum sp.	1		1											
Macrolepiotan rhacodes	2		1	1										
Marasmius sp.	1								1					
Melanoleuca sp.	3		1						1					1
Mycena nargan	3					1		1					1	
Mycena sp.	8		1	1		1		1	1	1			1	1
Mycoacia subceracea	2		1										1	
Omphalotus nidiformis	3		1					1					1	
Oudemansiella radicata	1		1											
Panaeolus fimbriata	1													1
Panaeolus fimicola	1		1											
Panellus ligulatus	1									1				
Paneolus sp.	1			1										
Panus fasciatus	2		1											1
Paxillus sp.	1								1					
Perichaena corticalis	1								1					
Phellinus sp.	3		1	1						1				
Phlebia subceracea	2		1	1										
Pholiotina sp.	1		1											
Phyllachora amplexicaulii	3			1	1				1					
Phyllachora sp,	5		1	1				1	1					1
Phylloporus clelandii	1								1					
Physarum cinereum	1								1					
Physarum viride	3		1					1						1
Pisolithus sp.	4		1					1	1					1
Plicaria sp.	1								1					
Pluteus pauperculus	3		1	1				1						
Pluteus petasatus	1								1					
Pluteus sp.	3		1						1				1	
Poria sp.	2					1		1						
Protrubera canescens	1							1						
Psathyrella bamba	1								1					
Psathyrella bipellis	1													1
Psathyrella sp.	6		1			1		1	1				1	1
Pycnoporus coccineus	12	1	1	1		1	1	1	1	1			1	1
Ramaria sp.	2								1					1
Ramaria gracilis	5		1					1	1	1				1
Resupinatus cinerescens	4	1	1						1	1				

Species	Total	Bateman	Blue Gum	Booragoon	Bull Creek	Ern Stapleton	George Welby	Harry Sandon	Piney Lakes Reserve Wetland	Reg Bourke	Richard Lewis	Troy Park	Wal Hughes	Wirelless Hill
Resupinatus subapplicatus	2		1					1						
Resupinatus sp.	3		1						1				1	
Rhizopogon roseolus	1								1					
Rhizopogon sp.	1								1					
Royoporus badius	1									1				
Russula clelandii	1								1					
Russula erumpens	1									1				
Russula floctoniae	1									1				
Russula sp.	2							1						1
Schizophyllum commune	7	1	1					1	1	1				1
Schizopora paradoxa	5	1	1			1			1		1			
Scleroderma sp.	3	1	1						1					
Stopharia sp.	1		1											
Stereum hirsutum	2								1					1
Suillus collinitus	2								1	1				
Tremella mesenterica	6	1	1					1	1	1			1	
Trichia decipiens	3		1							1				1
Trichia decipiens var.olivacea	1													1
Trichia persimilis	1								1					
Trichia sp.	1								1					
Tricholoma sp. Buff	1		1											
Tricholoma eucalypticum	3		1					1						1
Tubaria serrulata	1													1
Tubaria sp.	2								1	1				
Tubifera ferruginosa	2		1											1
Tylopilus sp.	1													1
Uromycladium tepperianum	11		1	1	1	1	1	1	1		1		1	1
Volvariella speciosa	3		1					1						1
Xerula australis	1								1					
Xerula mundroola	2		1					1						
Xerula sp.	1							1						
Xylaria sp.	1							1						
	370	**11**	**79**	**20**	**2**	**14**	**2**	**42**	**82**	**30**	**3**	**3**	**5**	**21**	**56**

Source: Davison (2010)

APPENDIX 4: FAUNA INVENTORIES

Table 37 Mammal Inventory

Species		Grand Total	Al Richardson Reserve	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Bill Brown	Blackwall Reach	Blue Gum Lake	Booragoon	Bullcreek	Carawatha Bushland	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Fred Johnson Park	George Welby Park	Harold Field Reserve	Harry Baker Park	Hatfield Park	Harry Strickland Park	Harry Sandon Park	Heathcote	Ken Hurst Park	Len Shearer Park	Olding Park	Peter Bosci	Peter Ellis Park	Pj Hanley Park	Philip Jane Reserve	Piney Lakes	Point Walter	Reg Bourke	Reg Seal Reserve	Rob Weir	Ron Carroll Reserve	Tom Firth Park	Wireless Hill	William Hall	Quenda
Gould's Wattled Bat	*Chalinolobus gouldii*	22	1				1		1	1	1	1	1	1						1	1		1	1	1		1		1	1		1		1	1		1	1	
Chocolate Wattled Bat	*Chalinolobus morio*	10	1									1	1							1	1			1	1				1					1				1	
Western False Pipistrelle	*Falsistrellus mackenziei*	1																						1															
Cat	*Felis catus*	9						1	1	1							1						1	1						1*	1				1	1			
Water Rat/Rakali	*Hydromys chrysogaster*	1									1																												
Southern Brown Bandicoot	*Isoodon obesulus fusciventer*	6								1	1													1			1*		1	1	1*								1
Western Grey Kangaroo	*Macropus fuliginosus*	1																						1															
Western Brush Wallaby	*Macropus irma*	1																						1															
House Mouse	*Mus musculus*	8						1	1								1					1	1	1						C					1	1			
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	17	1				1				1	1	1	1						1	1			1	1		1		1	1				1	1	1		1	
Gould's Long-eared Bat	*Nyctophilus gouldii*	9		1	1	1									1	1		1	1					1		1													
Greater Long-eared Bat	*Nyctophilus major*	1																						1															
Unidentified Long-eared Bat	*Nyctophilus sp.*	1								1																													
Rabbit	*Oryctolagus cuniculus*	6						1	C	C												1	1	1						1		1							
Bush Rat	*Rattus fuscipes*	1																						1															
Brown Rat	*Rattus norvegicus*	4															1						1												1	1			
Black Rat	*Rattus rattus*	8						1	1	1							1						1	1											1	1			
White-striped Bat	*Austronomus australis*	25	1	1	1	1	1		1	1	1	1	1		1	1		1	1	1	1		1	1	1	1			1			1		1	1			1	
Honey Possum	*Tarsipes rostratus*	1																						1															
Brush-tailed Possum	*Trichosurus vulpecula*	10	1								1	1	1							1	1				1				1		C			1				1	
Southern Forest Bat	*Vespadelus regulus*	16	1						1	1	1	1	1							1	1			1	1				1	1		1		1				1	
Fox	*Vulpes vulpes*	6						1	C	C													1	1						1	1								1
Grand Total		**167**	**6**	**2**	**2**	**2**	**3**	**5**	**7**	**7**	**7**	**6**	**6**	**2**	**2**	**2**	**4**	**2**	**2**	**6**	**6**	**2**	**8**	**19**	**6**	**2**	**2**	**1**	**6**	**4**	**5**	**4**	**1**	**6**	**3**	**7**	**4**	**1**	**6**	**2**

