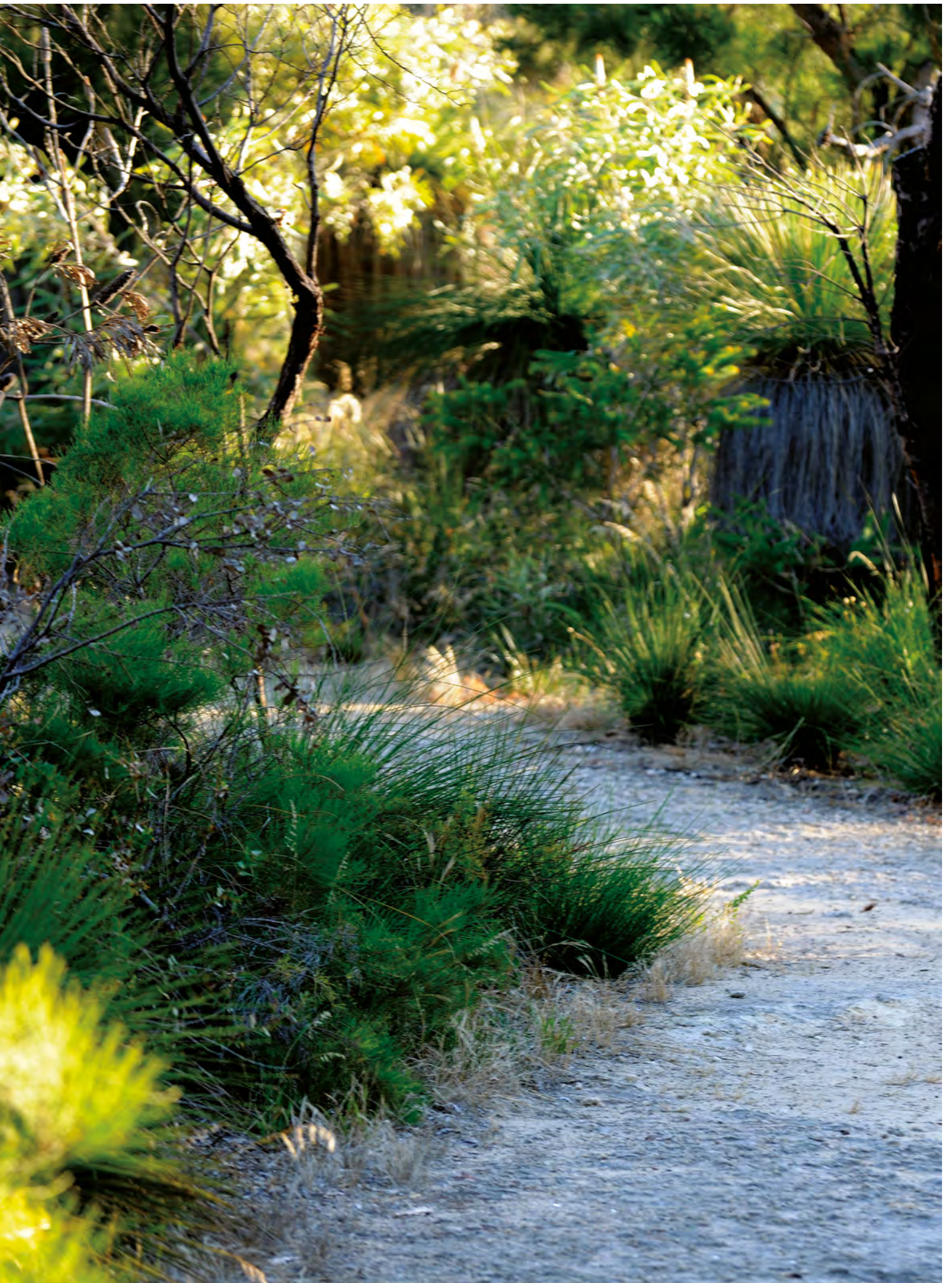


# Lilburne Park Management Plan





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- Syrinx Environmental PL; and
- 360 Environmental.

# Acronyms

Acronym / Abbreviation	Definition
AHD	Australian Height Datum
BoM	Bureau of Meteorology
the City	City of Joondalup
CoJ	City of Joondalup
DAFWA	Department of Agriculture and Food Western Australia
DEC	Department of Environment and Conservation
DEP	Department of Environmental Protection
DoE	Department of Environment
DoW	Department of Water
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
EDOWA	Environmental Defender's Office Western Australia (Inc)
EPA	Environmental Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
EWSWA	Environmental Weed Strategy for Western Australia
FCT	Floristic Community Type
FESA	Fire and Emergency Services Authority
GIS	Geographic Information System
ha	Hectare
IUCN	International Union for Conservation of Nature
JAMBA	Japan-Australia Migratory Bird Agreement
JSCWSC	Joint Steering Committee for Water Sensitive Cities
NWCPAG	National Wildlife Corridors Plan Advisory Group
Syrinx	Syrinx Environmental PL
WA	Western Australia
WALGA	Western Australian Local Government Association

# Executive Summary

The Lilburne Park Management Plan outlines a framework for the management of Lilburne Park for the next five years.

Lilburne Park is located 17 kilometres north-west from the Perth Central Business District in the suburb of Duncraig. The reserve covers approximately five hectares (ha) of bushland and is predominantly used for walking.

Lilburne Park is classified as a major conservation area and is ranked in the City of Joondalup's top five natural areas due to the high biodiversity values of the area. Lilburne Park is also listed as a place having significance for the purpose of protection of the landscape or environment in Schedule 5 of the City of Joondalup District Planning Scheme No. 2.

The majority of the native vegetation at Lilburne Park is in very good condition and surveys indicate that the area is likely to support 77 native flora species, 2 native mammals, 19 native birds, 8 native reptile species and 37 native invertebrates.

Environmental threats have the potential to degrade natural areas and reduce biodiversity values. Environmental threats include weeds, plant diseases, fire, non-native fauna species, human impacts and access and infrastructure. A total of 40 weed species, 6 non-native mammals, 5 non-native birds and 2 non-native invertebrates were recorded at Lilburne Park. A number of fires have occurred in the reserve over the past few years, resulting in some degradation of vegetation.

In order to address the key environmental threats at Lilburne a number of management actions are outlined within the Plan. Management actions have been proposed for the next five years and include implementation of the City's Pathogen Management Plan, regular weed control, annual fire fuel load assessments and engaging consultants to undertake flora, weeds, fungi, fauna, bat, the Graceful Sun Moth, invertebrates and fauna crossings studies. The management actions will be implemented in partnership with key stakeholders and community groups, where relevant.

# 1.0 Introduction

## 1.1 Background

The City of Joondalup ('the City') is situated along the Swan Coastal Plain, 30 kilometres from the Perth Central Business District. The City covers an area of 96.5 kilometres which encompasses a diverse range of natural areas including 17 kilometres of coastal foreshore, a chain of wetlands and a variety of bushland ecosystems (as shown in Figure 1).

The City's southern boundary is located approximately 16 kilometres from the Perth Central Business District, and is bounded by the City of Wanneroo to the east and north, the City of Stirling to the south, and the Indian Ocean to the west.

There are a number of regionally, nationally and internationally significant natural areas located within the City including the Yellagonga Regional Park, the Marmion Marine Park, the Neerabup National Park and a number of Bush Forever sites which contain species of high conservation value.

The City of Joondalup is committed to conserving and enhancing the City's natural assets to ensure the long term protection of the environment for future generations.

## 1.2 Natural Areas Management Plans

The City is developing Natural Areas Management Plans to provide strategic ongoing management of the City's natural areas and protect native vegetation and ecosystems.

Environmental threats have the potential to degrade natural areas and reduce biodiversity values. Environmental threats include weeds, plant diseases, fire, non-native fauna species, human impacts and access and infrastructure.

Natural Areas Management Plans describe the potential environmental impacts and risks of activities and environmental threats in natural areas and the associated management strategies that are implemented to minimise potential impacts.

## 1.3 Study Area

The Study Area for the Lilburne Park Management Plan is Lilburne Park, Duncraig.

Lilburne Park is located within the City of Joondalup, 17 kilometres north-west from the Perth Central Business District. Lilburne Park covers an area of approximately 5 hectares and is bounded by Hepburn Avenue, Lilburne Road and Hilarion Road (as shown in Figure 2). The Park is adjacent to Duncraig Fire Station and is surrounded by residential properties. Lilburne Park is located close to Hepburn Conservation Area, with the two areas being separated by Hepburn Avenue. Lilburne Park is also located close to Duncraig Senior High School.

Lilburne Park is vested with and managed by the City of Joondalup. The main uses of Lilburne Park are for passive recreational purposes such as walking or dog walking. Lilburne Park is zoned as 'Parks and Recreation', whilst the surrounding residential area is zoned as Residential R20.