Table 38 Bird Inventory

Species		Grand Total	Alfred Cove	Attadale	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Bateman	Beasley	Bill Brown	Blackwell Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushland	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Hatfield Park	Harold Field Reserve	Harry Baker Park	Harry Sandon Park	Harry Strickland Park	Heathcote	Hugh Corbet Park	Jim Ainsworth Reserve	John Creaney Reserve	Ken Hurst Park	Len Shearer Park	Marmion Lake	Olding Park	Peter Bosci Park	Pj Hanley Park	Peter Ellis	Philip Jane Reserve	Piney Lakes	Point Walter	Red Gum Park	Reg Seal Reserve	Reg Bourke	Richard Lewis	Rob Weir	Ron Carroll Reserve	Tom Firth Park	Wal Hughes	William Reynolds Park	William Hall	Wireless Hill	Quenda
Broad-tailed Thornbill (Inland Thornbill)	*Acanthiza apicalis*	2											C	C	1																1							C													C	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	7	1										C	C	1										1						1				1			1												1	C	
Western Thornbill	*Acanthiza*	5	1										1	1	1																1							C														

Species		Grand Total	Alfred Cove	Attadale	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Bateman	Beasley	Bill Brown	Blackwell Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushland	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Hatfield Park	Harold Field Reserve	Harry Baker Park	Harry Sandon Park	Harry Strickland Park	Heathcote	Hugh Corbet Park	Jim Ainsworth Reserve	John Creaney Reserve	Ken Hurst Park	Len Shearer Park	Marmion Lake	Olding Park	Peter Bosci Park	Pj Hanley Park	Peter Ellis	Philip Jane Reserve	Piney Lakes	Point Walter	Red Gum Park	Reg Seal Reserve	Reg Bourke	Richard Lewis	Rob Weir	Ron Carroll Reserve	Tom Firth Park	Wal Hughes	William Reynolds Park	William Hall	Wireless Hill	Quenda
	inornata																																																			
Western Spinebill	*Acanthorhynchus superciliosus*	2											C	C	1																1									C												C	
Collared Sparrowhawk	*Accipiter cirrocephalus*	15	1					1					1	1		1	1					1			1	1	1					1				1			C		1									1	1	
Brown Goshawk	*Accipiter fasciatus*	16	1					1				1	1	1	1	1	1					1			1	1	1					1	1							1			1											
Australian Reed Warbler	*Acrocephalus australis*	3	1										1	1																																							
Clamorous Reed-warbler	*Acrocephalus stentoreus*	1											1	C																										C													
Common Sandpiper	*Actitis hypoleucos*	0											C	C																																						
Australian Owlet-nightjar	*Aegotheles cristatus*	1																													1																					
Chestnut Teal	*Anas castanea*	1	1										C	C																																						
Grey Teal	*Anas gracilis*	6	1										1	1													1							1							1												
Mallard	*Anas platyrhynchos*	2											C	C	1																			1																		
Australasian Shoveler	*Anas rhynchotis*	3	1										1	1																											C													
Pacific Black Duck	*Anas superciliosa*	10	1						1				1	1	1												1			1	1		1							1													
Darter	*Anhinga melanogaster*	4	1									1	1	C	1																										C													
Australiasian Darter	*Anhinga novaehollandiae*	2											1	1																																							
Red Wattlebird	*Anthochaera carunculata*	41	1	1			1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1		1	1	1		1	1	1	1	1		1	1	1	1	1	1	1	1
Western Little Wattlebird	*Anthochaera lunulata*	24						1			1	1	C	1	1	1	1	1				1	1			1	1	1			1	1	1	1		1	1			1			1				1				1	1	
Australasian Pipit	*Anthus novaeseelandiae*	11	1					1								1	1					1				1	1					1	1									1		1									
Fork-tailed Swift	*Apus pacificus*	10	1					1								1	1					1				1							1				1						1								1	
Wedge-tailed Eagle	*Aquila audax*	1																													1																				
Little Eagle	*Aquila morphnoides*	1																																						1												
Great Egret	*Ardea alba*	4	1										C	1									1																	C	1												
Little Egret	*Ardea garzetta*	1											1	C																																						
Intermediate Egret	*Ardea intermedia*	2											1	1																																						
Eastern Great Egret	*Ardea modesta*	2							1					1																																						
White-faced Heron	*Ardea novaehollandiae*	5	1									1	1	C	1								1																	C													
White-necked Heron	*Ardea pacifica*	3	1										1	1																										C													
Ruddy Turnstone	*Arenaria*	1	1																																																	

Species		Grand Total	Alfred Cove	Attadale	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Bateman	Beasley	Bill Brown	Blackwell Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushland	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Hatfield Park	Harold Field Reserve	Harry Baker Park	Harry Sandon Park	Harry Strickland Park	Heathcote	Hugh Corbet Park	Jim Ainsworth Reserve	John Creaney Reserve	Ken Hurst Park	Len Shearer Park	Marmion Lake	Olding Park	Peter Bosci Park	Pj Hanley Park	Peter Ellis	Philip Jane Reserve	Piney Lakes	Point Walter	Red Gum Park	Reg Seal Reserve	Reg Bourke	Richard Lewis	Rob Weir	Ron Carroll Reserve	Tom Firth Park	Wal Hughes	William Reynolds Park	William Hall	Wireless Hill	Quenda
	interpres																																																				
Black-faced Woodswallow	*Artamus cinereus*	1																													1																					
Hardhead	*Aythya australis*	4	1										1	1																									1															
Australian Ringneck	*Barnardius zonarius*	25	1					1				1	1	1	1	1	1			1			1			1	1	1			1	1	1			1	1		1	1	1		1					1		1	1	
Musk Duck	*Biziura lobata*	2	1						1				C	C																									1	C														
Cattle Egret	*Bubulcus ibis*	2	1											1																																								
Sulphur-crested Cockatoo	*Cacatua galerita*	1										1																																										
Western Corella	*Cacatua pastinator*	2											1	1																																							
Little Corella	*Cacatua sanguinea*	18		1				1				1	1	1		1	1						1				1	1				1	1		1		1				1	1	1							1		
Long-billed Corella	*Cacatua tenuirostris*	5										1	1	1																										1	1														
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	4	1										1																		1																						1	
Sharp-tailed Sandpiper	*Calidris acuminata*	2	1												1																																							
Sanderling	*Calidris alba*	1	1																																																			
Red Knot	*Calidris canutus*	1	1																																																		
Curlew Sandpiper	*Calidris ferruginea*	1	1																																																		
Pectoral Sandpiper	*Calidris melanotos*	1	1																																																		
Red-necked Stint	*Calidris ruficollis*	1	1																																																		
Long-toed Stint	*Calidris subminuta*	1	1																																																		
Great Knot	*Calidris tenuirostris*	1	1																																																		
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*	23		1		1	1						1	1		1	1		1				1	1	1	1	1			1		1		1	1	1			1		1	1								1	1	
Baudin`s Cockatoo	*Calyptorhynchus baudinii*	7	1										1	1	1															1									1	C													1	
Carnaby`s Cockatoo	*Calyptorhynchus latirostris*	19					1				1	1	1	1		1	1						1			1	1	1				1	1			1				1		1	1			1		1		1	1	
Greater Sand Plover	*Charadrius leschenaultii*	1	1																																																		
Hooded Plover	*Charadrius rubricollis*	1	1																																																	
Red-capped Plover	*Charadrius ruficapillus*	1	1																																																	
Australian Wood Duck (Wood Duck)	*Chenonetta jubata*	5	1										1	1													1			1																								
White-backed Swallow	*Cheramoeca leucosternus*	9	1					1					C			1	1						1				1	1				1												1										
Horsfield`s Bronze	*Chrysococcyx*	1																													1																					