Figure 1: Location of Lilburne Park in City of Joondalup

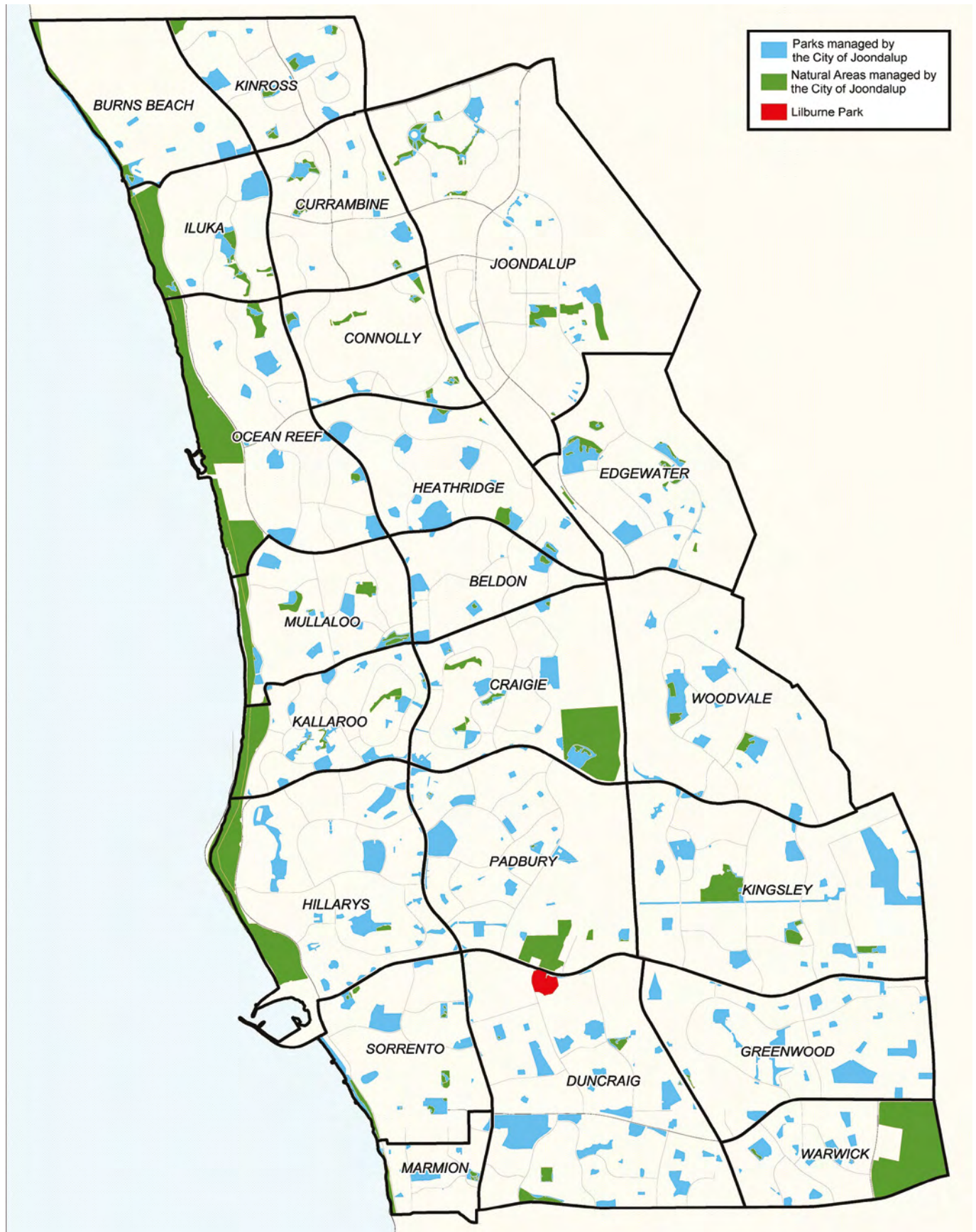




Figure 2: Map of Study Area



#### 1.4 Purpose

The purpose of the Lilburne Park Management Plan is to:

- Provide information to assist the City of Joondalup in prioritising maintenance schedules;
- Guide the future development of the City's Conservation Capital Works Program;
- Increase opportunities for grant funding by having a detailed schedule of projects; and
- Provide guidance to City employees and contractors and Friends Groups operating within Lilburne Park.

#### 1.5 Aims and Objectives

The aims of the Lilburne Park Management Plan are to:

- Establish a baseline description of the environment to guide future environmental planning and recommended management actions.
- Outline key environmental threats and management strategies to minimise impact and protect conservation and recreation values.
- Outline an implementation plan to address key threats including monitoring and reporting.

The objective of the Lilburne Park Management Plan is to provide mechanisms to protect and enhance biodiversity values of the Park whilst maintaining appropriate community access and awareness of the Park.

## 1.6 Strategic Context

To ensure the Lilburne Park Management Plan complements other management initiatives, relevant legislation, policies, guidelines and documents were reviewed and are briefly detailed below.

### 1.6.1 Local Government

#### Strategic Plan

The *City of Joondalup Strategic Community Plan 2012-2022* highlights the focus on preservation, conservation, and accessibility of the City's natural assets and the importance of engaging with the community and regional stakeholders.

#### Environment Plan

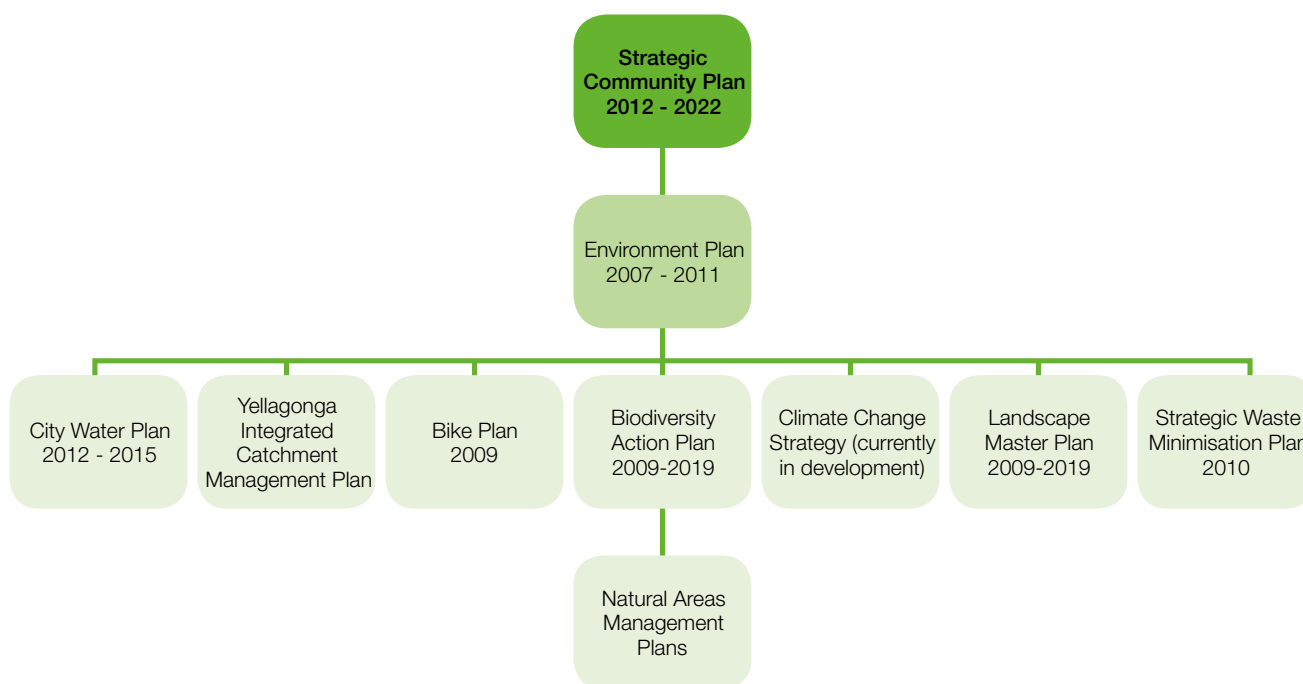
The *City of Joondalup Environment Plan 2007-2011* identifies the key environmental pressures and threats and provides the strategic response to the major issues affecting the City of Joondalup.

#### Biodiversity Action Plan

The *City of Joondalup Biodiversity Action Plan 2009 – 2019* provides direction for the City's biodiversity management activities and details the development of individual Natural Areas Management Plans as an action.

The City of Joondalup Strategic Environmental Framework is outlined in Figure 3.

**Figure 3: City of Joondalup Strategic Environmental Framework**



#### Perth Biodiversity Project

The City of Joondalup is one of 32 local governments subscribed to the Perth Biodiversity Project. The aim of the Perth Biodiversity Project is to support local governments to effectively integrate biodiversity conservation into land use planning to protect and manage local natural areas.

As part of the Perth Biodiversity Project, the City of Joondalup assessed all natural areas from 2004 onwards using the ecological criteria of the Natural Area Initial Assessment, resulting in a priority ranking of natural areas. The City of Joondalup assess major conservation, high priority and medium priority natural areas approximately every 5-7 years using this assessment tool. Lilburne Park is one of the City's five Major Conservation Areas due to the high biodiversity values of the area.

## City of Joondalup District Planning Scheme No. 2

Planning for land use occurs under the District Planning Scheme No 2. Lilburne Park is listed as a place having significance for the purpose of protection of the landscape or environment in Schedule 5 (Clause 5.3.1).

### 1.6.2 State Government

#### Aboriginal Heritage Act 1972

The Act makes provision for the preservation on behalf of the community of places and objects customarily used by or traditional to the original inhabitants of Australia or their descendants.

Lilburne Park is not listed on any State or Federal Indigenous or non-Indigenous heritage inventory or register.

#### Agriculture and Related Resources Protection Act 1976

The Act gives provision to declare plants and animals that are known to be a significant environmental threat and provides for the management, control and prevention of these declared plants and animals for the protection of agriculture and related resources.

One declared plant, One-leaf Cape Tulip (*Moraea flaccida*), is likely to exist in Lilburne Park.<sup>1</sup>

#### Bushfires Act 1954

The Act makes provision for diminishing the dangers resulting from bush fires and for the prevention, control and extinguishment of bush fires.

#### Environmental Protection Act 1986

The Act provides authority to the Environmental Protection Authority (EPA) for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment in Western Australia.

#### Wildlife Conservation Act 1950

The Act provides the statute relating to conservation and legal protection of flora and fauna.

Only one threatened flora species, Grand Spider Orchid (*Caladenia huegellii*), potentially exists in Lilburne Park. Three threatened fauna species are likely to utilise Lilburne Park: Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) for foraging habitat and the migratory species Rainbow Bee-eater (*Merops ornatus*).<sup>1</sup>

#### WA Planning Commission "Bush Forever" Strategy 2000

The Strategy identifies regionally significant bushland in the Perth Metropolitan Region to be retained, managed and protected forever.

Two species were listed as significant flora of the Perth Metropolitan Region, *Conostylis aculeata* subsp *cygnorum* and Yellow Leschenaultia (*Lechenaultia linarioides*).<sup>1</sup>

#### State Planning Policy 2.8

The State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region was prepared under the *Planning and Development Act 2005*. The aim of the Policy is to provide direction and an implementation framework that will ensure bushland protection and management issues in the Perth Metropolitan Region are appropriately addressed and integrated with broader land use planning and decision-making.

<sup>1</sup> Syrinx (2012)

### **1.6.3 Federal Government**

#### **Environment Protection and Biodiversity Conservation Act 1999**

The Act provides for the protection of the environment and the conservation of biodiversity, and for related purposes.

Two *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* listed species are likely to utilise Lilburne Park, Carnaby's Black-Cockatoo for foraging habitat (*Calyptorhynchus latirostris*) and the migratory species Rainbow Bee-eater (*Merops ornatus*). The endangered Grand Spider Orchid (*Caladenia huegelii*) could potentially exist within Lilburne Park.<sup>1</sup>

#### **Australia's Biodiversity Conservation Strategy 2010-2030**

The Strategy aims to protect biological diversity and maintain ecological processes and systems.

### **1.6.4 International Conventions or Listings**

#### **International Union for Conservation of Nature (IUCN) Red List of Threatened Species**

The IUCN Red List of Threatened Species™ provides taxonomic, conservation status and distribution information on plants and animals that have been globally evaluated using the IUCN Red List Categories and Criteria.

One endangered IUCN Red List species is likely to utilise Lilburne Park as foraging habitat, the Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*).<sup>1</sup>

### **1.6.5 Stakeholder Consultation**

Stakeholder engagement will occur through a community consultation process with the Council endorsed draft version of the Lilburne Park Management Plan.

### **1.6.6 Land Tenure and Vesting**

Lilburne Park is vested with and managed by the City of Joondalup.

# 2.0 Description of the Environment

## 2.1 Physical Environment

### 2.1.1 Geology, Soils and Landforms

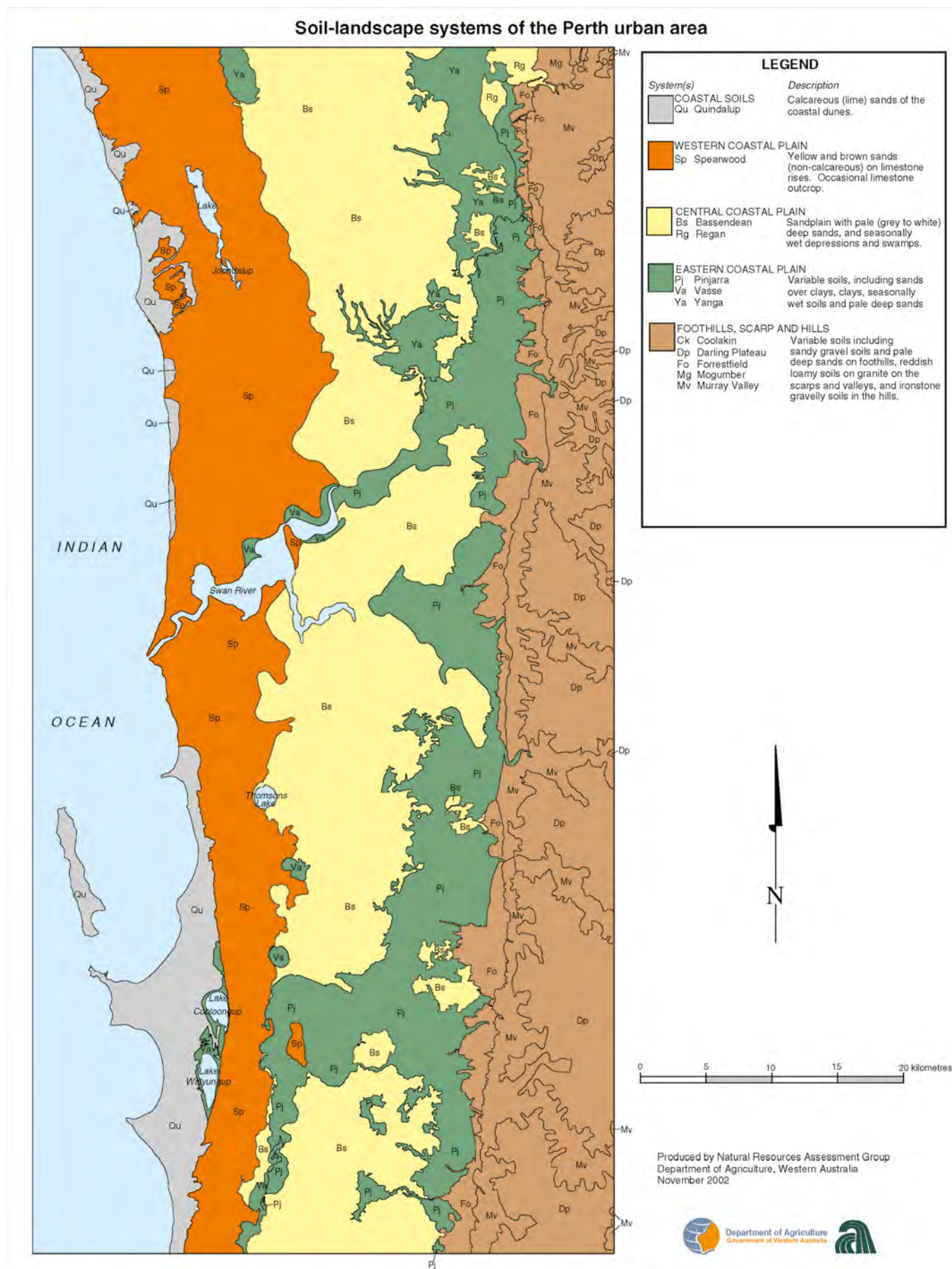
#### Soils of the Swan Coastal Plain

Lilburne Park is situated with the City of Joondalup which is located within the Swan Coastal Plain. The majority of the soils of the Swan Coastal Plain are formed by material deposited by rivers and wind. A series of dune systems has been formed with the youngest dunes being the Quindalup Dunes nearest the coast, followed by the Spearwood Dunes and the oldest Bassendean Dunes are farthest from the coast, as shown in Figure 4.<sup>2</sup>



<sup>2</sup> Bolland (1998)

Figure 4: Soils of the Swan Coastal Plain (Department of Agriculture 2002)



Lilburne Park is located within the Spearwood Dunes which have a core of sandy aeolianite with a capping of secondary limestone (Tamala Limestone, predominantly calcarenite) overlain by yellow brown siliceous sands with weak podzol development.<sup>3,4</sup>

The Spearwood Dunes are believed to have formed around 40,000 years ago and comprise of red/brown, yellow and pale yellow/grey sands. The majority of the sands to the east are the yellow/grey sands known as the Karrakatta sands<sup>5</sup> representative of the following:

- Karrakatta sand (yellow phase). Grey—brown sandy surface passing into bright yellow siliceous sand and often with limestone within two metres.
- Karrakatta sand (grey phase). Grey sandy surface, a very light grey sub-surface, and pale yellow sand within one metre; limestone occurs at depth.