Species		Grand Total	Alfred Cove	Attadale	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Bateman	Beasley	Bill Brown	Blackwell Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushland	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Hatfield Park	Harold Field Reserve	Harry Baker Park	Harry Sandon Park	Harry Strickland Park	Heathcote	Hugh Corbet Park	Jim Ainsworth Reserve	John Creaney Reserve	Ken Hurst Park	Len Shearer Park	Marmion Lake	Olding Park	Peter Bosci Park	Pj Hanley Park	Peter Ellis	Philip Jane Reserve	Piney Lakes	Point Walter	Red Gum Park	Reg Seal Reserve	Reg Bourke	Richard Lewis	Rob Weir	Ron Carroll Reserve	Tom Firth Park	Wal Hughes	William Reynolds Park	William Hall	Wireless Hill	Quenda
Cuckoo	*basalis*																																																			
Shining Bronze Cuckoo	*Chrysococcyx lucidus*	1											C	C																	1									C													
Brown Songlark	*Cincloramphus cruralis*	1	1																																																	
Rufous Songlark	*Cincloramphus mathewsi*	8	1					1								1	1						1				1					1												1											
Swamp Harrier	*Circus approximans*	3	1										1	1																																							
Banded Stilt	*Cladorhynchus leucocephalus*	3	1										1	1																																						
Rufous Treecreeper	*Climacteris rufa*	1	1																																																
Grey Shrike-thrush	*Colluricincla harmonica*	1																													1																				
Domestic Pigeon	*Columba livia*	4	1									1	C	C													1				1									C													
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	24	1	1				1				1	1	1	1	1	1						1			1	1	1			1	1	1	1			1			1	1		1							1	1	1
Australian Raven	*Corvus coronoides*	35	1	1				1		1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1		1	1	1	1			1			1	1	1	1			1	1	1	1			1	1
Pied Butcherbird	*Cracticus nigrogularis*	8						1								1	1						1				1					1								C			1										1	
Australian Magpie	*Cracticus tibicen*	41	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1	1	1	1	1			1		1	1	1		1	1	1	1	1			1	1
Grey Butcherbird	*Cracticus torquatus*	21	1					1				1	1	1	1	1	1	1		1	1		1				1	1			1	1			1					C			1			1				1			
Fan-tailed Cuckoo	*Cuculus flabelliformis*	0											C																																						
Pallid Cuckoo	*Cuculus pallidus*	2	1										C	C																	1									C												
Black Swan	*Cygnus atratus*	5	1										1	1	1																		1							C												
Laughing Kookaburra	*Dacelo novaeguineae*	11	1									1	1	1	1				1							1		1												1	1										1		
Varied Sittella	*Daphoenositta chrysoptera*	2	1										C																		1									C											C	
Wandering Whistling Duck (Chestnut Whistling Duck)	*Dendrocygna arcuata*	0											C	C																																					
Mistletoebird	*Dicaeum hirundinaceum*	13	1	1				1					1	1		1	1						1				1	1			1	1											1											
Little Egret	*Egretta garzetta*	3											1	1	1																																					
White- faced Heron	*Egretta novaehollandiae*	2							1					1																																					
Black-shouldered Kite	*Elanus axillaris*	7	1									1	1	1	1																1									C	1											
Black-fronted Dotterel	*Elseyornis melanops*	3	1										1	1																																					
Pink and Grey Galah	*Eolophus roseicapilla*	24	1					1				1	1	1	1	1	1			1		1				1	1	1			1	1	1				1			1	1	1		1					1		1		1

Species		Grand Total	Alfred Cove	Attadale	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Bateman	Beasley	Bill Brown	Blackwell Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushland	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Hatfield Park	Harold Field Reserve	Harry Baker Park	Harry Sandon Park	Harry Strickland Park	Heathcote	Hugh Corbet Park	Jim Ainsworth Reserve	John Creaney Reserve	Ken Hurst Park	Len Shearer Park	Marmion Lake	Olding Park	Peter Bosci Park	Pj Hanley Park	Peter Ellis	Philip Jane Reserve	Piney Lakes	Point Walter	Red Gum Park	Reg Seal Reserve	Reg Bourke	Richard Lewis	Rob Weir	Ron Carroll Reserve	Tom Firth Park	Wal Hughes	William Reynolds Park	William Hall	Wireless Hill	Quenda
White-fronted Chat	*Epthianura albifrons*	1	1																																																	
Red-kneed Dotterel	*Erythrogonys cinctus*	1	1										C																																							
Brown Falcon	*Falco berigora*	1												C														1												C												
Australian Kestrel	*Falco cenchroides*	14	1					1					1	1	1	1	1						1				1	1			1	1							C	1		1										C	
Australian Hobby	*Falco longipennis*	16	1					1					1	1	1	1	1						1				1	1			1	1				1				1		1									1	
Peregrine Falcon	*Falco peregrinus*	13	1					1								1	1						1			1	1	1			1	1				1						1									1	
Eurasian Coot	*Fulica atra*	6	1										1	1	1																		1						1												
Dusky Moorhen	*Gallinula tenebrosa*	3											1	1																								1												
Buff-banded Rail	*Gallirallus philippensis*	2	1										C	C	1																																			
Western Gerygone	*Gerygone fusca*	15						1					1	1		1	1						1				1	1			1	1				1				C	1		1								1	1
Musk Lorikeet	*Glossopsitta concinna*	1	1																																															
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	1																										1																								
Tawny-crowned Honeyeater	*Glyciphila melanops*	10						1							1	1	1						1				1					1				1						1									1	C	
Magpie-lark	*Grallina cyanoleuca*	26	1	1			1	1			1	1	1	1	1	1	1	1		1		1			1	1	1		1	1	1	1		1				1	1		1										C	1
Pied Oystercatcher	*Haematopus longirostris*	1	1																																															
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	2	1																								1																								
Whistling Kite	*Haliastur sphenurus*	6	1								1	1	1														1			1								C												
Little Eagle	*Hieraaetus morphnoides*	2	1																				1							1							C												
Black-winged Stilt	*Himantopus himantopus*	3	1										1	1																							C												
Fairy Martin	*Hirundo ariel*	1																																															1		
Welcome Swallow	*Hirundo neoxena*	20	1	1				1			1	1	1	1	1	1							1			1	1	1			1	1							C	1		1										1	
White-winged Triller	*Lalage sueurii*	12	1					1					C			1	1						1				1	1			1	1				1				C			1									1	
Silver Gull	*Larus novaehollandiae*	6	1								1	C	C	1																	1		1						C	1												
Singing Honeyeater	*Lichenostomus virescens*	34	1	1	1		1	1		1		1	1	C	1	1	1		1	1		1	1			1	1	1		1	1	1	1			1	1			1	1	1	1						1	1	1		1	1	1
Brown Honeyeater	*Lichmera indistincta*	37	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1		1	1	1			1		1	1	1	1						1	1	1	1	1	1	1
Broad-billed Sandpiper	*Limicola falcinellus*	1	1																																															
Bar-tailed Godwit	*Limosa*	1	1																																															