This system has an undulating surface, with some higher ridges and hills, and hollows representing dune swales.<sup>6</sup> The land contours range from 20-34 metres Australian Height Datum (AHD).<sup>4</sup> Lilburne Park gently slopes from north to west.

### Acid Sulphate Soils

Acid Sulphate Soils are naturally occurring soils and sediments that contain iron sulphides. Acid Sulphate Soils are predominantly found in low-lying coastal wetlands and tidal flats and are harmless when left undisturbed. Exposure to air causes the iron sulphides in Acid Sulphate Soils to react with oxygen and water producing iron compounds and sulphuric acid, which can lead to heavy metals being released into the surrounding environment.<sup>7</sup>

Acid Sulphate Soils are categorised as Potential Acid Sulphate Soils or Actual Acid Sulphate Soils. Potential Acid Sulphate Soils have not been oxidised by exposure to air whilst Actual Acid Sulphate Soils have been disturbed or exposed to oxygen and become acidic.<sup>8</sup>

There is no known risk of Acid Sulphate Soils in Lilburne Park.<sup>4</sup> The risk of Acid Sulphate Soils is based on the likelihood of Acid Sulphate Soils occurring within soil profiles and has been mapped by the Department of Environment and Conservation (DEC) using available desk-top information and limited ground-truthing within areas where intensive on-ground mapping and soil analysis work has been undertaken. The mapping undertaken has found that Acid Sulphate Soils are not known or expected to occur in the environment of Lilburne Park on the basis of origin of the geological units present, depth to groundwater and partial “ground truthing” or onsite investigation.<sup>8</sup>

## 2.1.2 Hydrology

### Groundwater

The City of Joondalup is located on Perth’s largest source of groundwater, the Gnangara Groundwater System, comprising four main aquifers: superficial (shallow, unconfined), Mirrabooka (deeper, semi-confined), Leederville (deep, mostly confined) and the Yarragadee (deep, mostly confined). The Gnangara Mound extends across most of the superficial aquifer and refers to the water table creating a mound shape, as shown in Figure 5. Groundwater levels in the superficial aquifer have been declining over recent years due to pressure from extraction and the impacts of climate change.<sup>9</sup>

<sup>3</sup> McArthur and Bettenay cited in Syrinx (2012)

<sup>4</sup> Department of Water (2004)

<sup>5</sup> DAFWA cited in Syrinx (2012)

<sup>6</sup> Shire of Wanneroo cited in Syrinx (2012)

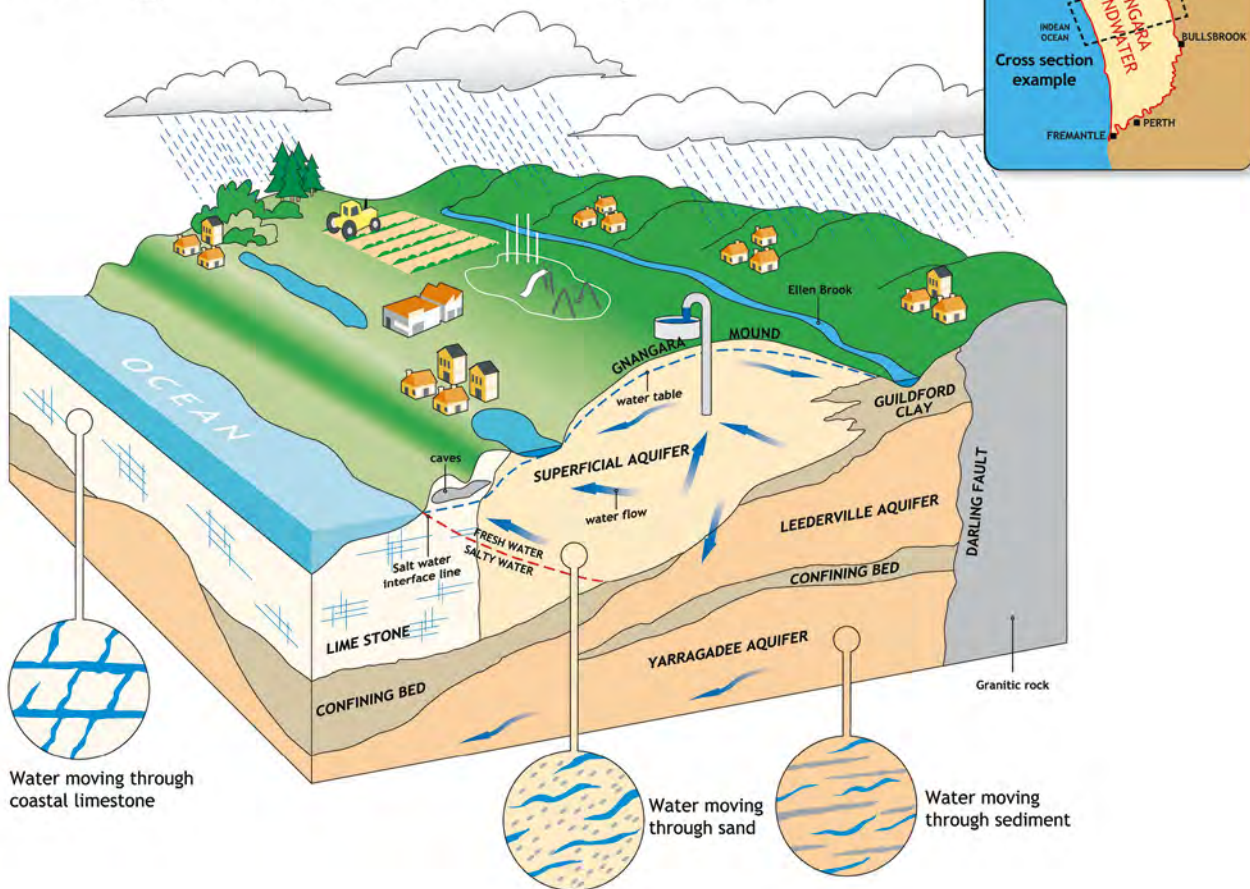
<sup>7</sup> DEC n.d.(a)

<sup>8</sup> Landgate (2006)

<sup>9</sup> CoJ (2012a)

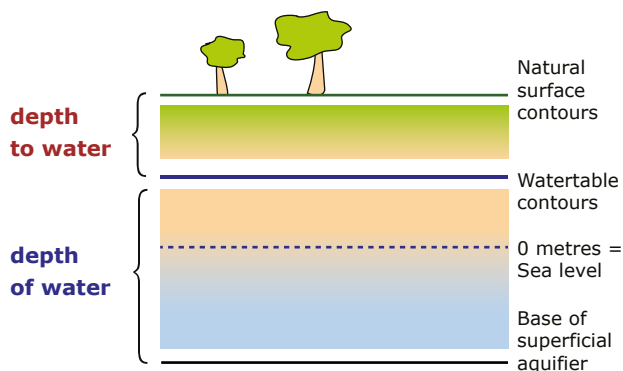
Figure 5: Gnangara Groundwater System (DoW n.d.)

# Gnangara Groundwater System



Vegetation at Lilburne Park is unlikely to be dependent on groundwater for survival as the depth to water is 17-29 metres and the depth of water is 32 metres. Depth to water is the depth from the natural surface contours to the water table, whilst depth of water is depth from the water table contours to the base of the superficial aquifer (see Figure 6). Groundwater salinity at Lilburne Park is fresh (0 – 500 TDS in mg/L).

Figure 6: Groundwater Depth Explanation (DoW 2004)



The use of groundwater for domestic irrigation through bores is deemed suitable in the area and is supported in preference to scheme water. The area is low in iron concentration, resulting in a low iron staining risk.<sup>4</sup>



## Stormwater Drainage

Stormwater consists of runoff from rainfall and any material collected in its path of flow. Stormwater has the potential to recharge the superficial aquifer.<sup>10</sup>

Sumps allow stormwater to infiltrate retention basins (sumps), detain the water and over time the water is absorbed back into groundwater. Most sumps are steeply graded rectangular excavations with an inflow at the bottom. Sumps are fenced off in the interest of community safety due to the potential for rapid stormwater inflow.<sup>11</sup>

The main stormwater drainage line in Lilburne Park is from west to east along the limestone path and into the sump, as shown in Figure 7.

**Figure 7: Lilburne Park Drainage Lines and Sump**



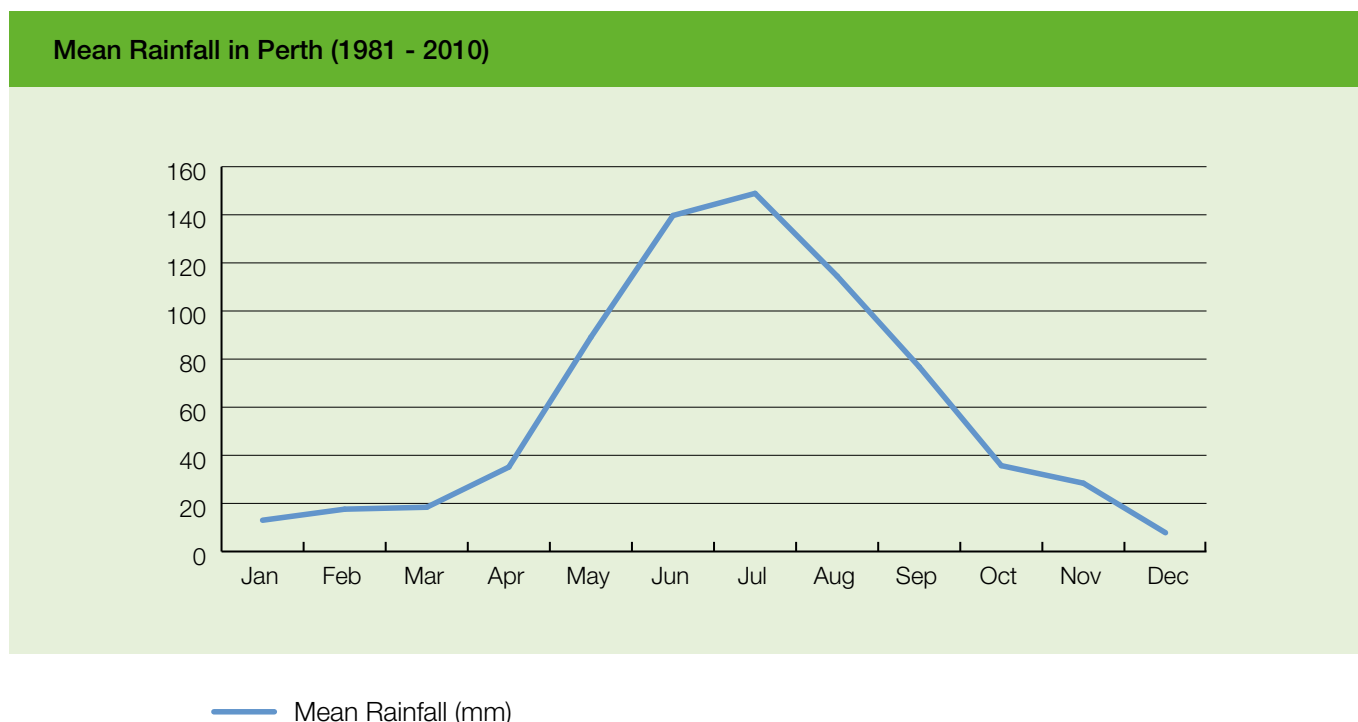
### 2.1.3 Climate

The City of Joondalup experiences a Mediterranean climate with hot dry summers with an average temperature of 31 degrees during the day and cold wet winters with an average day time temperature of 19 degrees. Approximately 80 percent of the annual rain falls between the months of May and September, as shown in Figure 8.<sup>12</sup>

<sup>10</sup> DoE (2004)

<sup>11</sup> Grose and Hedgcock (n.d.)

<sup>12</sup> BoM (2012)

**Figure 8: Mean rainfall recorded at Perth Airport Weather Station 1981-2010 (BoM 2012)**

#### 2.1.4 Vegetation

##### Vegetation Complexes

Vegetation complexes are based on soils and landforms in medium to large areas on the Swan Coastal Plain. Regional scale mapping shows the project area is classified as having Cottesloe Complex - Central and South (see Figure 9). This complex consists of predominantly open forest of *Eucalyptus gomphocephala* – *Eucalyptus Marginata* – *Corymbia calophylla* and woodland of *Eucalyptus Marginata* – *Banksia* species.<sup>13</sup>

The City of Joondalup portion of the pre-European extent of Cottesloe Complex – Central and South in Perth and Peel was 9% (3,966 ha). Approximately 35% (15,251 ha) of this vegetation complex currently remains in Perth and Peel. The City of Joondalup proportion of the current extent of Cottesloe complex – Central and South in Perth and Peel is 2% (345 ha), while the City of Joondalup level of retention of pre-European Cottesloe complex Central and South is just under 9%.

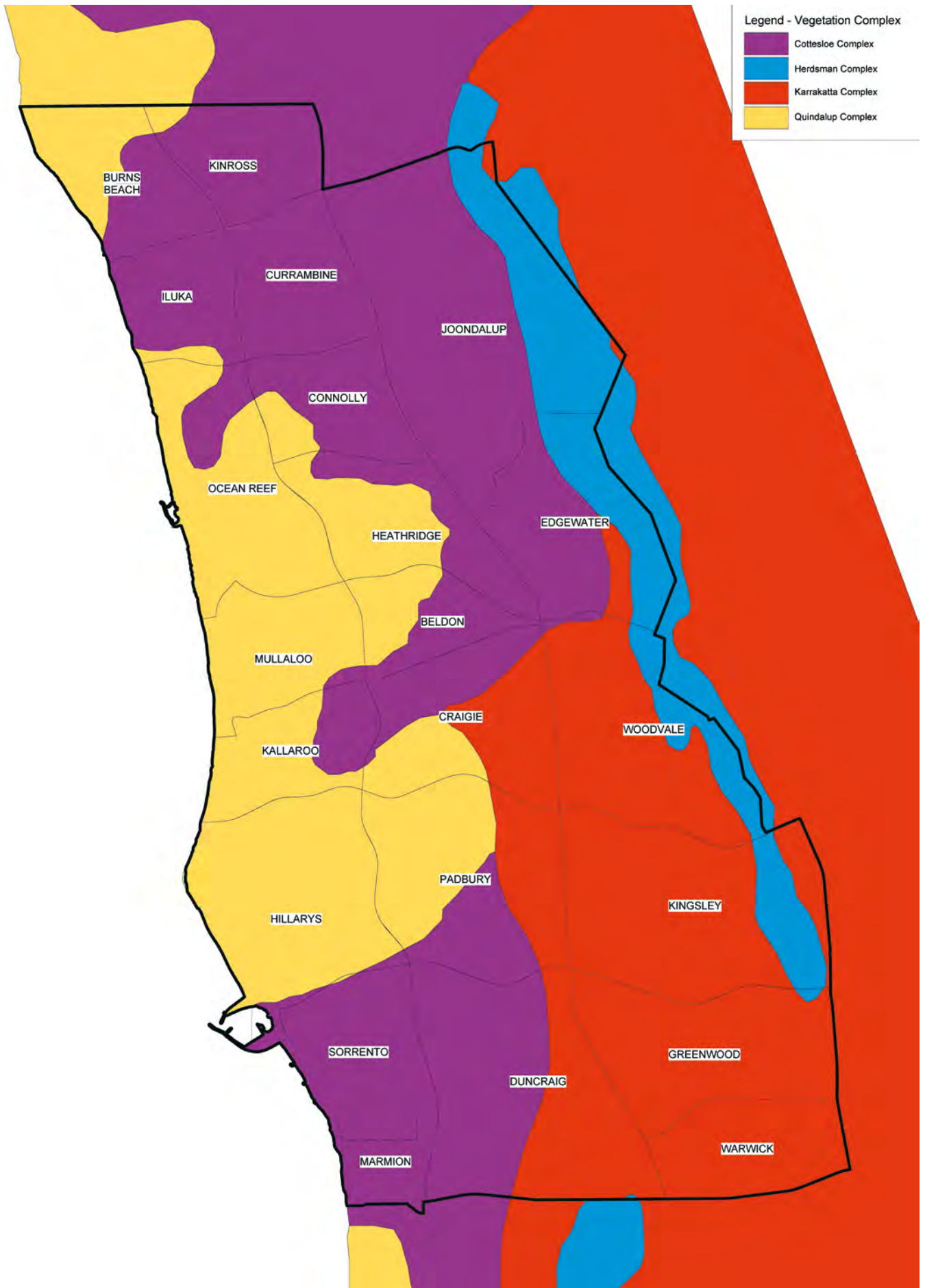
The State Government has established targets under Bush Forever which aim to protect at least 10% of each vegetation complex in the Perth Metropolitan Region to achieve a comprehensive representation of all the ecological communities originally occurring in the region.<sup>14,15</sup>

The project area's vegetation was described as Eucalyptus Woodland: Low Woodland Other.<sup>16</sup>

<sup>13</sup> Heddle et. al. cited in Syrinx (2012)  
<sup>14</sup> WALGA (2010)

<sup>15</sup> Department of Planning (2000)  
<sup>16</sup> Beard cited in Syrinx (2012)

Figure 9: City of Joondalup Vegetation Complexes



## Floristic Community Types

Floristic Community Types (FCTs) classify vegetation on the Swan Coastal Plain into groups of plant species that tend to co-occur in small to medium areas.

The following FCTs are possible within Lilburne Park:

- 24 - Northern Spearwood shrublands and woodlands;
- 26b - Woodlands and Mallees on limestone;
- 28 - Spearwood *Banksia attenuata* or *Banksia attenuata* - Eucalyptus woodlands; and
- 29a - Coastal shrublands on shallow sands.