Species		Grand Total	Alfred Cove	Attadale	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Bateman	Beasley	Bill Brown	Blackwell Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushland	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Hatfield Park	Harold Field Reserve	Harry Baker Park	Harry Sandon Park	Harry Strickland Park	Heathcote	Hugh Corbet Park	Jim Ainsworth Reserve	John Creaney Reserve	Ken Hurst Park	Len Shearer Park	Marmion Lake	Olding Park	Peter Bosci Park	Pj Hanley Park	Peter Ellis	Philip Jane Reserve	Piney Lakes	Point Walter	Red Gum Park	Reg Seal Reserve	Reg Bourke	Richard Lewis	Rob Weir	Ron Carroll Reserve	Tom Firth Park	Wal Hughes	William Reynolds Park	William Hall	Wireless Hill	Quenda
	lapponica																																																				
Black-tailed Godwit	*Limosa limosa*	1	1																																																		
Square-tailed Kite	*Lophoictinia isura*	2											1	1																																							
Pink-eared Duck	*Malacorhynchus membranaceus*	2											1	1																																							
Splendid Fairy-wren	*Malurus splendens*	5											1	1	1																	1								1													
Yellow-throated Miner	*Manorina flavigula*	0											C	C																																							
Little Grassbird	*Megalurus gramineus*	1	1																																					C													
Hooded Robin	*Melanodryas cucullata*	1																														1																					
White-naped Honeyeater	*Melithreptus lunatus*	1											1																																								
Budgerigar	*Melopsittacus undulatus*	2	1										1																																								
Rainbow Bee-eater	*Merops ornatus*	21	1	1				1				1	1	1	1	1	1						1			1	1	1			1	1	1				1			1	1		1								1	C	
Little Pied Cormorant	*Microcarbo melanoleucos*	5										1	1	1																	1									C	1												
Elegant Parrot	*Neophema elegans*	0																														1*																					
Barking Owl	*Ninox connivens*	0											C																																								
Boobook Owl	*Ninox novaeseelandiae*	13						1					C	1		1	1						1				1	1				1	1				1						1			1*					1	1	
Eastern Curlew	*Numenius madagascariensis*	1	1																																																		
Whimbrel	*Numenius phaeopus*	1	1																																																		
Rufous Night Heron	*Nycticorax caledonicus*	4	1										1	1														1																									
Cockatiel	*Nymphicus hollandicus*	1											1																																								
Crested Pigeon	*Ocyphaps lophotes*	11						1						1		1	1						1				1						1				1		1				1								1		
Blue-billed Duck	*Oxyura australis*	3	1										1	1																																							
Rufous Whistler	*Pachycephala rufiventris*	17	1					1				1	1	1	1	1	1						1			1	1					1	1				1			1			1								1	C	
Eastern-Osprey	*Pandion haliaetus*	10	1					1				1	C			1	1						1				1					1	1										1										
Spotted Pardalote	*Pardalotus punctatus*	13						1				1	1	1		1	1						1				1	1					1				1						1								1		
Striated Pardalote	*Pardalotus striatus*	27	1	1				1				1	1	1	1	1	1		1	1		1	1			1	1	1			1	1	1		1		1		1		1		1						1		1	1	

Species		Grand Total	Alfred Cove	Attadale	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Bateman	Beasley	Bill Brown	Blackwell Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushland	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Hatfield Park	Harold Field Reserve	Harry Baker Park	Harry Sandon Park	Harry Strickland Park	Heathcote	Hugh Corbet Park	Jim Ainsworth Reserve	John Creaney Reserve	Ken Hurst Park	Len Shearer Park	Marmion Lake	Olding Park	Peter Bosci Park	Pj Hanley Park	Peter Ellis	Philip Jane Reserve	Piney Lakes	Point Walter	Red Gum Park	Reg Seal Reserve	Reg Bourke	Richard Lewis	Rob Weir	Ron Carroll Reserve	Tom Firth Park	Wal Hughes	William Reynolds Park	William Hall	Wireless Hill	Quenda
Australian Pelican	*Pelecanus conspicillatus*	7	1									1	1	1	1																1								C	1												
Tree Martin	*Petrochelidon nigricans*	20	1	1				1				1	1	C	1	1	1			1			1			1	1	1				1	1	1						C	1		1				1					1	
Red-capped Robin	*Petroica goodenovii*	2	1										1																																								
Scarlet Robin	*Petroica multicolor*	1																													1																					
Great Cormorant	*Phalacrocorax carbo*	1	1										C	C																																						
Little Black Cormorant	*Phalacrocorax sulcirostris*	5	1										1	1	1																									C	1												
Pied Cormorant	*Phalacrocorax varius*	3	1									1	C	C																									C	1												
Common Bronzewing	*Phaps chalcoptera*	3											C		1																1								1												C	
Ruff	*Philomachus pugnax*	1	1																																																	
White-cheeked Honeyeater	*Phylidonyris nigra*	22		1				1		1		1	1	1		1	1					1	1			1	1				1	1				1	1		1			1				1	1			1	1
New Holland Honeyeater	*Phylidonyris novaehollandiae*	25		1				1			1	1	1	1	1	1	1					1	1			1	1	1			1	1	1				1			1			1			1	1	1			1	1
Yellow-billed Spoonbill	*Platalea flavipes*	3	1										C	1																1									C													
Glossy Ibis	*Plegadis falcinellus*	2											1	1																																						
American Golden Plover	*Pluvialis dominica*	1	1																																																
Grey Plover	*Pluvialis squatarola*	1	1																																															
Tawny Frogmouth	*Podargus strigoides*	11						1					C			1	1				1					1	1				1	1				1		1*				1								1		
Great Crested Grebe	*Podiceps cristatus*	1	1										C	C																																						
Hoary-headed Grebe	*Poliocephalus poliocephalus*	3	1										1	1																																						
Purple Swamphen	*Porphyrio porphyrio*	5	1										1	1	1																									1												
Australian Spotted Crake	*Porzana fluminea*	1	1										C	C																																					
Baillon`s Crake	*Porzana pusilla*	0											C	C																																					
Spotless Crake	*Porzana tabuensis*	1	1										C	C																										C												
Red-capped Parrot	*Purpureicephalus spurius*	25	1					1				1	1	1	1	1	1			1		1	1			1	1	1			1	1				1		1	C	1		1			1	1		1		1	1
Red-necked Avocet	*Recurvirostra novaehollandiae*	3	1										1	1																																						
Grey Fantail	*Rhipidura albiscapa*	15	1					1					1	1	1	1	1						1			1	1	1			1	1								C			1									1	
Willie Wagtail	*Rhipidura*	3	1	1			1	1			1	1	1	1	1	1	1					1	1		1	1	1	1			1	1	1			1			1	1	1		1			1	1	1		1		1