## Vegetation Communities

Two vegetation communities were identified at Lilburne Park, as described in Table 1 (shown in Figures 10, 11 and 12):

**Table 1: Vegetation Communities at Lilburne Park**

Vegetation Community No.	Description	Vegetation Condition
1	<i>Banksia attenuata</i> Low Woodland over Mixed Open Heath over Open Sedgeland of <i>Mesomelaena pseudostygia</i> and <i>Desmocladius flexuosus</i>	Very Good
2	<i>Eucalyptus gomphocephala</i> Open Woodland over <i>Eucalyptus marginata</i> Low Open Woodland over Mixed Open Heath over Mixed Low Shrubland over Very Open Mixed Sedgeland	Very Good

No Threatened or Priority Ecological Communities were identified within Lilburne Park or in nearby bushland.<sup>1</sup>

## Vegetation Condition

The vegetation condition at Lilburne Park ranges from very good to degraded. The majority of the remnant vegetation is in very good condition, with patches of very good vegetation with the edges being degraded from past disturbance and encroachment of weeds. There is a degraded area in the centre of Lilburne Park that was burnt in 2011. Vegetation condition is shown in Figure 13 and 14.

Natural Areas Initial Assessments conducted in 2004 and 2011 by the City of Joondalup rated the vegetation condition using the Keighery Scale. Syrinx and 360 Environmental conducted a vegetation condition assessment in February 2012 and September 2012 respectively. The Keighery Scale rates the condition of vegetation from pristine to completely degraded, as detailed in Appendix 3. The majority of the vegetation condition in 2012 was rated as very good, followed by degraded, as shown in Table 2. The vegetation assessment in September 2012 was derived by 360 Environmental due to observations regarding the species richness of the community, numbers of native species, the impact to the structure of the community, physical disturbance, the health condition of most species' populations and the numbers of aggressive and competitive weeds. There has been a reduction in the amount of vegetation rated as excellent and good over the past decade, which can be largely attributed to the amount of bush fires that have taken place.

**Table 2: Lilburne Vegetation Condition Assessment using Keighery Scale (2004, 2011 and 2012)**

Year	Pristine	Excellent	Very Good	Good	Degraded	Completely Degraded
April 2004	0	20%	55%	20%	5%	0
Nov 2011	0	0	75%	20%	5%	0
Sept 2012	0	0	72%	2%	26%	0

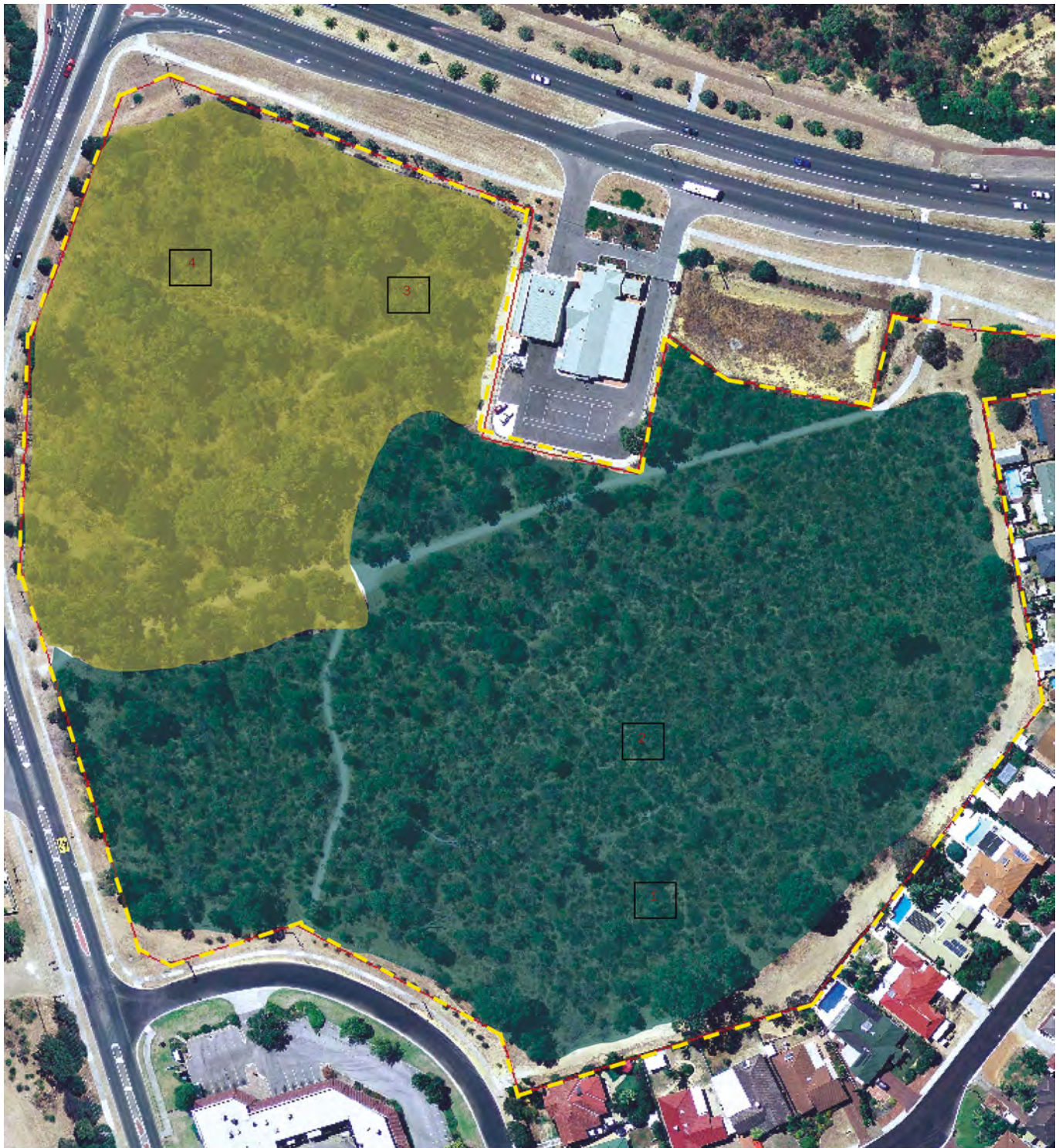
Figure 10: Vegetation Community 1 (Syrinx 2012)



Figure 11: Vegetation Community 2 (Syrinx 2012)



Figure 12: Lilburne Park Vegetation Communities (Syrinx 2012)



VEGETATION TYPES LEGEND:   STUDY AREA

1 *Banksia attenuata* Low Woodland over Mixed Open Heath over Open Sedgeland of *Mesomelaena pseudostygia* and *Desmocladius flexuosus*

2 *Eucalyptus gomphocephala* Open Woodland over *Eucalyptus marginata* Low Open Woodland over Mixed Open Heath over Mixed Low Shrubland over Very Open Mixed Sedgeland

1 Plot Number



Figure 13: Lilburne Park Vegetation Condition - February 2012 (Syrinx 2012)



Figure 14: Lilburne Park Vegetation Condition - September 2012 (360 Environmental 2012)





# 3.0 Biodiversity Conservation

The natural area of Lilburne Park supports an abundance of plant and animals species. The long term protection of biodiversity values within Lilburne Park is critical to ensure the conservation of this unique habitat. The protection and enhancement of biodiversity within Lilburne Park also benefits the community through the provision of ecological services such as the capture of carbon dioxide, cooling of urban environments and a number of recreational and cultural experiences.<sup>17</sup>

There are a number of environmental threats that pose a risk to the biodiversity of Lilburne Park. The key environmental threats at Lilburne Park include:

- Weeds;
- Fire;
- Pathogens and disease; and
- Non-native fauna species.

Management strategies to address the key environmental threats have been established and are discussed in detail in the following section.

## 3.1 Flora

Southwest Australia, from Shark Bay in the north to Israelite Bay in the south, is one of 34 biodiversity hotspots in the world. There are over 2,900 endemic plant species in this region. Approximately 30% of the original vegetation extent of this area remains, with habitat loss being primarily due to agricultural expansion.<sup>18</sup> Lilburne Park is located within the Southwest Australia biodiversity hotspot.

The City engaged consultants, Syrinx Environmental PL, to undertake a flora survey of Lilburne Park in February 2012. Flora surveys document components of biodiversity and make recommendations to minimise ecological impacts. The findings and recommendations from scientifically-based flora surveys can be reflected in management planning decisions.<sup>19</sup> Subsequent to the flora survey, a vegetation condition assessment was conducted by consultants, 360 Environmental, in September 2012. In addition to a vegetation condition assessment, observations of some native and non-native flora species were recorded.

### Flora Survey Methodology

#### Desktop study

A review was undertaken of all the available information provided by the City of Joondalup and any additional relevant information to provide a detailed background for Lilburne Park.<sup>1</sup> Natural Area Initial Assessments were undertaken by the City of Joondalup in 2004 and 2011 and were reviewed as part of the desktop study. Natural Area Initial Assessments include documenting information such as:

- vegetation complexes;
- threatened or significant flora or ecological communities;
- structured plant communities;
- weed species;
- rating vegetation condition;
- ecological criteria rankings; and
- a viability estimate.

#### Field survey

The floristic survey method included the set-up of two quadrats (10m x 10m) within each vegetation type delineated on aerial photography during the desktop assessment. Within each quadrat all species present were recorded (native and non-native) along with estimated abundance and percent cover per species. Vegetation and potential threatened species habitat was also traversed on foot in a series of parallel transects with vegetation condition being assessed. Weed populations were surveyed and recorded.<sup>1</sup>

Due to time limitations, the flora survey was conducted in summer. The optimum time to survey flowering annual flora species is spring, whilst weeds are most detectable in winter.

<sup>17</sup> CoJ (2012b)

<sup>18</sup> Conservation International (2012)

<sup>19</sup> Murray, Bell and Hoye (2002)

**Native Flora**





Native flora is an important part of the Lilburne Park ecosystem. The loss of native plant species can lead to a loss of fauna that depend on flora for food and shelter. A total of 77 native species were recorded at Lilburne Park (see Appendix 2).

Only one threatened species, Grand Spider Orchid (*Caladenia huegelii*), potentially exists in Lilburne Park.<sup>1</sup>

Two species in Lilburne Park were listed as significant flora of the Perth Metropolitan Region, *Conostylis aculeata* subsp *cygnorum* and Yellow Leschenaultia (*Lechenaultia linarioides*).<sup>1</sup>

Several populations of *Lomandra maritima* were observed in Lilburne Park, the food source for the threatened fauna species the Graceful Sun Moth (*Synemon gratiosa*). Some of the key native flora species existing or potentially existing at Lilburne Park are shown in Table 3.

**Table 3: Potential or Confirmed Threatened and Significant Flora at Lilburne Park (Syrinx 2012)**

Name	Common Name	Conservation Code	Likelihood	Image
<i>Caladenia huegelii</i>	Grand Spider Orchid	Schedule 1 ( <i>Wildlife Conservation Act</i> ), Critically Endangered (DEC) and Endangered (EPBC)	Potential	 <p><i>Caladenia huegelii</i> Photo: I. And M. Greeve &amp; J.L. Robinson</p> <p>Photo: I. And M. Greeve (WA Herbarium n.d.)</p>
<i>Conostylis aculeata</i> subsp <i>cygnorum</i>		Taxa endemic to the Swan Coastal Plain, Significant Flora of the Perth Metropolitan Region	Confirmed	 <p><i>Conostylis aculeata</i> subsp. <i>cygnorum</i> Photo: K.C. Richardson</p> <p>Photo: K.C. Richardson (WA Herbarium n.d.)</p>
<i>Lechenaultia linarioides</i>	Yellow Leschenaultia	Considered to be poorly reserved, Significant Flora of the Perth Metropolitan Region	Confirmed	
<i>Lomandra maritima</i>		Food source for threatened fauna species the Graceful Sun Moth ( <i>Synemon gratiosa</i> )	Confirmed	

Note: For further explanations on Conservation Codes, refer to Appendix 2.

## Weeds

Non-native flora or weeds can be exotic species or native species in ecosystems in which they previously did not exist. Weeds are commonly introduced and distributed within bushland areas through the dispersal of seed by wind and animals and birds, through dumping of garden refuse and through the use of machinery in natural areas.

Weeds have major economic, environmental and social impacts in Australia and can:

- displace native plant species;
- harbour pests and diseases;
- create fuel loads for fires;
- impact negatively on fauna and flora and their habitats; and
- compete with native species for space, water and nutrients.<sup>17</sup>

Over 27,000 known alien plant species have been introduced to Australia with approximately 10% now being established in the environment. Garden plants are the main source of Australia's weeds, accounting for 66% of recognised weed species.<sup>17,20,21</sup>

A total of 40 weed species were recorded at Lilburne Park (see Appendix 2). The majority of the weed species were grasses from the Poaceae family and daisies from the Asteraceae family. The majority of weeds were located in previously cleared degraded areas and along the edges of the remnant vegetation. The Annual Veldt grass was scattered throughout the bushland. The weed species with the most populations in summer were False Onion Weed (*Trachyandra divaricata*), Flaxleaf Fleabane (*Conyza bonariensis*) and Rose Pelargonium (*Pelargonium capitatum*).<sup>1</sup>

One declared plant, One-leaf Cape Tulip (*Moraea flaccida*), is likely to exist in Lilburne Park.<sup>1</sup> Key weed species existing at Lilburne Park are shown in Table 4 and the location of invasive weed species at Lilburne Park is shown in Figure 16.

## Revegetation

The City of Joondalup follows the 'Bradley Method' of bush regeneration, i.e. "remove weeds competing with native plants in the good condition sections of bush and work out at the pace of natural regeneration, disturbing the soil as little as possible".<sup>22</sup> These principles encourage the vegetation to re-establish by itself and maintain high conservation values of natural areas.

## Current Management Approach

Management of weeds at Lilburne Park is undertaken through weed monitoring, on ground weed management and community education initiatives.

Weed monitoring is conducted monthly at Lilburne Park to establish the extent of weeds and to identify priority weed species. The outcomes from weed monitoring inform the on ground weed management program.

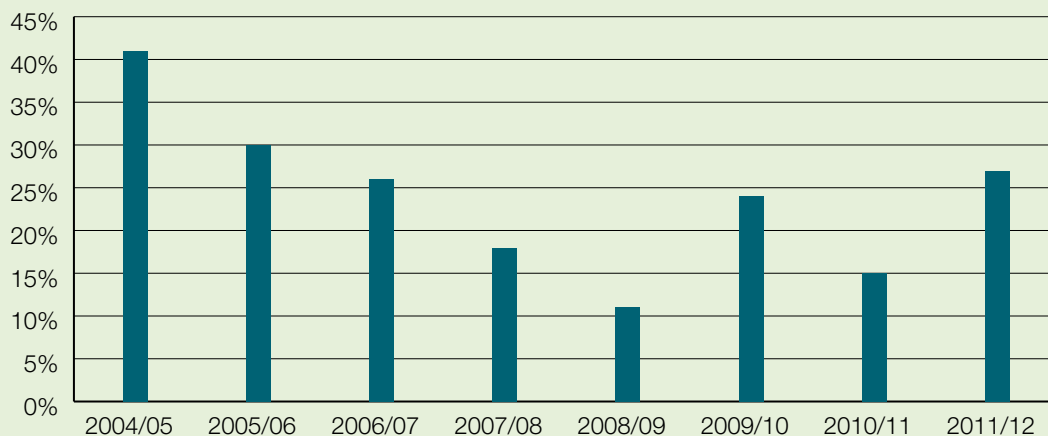
The City monitors the density of priority environmental weeds in Lilburne Park on an annual basis, measured on three transects in the reserve. There has been an increase in weed density in 2011/12 due to prolonged rainfall in spring 2011, which increased the longevity of winter weeds and enabled new growth later in the season (see Figure 15).

<sup>20</sup> DSEWPC (2012)

<sup>21</sup> Groves, Boden and Lonsdale (2005)

<sup>22</sup> Bradley (2002)

### Density of Priority Environmental Weeds in Lilburne Park



■ Density of Priority Environmental Weeds in Lilburne Park

**Figure 15: Density of Priority Environmental Weeds in Lilburne Park**

In accordance with the City's Annual Bushland and Weekly Bushland Schedules on ground weed management occurs through weed spraying and hand weeding methods with approximately 16 hours a fortnight being allocated to weed management at Lilburne Park. In addition to this, contractors are engaged to spray weeds for approximately 70 hours per year and hand weed for approximately 150 hours annually. City of Joondalup staff use a weed spraying procedure and conduct weed trials periodically to evaluate the most effective weed management methods. There is currently no specific City of Joondalup hand weeding procedure due to the need for different hand weeding procedures for different weed species.

A City of Joondalup Weed Management Plan is to be developed in 2012/13 to provide guidance on weed surveying, priority weed species control and seasonal weed control measures.<sup>17</sup>

The recommended weed treatment methodology is detailed in Table 5 and Table 6.

A number of education initiatives have been undertaken to raise the awareness of weeds with the community, these include:

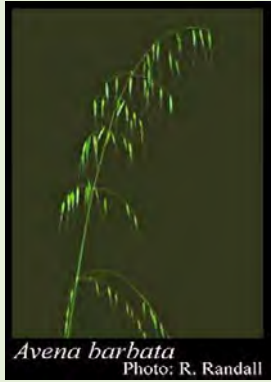




- Delivery of Great Gardens Workshops;
- Development and distribution of two weed brochures – Environmental Weeds and Garden Escapees; and
- Weed Education Workshops for Local Friends Groups.