Species		Grand Total	Alfred Cove	Attadale	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Bateman	Beasley	Bill Brown	Blackwell Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushland	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Hatfield Park	Harold Field Reserve	Harry Baker Park	Harry Sandon Park	Harry Strickland Park	Heathcote	Hugh Corbet Park	Jim Ainsworth Reserve	John Creaney Reserve	Ken Hurst Park	Len Shearer Park	Marmion Lake	Olding Park	Peter Bosci Park	Pj Hanley Park	Peter Ellis	Philip Jane Reserve	Piney Lakes	Point Walter	Red Gum Park	Reg Seal Reserve	Reg Bourke	Richard Lewis	Rob Weir	Ron Carroll Reserve	Tom Firth Park	Wal Hughes	William Reynolds Park	William Hall	Wireless Hill	Quenda
	leucophrys	0																																																	
White-browed Scrubwren	*Sericornis frontalis maculatus*	0																																					C														
Weebill	*Smicrornis brevirostris*	2 1	1	1				1	1			1	1	1		1	1						1	1			1	1				1	1							1	1		1	1	1						1		
Spotted Dove	*Spilopelia chinensis*	3											1	1																			1																				
Laughing Turtle-Dove	*Spilopelia senegalensis*	2 2	1	1	1	1						1	1	1	1				1					1		1		1		1	1	1		1	1					1	1							1			1	1
Crested Tern	*Sterna bergii*	1	1																																																	
Caspian Tern	*Sterna caspia*	2	1									1																																								
Whiskered Tern	*Sterna hybrida*	1	1																																																
White-winged Black Tern	*Sterna leucoptera*	1	1																																																
Fairy Tern	*Sterna nereis*	1	1																																																
Gull-billed Tern	*Sterna nilotica*	1	1																																																
Arctic Tern	*Sterna paradisaea*	1	1																																																
Grey Currawong	*Strepera versicolor*	1												1																																						
Spotted Turtle Dove	*Streptopelia chinensis*	1 2	1	1								1	1	C	1											1		1				1								C	1			1		1			1				
Australasian Grebe (Black-throated Grebe)	*Tachybaptus novaehollandiae*	5	1										1	1																		1								1														
Australian Shelduck (Mountain Duck)	*Tadorna tadornoides*	6	1									1	1	1	1												1																										
Australian White Ibis	*Threskiornis moluccus*	19	1					1					1	1	1	1	1		1				1			1	1				1	1	1			1			1			1									1	1
Straw-necked Ibis	*Threskiornis spinicollis*	13	1					1					1	1		1	1						1				1					1				1				1			1									1	
Sacred Kingfisher	*Todiramphus sanctus*	17	1					1				1	1	1	1	1	1						1				1	1				1	1				1			C			1									1	1
Rainbow Lorikeet	*Trichoglossus moluccanus*	19	1		1	1	1					1	1	1					1		1		1	1					1	1	1	1			1					1	1							1				
Grey-tailed Tattler	*Tringa brevipes*	2	1																								1																									
Wood Sandpiper	*Tringa glareola*	3	1										1	1																																					
Common Sandpiper	*Tringa hypoleucos*	3	1										1	1																																					
Common Greenshank	*Tringa nebularia*	3	1										1	1																											C												
Marsh Sandpiper	*Tringa stagnatilis*	1	1																																																
Painted Button-quail	*Turnix varia*	2																														1																				1
Barn Owl	*Tyto alba*	11						1					C		1	1							1	1			1	1				1	1				1			C			1									1	
Masked Lapwing	*Vanellus miles*	1												1																																						
Banded Lapwing	*Vanellus tricolor*	2	1																													1																				

Species		Grand Total	Alfred Cove	Attadale	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Bateman	Beasley	Bill Brown	Blackwell Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushland	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Hatfield Park	Harold Field Reserve	Harry Baker Park	Harry Sandon Park	Harry Strickland Park	Heathcote	Hugh Corbet Park	Jim Ainsworth Reserve	John Creaney Reserve	Ken Hurst Park	Len Shearer Park	Marmion Lake	Olding Park	Peter Bosci Park	Pj Hanley Park	Peter Ellis	Philip Jane Reserve	Piney Lakes	Point Walter	Red Gum Park	Reg Seal Reserve	Reg Bourke	Richard Lewis	Rob Weir	Ron Carroll Reserve	Tom Firth Park	Wal Hughes	William Reynolds Park	William Hall	Wireless Hill	Quenda
Terek Sandpiper	*Xenus cinereus*	1	1																																																	
Grey-breasted White-eye (Silvereye)	*Zosterops lateralis*	23	11	1						1		1		1	1	1	1						1			1	1	1			1	1	1					1	1	1		1				1					1	
Grand Total		137	129	20	6	4	7	49	5	5	7	45	89	87	52	49	49	6	10	10	5	12	49	8	7	31	49	52	2	5	26	69	49	14	8	9	32	2	10	37	34	6	49	1	1	8	13	8	14	4	32	33	9

Table 39 Reptiles Inventory

Species		Grand Total	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Attadale	Bateman	Beasley	Bill Brown	Blackwell Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushalnd	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Harold Field Reserve	Hugh Corbet Park	Harry Sandon Park	Hatfield Park	Harry Strickland Park	Heathcote	Ken Hurst Park	Len Shearer Park	Olding Park	Peter Ellis Park	Philip Jane Reserve	Piney Lakes	Pj Hanley Park	Red Gum Park	Reg Seal Reserve	Rob Weir	Ron Carroll Reserve	Wal Hughes	Wireless Hill	William Hall	Quenda
Chelodina oblonga	*Long-necked Turtle*	0										1	C																			C								
Three-lined Skink	*Acritoscincus trilineatus*	3								1			1	1													1					1								1
Sanplain Worm Lizard	*Aprasia repens*	10				1						1		1	1	1								1	1	1	1	1	1					1		1			1		1	
Marbled Gecko	*Christinus marmoratus*	9				1					1			1	1	1								1	1	1	1		1					1		1				1	1
Buchanan's Snake-Eyed Skink	*Cryptoblepharus buchananii*	17	1	1		1			1	1	1	1	1		1	1		1		1		1	1		1	1	1		1	1		1		1	1	1	1			1	1	1
Fence Skink	*Cryptoblepharus plagiocephalus*	4												1					1					1				1											1	C		
Fence Skink	*Cryptoblepharus virgatus*	1										C	C																			1								
Western Limestone Ctenotus	*Ctenotus australis*	4						1	1		1	1								1				1			1	1											C		
Striped Skink	*Ctenotus fallens*	9	1			1	1				1	C			1	1									1	1	1		1			1	1		1					1	1
Odd-striped Skink	*Ctenotus impar*	0												1																										
Striped Skink	*Ctenotus lesueurii*	3									1			1										1			1												1	C		
Fraser's Legless Lizard	*Delma fraseri*	1												1													1														
Gray's Legless Lizard	*Delma grayii*	1												1													1														
Yellow-faced Whip Snake	*Demansia psammophis*	1																									1														

Species		Grand Total	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Attadale	Bateman	Beasley	Bill Brown	Blackwall Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushalnd	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Harold Field Reserve	Hugh Corbet Park	Harry Sandon Park	Hatfield Park	Harry Strickland Park	Heathcote	Ken Hurst Park	Len Shearer Park	Olding Park	Peter Ellis Park	Philip Jane Reserve	Piney Lakes	Pj Hanley Park	Red Gum Park	Reg Seal Reserve	Rob Weir	Ron Carroll Reserve	Wal Hughes	Wireless Hill	William Hall	Quenda
King Skink	*Egernia kingii*	1											1														1														
Mourning Skink	*Egernia luctuosa*	0												1																												
South-west Crevice Egernia	*Egernia napoleonis*	1																									1														
Variegated Dtella	*Gehyra variagata*	1																													1										
Two-toed Earless Skink	*Hemiergis quadrilineata*	15	1	1	1	1			1			1	1	1	1	1		1	1			1		1	1	1	1	1	1	1			1	1		1			1	C	1	
West coast Four-toed Lerista	*Lerista elegans*	13				1								1	1	1			1					1	1	1	1	1	1				1	1		1			1		1	1
Lined Skink	*Lerista lineata*	12				1						1			1	1			1					1	1	1	1	1	1					1		1			1	C	1	1
Worm Lerista	*Lerista praepedita*	7				1					1				1	1									1	1	1		1					1		1					1	
Burton's Snake-Lizard	*Lialis burtonis*	2												1							1							1														
Common Dwarf Skink	*Menetia greyii*	14				1					1	1		1	1	1			1	1		1		1	1	1	1	1	1				1	1		1			1	C	1	
Western Pale-flecked Morethia	*Morethia lineoocellata*	13				1					1	1		1	1	1			1					1	1	1	1	1	1				1	1		1			1		1	1
Shrubland Pale-flecked Morethia	*Morethia obscura*	10				1					1			1	1	1			1					1	1	1	1		1					1		1			1		1	
Black-naped Snake	*Neelaps bimaculatus*	1																									1														
Black-striped Snake	*Neelaps calonotos*	1																									1														
Western Tiger Snake	*Notechis scutatus*	0												1																		C										
Marbled Gecko	*Phyllodactylus marmoratus*	1									1			1													1														
Keeled Legless Lizard	*Pletholax gracilis*	1												1													1														
Western Bearded Dragon	*Pogona minor*	4												1													1					1								1		1
Dugite	*Pseudonaja affinis*	4												1												1	1					1							1			
Common Scaly-Foot	*Pygopus lepidopodus*	2												1						1							1														
Southern Blind Snake	*Ramphotyphlops australis*	2																								1	1														
Common Beaked Blind Snake	*Ramphytoplops waitii*	0												1																												
Western Heath Dragon	*Rankinia adelaidensis*	1												1													1														

Species		Grand Total	Alec Lambert Park	Art Wright Reserve	Arthur Kay Reserve	Al Richardson Reserve	Attadale	Bateman	Beasley	Bill Brown	Blackwall Reach	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushalnd	Conelly Park	Douglas Freeman	Elizabeth Manion Park	Em Stapleton	Fred Johnson Park	George Welby Park	Harold Field Reserve	Hugh Corbet Park	Harry Sandon Park	Hatfield Park	Harry Strickland Park	Heathcote	Ken Hurst Park	Len Shearer Park	Olding Park	Peter Ellis Park	Philip Jane Reserve	Piney Lakes	Pj Hanley Park	Red Gum Park	Reg Seal Reserve	Rob Weir	Ron Carroll Reserve	Wal Hughes	Wireless Hill	William Hall	Quenda
Gould's Hooded Snake	*Rhinoplocephalus gouldii*	1																									1														
Simoselaps bertholdi	*Jan's Bandy-Bandy*	1																								1															
Southern Spiny-tailed Gecko	*Strophurus spinigerus*	5				1									1	1								1	1	1		1							1						
Western Bluetongue	*Tiliqua occipitalis*	1																									1													
Bobtail	*Tiliqua rugosa*	19				1	1				1	1		1	1	1	1		1	1				1	1	1	1	1	1		1	1	1	1		1		1	1	1	1	1
Gould's Sand Goanna	*Varanus gouldii*	1																									1												C		
Black-naped Snake	*Vermicella bimaculata*	1																									1														
Grand Total		**198**	**3**	**2**	**1**	**13**	**2**	**1**	**3**	**2**	**11**	**9**	**4**	**24**	**13**	**13**	**1**	**2**	**8**	**5**	**1**	**3**	**1**	**12**	**13**	**13**	**18**	**29**	**13**	**2**	**1**	**3**	**10**	**12**	**1**	**13**	**1**	**1**	**10**	**4**	**12**	**9**

Table 40 Amphibians Inventory

Species		Grand Total	Al Richardson Reserve	Blue Gum Lake	Booragoon	Bull Creek	Carawatha Bushland	Conelly Park	Harry Strickland Park	Hatfield Park	Heathcote	Ken Hurst Park	Len Shearer Park	Piney Lakes	Pj Hanley Park	Reg Seal Reserve	Wireless Hill	William Hall	Quenda
Clicking Frog	*Crinia glauerti*	4		1	1	1								C					1
Sandplain Froglet	*Crinia insignifera*	2				1						1		C					
Moaning Frog	*Heleioporus eyrei*	15	1	1	1	1	1	1	1	1		1	1	1	1	1		1	1
Western Banjo Frog	*Limnodynastes dorsalis*	13	1		1	1	1	1	1	1		1	1	1	1	1		1	
Slender Tree Frog	*Litoria adelaidensis*	10	1		1	1	1	1	1	1			1	C		1			1
Western Bell Frog/Motorbike frog	*Litoria moorei*	12	1		1	1	1	1	1	1	1		1	C	1	1		1	
Turtle Frog	*Myobatrachus gouldii*	1										1					C		
Crawling Toadlet	*Pseudophryne gouldii*	1										1							
Guenther's Toadlet	*Pseudophryne guentheri*	1										1							
Grand Total		**59**	**4**	**2**	**5**	**6**	**4**	**4**	**4**	**4**	**1**	**6**	**4**	**2**	**3**	**4**	**0**	**3**	**3**

APPENDIX 5: MONITORING

Table 41 Sites Targeted for Direct Monitoring

				Threats										
Significance	Group	Name	No. of Melville Reserves	Physical Disturbance	Fire	Weeds	Habitat Loss	Feral Animals	Diseases & Pathogens	Stormwater	Reticulation	Acid Sulfate Soils	Climate Change
High	Ecological Communities	Northern Spearwood Shrublands and Woodlands	1	X	X	X	X				X		
High	Ecological Communities	Wooded wetlands which support colonial waterbird nesting areas	1				X			X	X	X	X
Medium	Ecological Communities	Saltwater Sheoak *(Casuarina obesa)* trees over sedges	1			X				X		X	
Medium	Ecological Communities	Shrublands on shallow soil overlying limestone	2	X	X	X							
Medium	Fauna Habitats	Very Trees					X						
Very High	Wetlands	Sumpland	7	X	X	X	X			X	X	X	X
Very High	Wetlands	Dampland	4	X	X	X	X			X	X	X	X
Very High	Wetlands	Lake	1				X			X	X	X	X
High	Wetlands	Sumpland	1	X	X	X	X			X	X	X	X

Table 42 Species Targeted for Direct Monitoring

Significance	Group	Species Group	Scientific Name	Common Name	No. of Melville Reserves	Threats: Physical Disturbance	Fire	Weeds	Habitat Loss	Feral Animals	Diseases & Pathogens	Stormwater	Reticulation	Acid Sulfate Soils	Climate Change
Very High	Marsupials	Kangaroos, Wallabies	*Macropus irma*	Western Brush Wallaby	1		X		X	X					
Medium	Marsupials	Kangaroos, Wallabies	*Macropus fuliginosus*	Western Grey Kangaroo	1		X		X	X					
Very High	Mammals	Bandicoots	*Isoodon obesulus fusciventer*	Southern Brown Bandicoot	2		X		X	X		X		X	X
Medium	Mammals	Rats	*Rattus fuscipes*	Bush Rat	1		X		X	X					
Medium	Mammals	Possums	*Tarsipes rostratus*	Honey Possum	1		X		X	X					
Medium	Mammals	Possums	*Trichosurus vulpecula*	Brush-tailed Possum	1		X		X	X					
Very High	Mammals	Bats	*Falsistrellus mackenziei*	Western False Pipistrelle	1				X	X					
Medium	Mammals	Bats	*Chalinolobus gouldii*	Gould's Wattled Bat	1				X	X					
Medium	Mammals	Bats	*Chalinolobus morio*	Chocolate Wattled Bat	1				X	X					
Medium	Mammals	Bats	*Nyctophilus geoffroyi*	Lesser Long-eared Bat	1				X	X					
Medium	Mammals	Bats	*Nyctophilus gouldii*	Gould's Long-eared Bat	1				X	X					
Medium	Mammals	Bats	*Nyctophilus major*	Greater Long-eared Bat	1				X	X					
Medium	Mammals	Bats	*Vespadelus regulus*	Southern Forest Bat	1				X	X					
Very High	Birds	Cockatoos, Parrots	*Calyptorhynchus baudinii*	Baudin's Black-Cockatoo	8				X	X					
Very High	Birds	Cockatoos, Parrots	*Calyptorhynchus latirostris*	Carnaby's Black-Cockatoo	5				X	X					
Very High	Birds	Cockatoos, Parrots	*Calyptorhynchus banksii*	Red-tailed Black-Cockatoo	1				X	X					
Very High	Birds	Owls	*Ninox connivens*	Barking Owl	1				X	X					

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Very High	Birds	Bee-Eaters, Rollers	*Merops ornatus*	Rainbow Bee-eater	11				X	X					
Very High	Birds	Herons, Ibis, Allies	*Ardea alba*	Eastern Great Egret	7				X	X					
Very High	Birds	Herons, Ibis, Allies	*Ardea ibis*	Cattle Egret	1				X	X					
Very High	Birds	Swifts	*Apus pacificus*	Fork-tailed Swift	1				X	X					
High	Birds	Button-Quails	*Turnix varia*	Painted Button-quail	1				X	X					
High	Birds	Crakes, Rails, Allies	*Gallinula tenebrosa*	Dusky Moorhen	3				X	X					
High	Birds	Fairy-Wrens, Grasswrens	*Malurus splendens*	Splendid Fairy-wren	4				X	X					
High	Birds	Herons, Ibis, Allies	*Nycticorax caledonicus*	Nankeen Night-Heron	3				X	X					
High	Birds	Pigeons, Doves	*Phaps chalcoptera*	Common Bronzewing	3				X	X					
High	Birds	Scrubwrens, Allies	*Acanthiza apicalis*	Inland Thornbill	6				X	X					
High	Birds	Scrubwrens, Allies	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	8				X	X					
High	Birds	Scrubwrens, Allies	*Acanthiza inornata*	Western Thornbill	6				X	X					
High	Birds	Scrubwrens, Allies	*Smicrornis brevirostris*	Weebill	4				X	X					
High	Birds	Treecreepers	*Climacteris rufa*	Rufous Treecreeper	1				X	X					
High	Birds	Waterfowl	*Anas rhynchotis*	Australasian Shoveler	3				X	X		X		X	X
High	Birds	Waterfowl	*Aythya australis*	Hardhead	4				X	X		X		X	X
High	Birds	Waterfowl	*Biziura lobata*	Musk Duck	4				X	X		X		X	X
High	Birds	Waterfowl	*Malacorhynchus membranaceus*	Pink-eared Duck	2				X	X		X		X	X
High	Birds	Waterfowl	*Oxyura australis*	Blue-billed Duck	3				X	X		X		X	X
Medium	Birds	Cockatoos, Parrots	*Purpureicephalus spurius*	Red-capped Parrot	10				X	X					
Medium	Birds	Robins, Scrub-Robins	*Petroica boodang*	Scarlet Robin	1				X	X					
Medium	Birds	Whistlers, Shrike-Thrush	*Colluricincla harmonica*	Grey Shrike-thrush	1				X	X					
Low	Birds	Cockatoos, Parrots	*Cacatua roseicapilla*	Galah	9				X	X					
Low	Birds	Cockatoos, Parrots	*Cacatua sanguinea*	Little Corella	3				X	X					
Low	Birds	Cockatoos, Parrots	*Platycercus zonarius*	Australian Ringneck	12				X	X					
Low	Birds	Cockatoos, Parrots	*Trichoglossus haematodus*	Rainbow Lorikeet	8				X	X					
Low	Birds	Honeyeaters, Chats	*Acanthorhynchus superciliosus*	Western Spinebill	5				X	X					
Low	Birds	Honeyeaters, Chats	*Anthochaera lunulata*	Western Wattlebird	7				X	X					
Low	Birds	Honeyeaters, Chats	*Phylidonyris novaehollandiae*	New Holland Honeyeater	5				X	X					
Low	Birds	Kingfishers	*Todiramphus sanctus*	Sacred Kingfisher	8				X	X					
Low	Birds	Pardalotes	*Pardalotus striatus*	Striated Pardalote	10				X	X					
Low	Birds	Swallows, Martins	*Hirundo nigricans*	Tree Martin	12				X	X					
Low	Birds	Waterfowl	*Anas superciliosa*	Pacific Black Duck	8				X	X		X		X	X
Very High	Reptiles	Front-fanged Snakes	*Neelaps calonotos*	Black-striped Snake	1			X	X	X			X		
Very High	Reptiles	Skinks	*Lissolepis luctosa*	Mourning Skink	1		X	X	X	X		X	X	X	X
Very High	Reptiles	Skinks	*Lerista lineata*	Lined Skink	4		X	X	X	X			X		
High	Reptiles	Goannas	*Varanus gouldii*	Gould's Sand Goanna	2			X	X	X			X		
Medium	Reptiles	Front-fanged Snakes	*Demansia psammophis*	Yellow-faced Whip Snake	1		X	X	X	X			X		

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Medium	Reptiles	Front-fanged Snakes	*Neelaps bimaculatus*	Black-naped Snake	1			X	X	X			X		
Medium	Reptiles	Front-fanged Snakes	*Notechis scutatus*	Western Tiger Snake	2		X	X	X	X			X		
Medium	Reptiles	Front-fanged Snakes	*Rhinoplocephalus gouldii*	Gould's Hooded Snake	1		X	X	X	X			X		
Medium	Reptiles	Blind Snakes	*Ramphotyphlops australis*	Southern Blind Snake	1			X	X	X			X		
Medium	Reptiles	Blind Snakes	*Ramphytoplops waitii*	Beaked Blind Snake	1			X	X	X			X		
Medium	Reptiles	Dragons	*Ctenophorus adelaidensis*	Western Heath Dragon	2			X	X	X			X		
Medium	Reptiles	Legless Lizards	*Delma fraseri*	Fraser's Legless Lizard	2			X	X	X			X		
Medium	Reptiles	Legless Lizards	*Delma grayii*	Gray's Legless Lizard	2			X	X	X			X		
Medium	Reptiles	Legless Lizards	*Lialis burtonis*	Burton's Snake-Lizard	2			X	X	X			X		
Medium	Reptiles	Legless Lizards	*Pletholax gracilis*	Keeled Legless Lizard	2			X	X	X			X		
Medium	Reptiles	Legless Lizards	*Pygopus lepidopodus*	Common Scaly-Foot	2			X	X	X			X		
Low	Reptiles	Dragons	*Pogona minor minor*	Western Bearded Dragon	3				X	X					
Low	Reptiles	Front-fanged Snakes	*Pseudonaja affinis*	Dugite	4		X	X	X				X		
Low	Reptiles	Geckos	*Christinus marmoratus*	Marbled Gecko	4				X	X					
Low	Reptiles	Legless Lizards	*Aprasia repens*	Worm Lizard	4			X	X	X			X		
High	Invertebrates	Dragonflys	*Petalura hesperia*	Wetern Petalura	1		X	X	X	X		X	X	X	X
Medium	Plants	Trees	*Eucalyptus DBCAipiens* ssp. *DBCAipiens*	Limestone Marlock	1				X						
Medium	Plants	Trees	*Xylomelum occidentale*	Woody Pear	1				X						
High	Plants	Trees	*Melaleuca lanceolata*	Rottnest Teatree	1				X						
High	Plants	Trees	*Agonis flexuosa*	Peppermint Tree	12				X						
Very High	Plants	Shrubs	*Aotus cordifolia*		2	X		X	X			X	X	X	X
Very High	Plants	Shrubs	*Jacksonia sericea*	Waldjumi	2	X		X	X				X		
High	Plants	Shrubs	*Melaleuca systena*		4	X		X	X				X		
High	Plants	Shrubs	*Lechenaultia linarioides*	Yellow Leschenaultia	4	X		X	X			X	X	X	X
High	Plants	Shrubs	*Boronia purdieana*	Winter Boronia	1	X		X	X			X	X	X	X
High	Plants	Shrubs	*Lysinema elegans*		1	X		X	X				X		
High	Plants	Shrubs	*Chamelaucium uncinatum*	Geraldton Wax	18	X		X	X				X		
High	Plants	Shrubs	*Hibbertia cuneiformis*	Cutleaf Hibbertia	1	X		X	X				X		
High	Plants	Shrubs	*Alyogyne huegelii*	Lilac Hibiscus	1	X		X	X				X		
High	Plants	Shrubs	*Grevillea obtusifolia*	Obtuse Leaved Grevillea	1	X		X	X		X	X	X	X	X
High	Plants	Shrubs	*Astroloma macrocalyx*	Swan Berry	3	X		X	X		X		X		
High	Plants	Shrubs	*Conospermum triplinervium*	Tree Smokebush	4	X	X	X	X		X		X		
Medium	Plants	Shrubs	*Acacia ?tetragonocarpa*		1	X		X	X				X		
Very High	Plants	Herbs	*Caladenia huegelii*	Grand Spider Orchid	3	X		X	X	X			X		
Very High	Plants	Herbs	*Goodenia filiformis*	Thread-leaved Goodenia	1	X		X	X	X			X		
High	Plants	Herbs	*Drosera macrantha*	Bridal Rainbow	3	X		X	X	X		X	X	X	X
High	Plants	Herbs	*Gnephosis angianthoides*		1	X		X	X	X			X		
High	Plants	Herbs	*Stylidium preissii*	Lizard Triggerplant	1	X		X	X	X			X		

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High	Plants	Herbs	*Caesia micrantha*	Pale Grass-lily	4	X		X	X	X		X	X	X	X
High	Plants	Herbs	*Dielsia stenostachya*		1	X		X	X	X		X	X	X	X
High	Plants	Herbs	*Schoenus latitans*		1	X		X	X	X			X		
High	Plants	Herbs	*Hensmania turbinata*		1	X		X	X	X			X		
High	Plants	Herbs	*Laxmannia grandiflora*		1	X		X	X	X		X	X	X	X
High	Plants	Herbs	*Macarthuria apetala*		1	X		X	X	X			X		

MAPS

Map 1: Geographic Setting

Map 2: Natural Area Reserves

Map 3: Landforms and Soils

Map 4: Vegetation

Map 5: Groundwater

Map 6: Acid Sulfate Soil Risk

Map 7: Groundwater