#### Recommended Management Actions




To monitor, conserve and protect native flora in Lilburne Park, the following management actions are proposed:

- Engage consultants to undertake a follow up flora survey in spring to supplement previous flora survey undertaken in summer.
- Conduct five yearly follow up of Natural Areas Initial Assessment in spring to monitor ecological health of site.
- Engage consultants to undertake a follow up weed survey in winter to supplement previous weed survey undertaken in summer.
- Undertake coordinated approach to regular weed control by implementing Annual Bushland Schedule and Weekly Bushland Schedule.
- Develop and implement hand weeding procedure to ensure a consistent hand weeding approach is undertaken by the City of Joondalup, contractors and Friends groups.
- Update the City's weed spraying procedure to reflect current weed spraying methodology which has improved over time through weed trials.
- Develop and implement a City of Joondalup Weed Management Plan to provide guidance on weed surveying, priority weed species control and seasonal weed control measures.

Table 4: Key Weed Species at Lilburne Park (Syrinx 2012, 360 Environmental 2012)

Name	Common Name	Conservation Code	Image
<i>Avena barbata</i>	Bearded Oat	Alien to Western Australia	 <p><i>Avena barbata</i> Photo: R. Randall</p> <p>Photo: R. Randall (WA Herbarium n.d.)</p>
<i>Brassica tournefortii</i>	Mediterranean Turnip	Alien to Western Australia	 <p><i>Brassica tournefortii</i> Photos: K.C. Richardson and J.F. Smith (WA Herbarium n.d.)</p>
<i>Briza maxima</i>	Blowfly Grass	Alien to Western Australia	 <p><i>Briza maxima</i> Photos: A. Ireland and K.R. Thiele (WA Herbarium n.d.)</p>
<i>Bromus sp</i>	Brome Grass	Alien to Western Australia	 <p><i>Bromus diandrus</i> Photo: Una Bell (WA Herbarium n.d.)</p>
<i>Carpobrotus edulis</i>	Hottentot Fig	Alien to Western Australia	 <p><i>Carpobrotus edulis</i> Photos: I.R. Dixon, K. Richardson and R. Robson (WA Herbarium n.d.)</p>

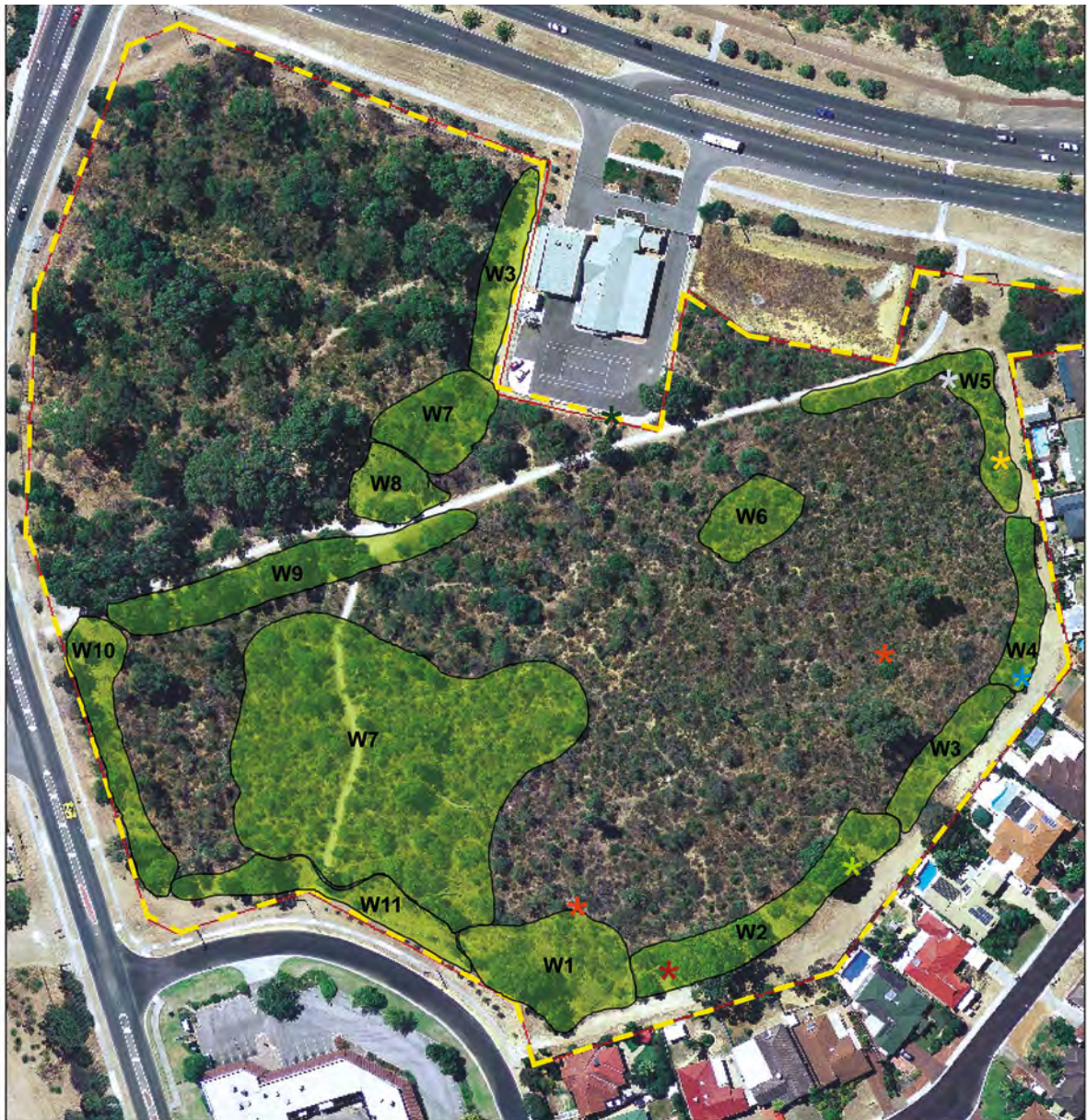
Name	Common Name	Conservation Code	Image
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Alien to Western Australia	
<i>Ehrharta calycina</i>	Perennial Veldt Grass	Alien to Western Australia	 <p data-bbox="1050 701 1428 723"><i>Ehrharta calycina</i> Photos: S.M. Armstrong (WA Herbarium n.d.)</p>
<i>Ehrharta longiflora</i>	Annual Veldt Grass	Alien to Western Australia	 <p data-bbox="1050 1037 1428 1059"><i>Ehrharta longiflora</i> Photos: L. Fontanini and R. Randall (WA Herbarium n.d.)</p>
<i>Eragrostis curvula</i>	African Lovegrass	Alien to Western Australia	 <p data-bbox="1050 1373 1428 1395"><i>Eragrostis curvula</i> Photos: J. Dodd, L. Fontanini &amp; R. Randall (WA Herbarium n.d.)</p>
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	Alien to Western Australia	
<i>Ferraria crispa</i>	Black Flag	Alien to Western Australia	 <p data-bbox="1050 2000 1428 2022"><i>Ferraria crispa</i> Photos: K.C. Richardson and D.P. Robinson (WA Herbarium n.d.)</p>

Name	Common Name	Conservation Code	Image
<i>Freesia alba x leichtlinii</i>	Freesia	Alien to Western Australia	 <p data-bbox="1139 439 1490 488">Photos: J. Dodd and K.R. Thiele (WA Herbarium n.d.)</p>
<i>Fumaria capreolata</i>	Whiteflower Fumitory	Alien to Western Australia	 <p data-bbox="1139 775 1490 824">Photos: J. Dodd, K.C. Richardson and K.R. Thiele (WA Herbarium n.d.)</p>
<i>Gladiolus caryophyllaceus</i>	Wild Gladiolus	Alien to Western Australia	 <p data-bbox="1139 1111 1490 1160">Photos: J. Dodd and K.C. Richardson (WA Herbarium n.d.)</p>
<i>Lupinus consentinii</i>	Blue Lupin	Alien to Western Australia	 <p data-bbox="1139 1447 1490 1496">Photos: J. Dodd and J.F. Smith (WA Herbarium n.d.)</p>
<i>Moraea flaccida</i>	One-leaf Cape Tulip	Declared Weed, Department of Agriculture and Food WA (DAFWA)	 <p data-bbox="1139 1783 1490 1832">Photos: R. Knox and K.C. Richardson (WA Herbarium n.d.)</p>
<i>Pelargonium capitatum</i>	Rose Pelargonium	Alien to Western Australia	

Name	Common Name	Conservation Code	Image
<i>Trachyandra divaricata</i>	False Onion Weed	Alien to Western Australia	 <p data-bbox="1050 416 1433 434"><i>Trachyandra divaricata</i> Photos: K. Eddington, K.C. Richardson &amp; J.F. Smith</p> <p data-bbox="1050 439 1433 517">Photos: K. Eddington, K.C. Richardson and J.F. Smith (WA Herbarium n.d.)</p>
<i>Watsonia meriana</i> var. <i>bulbillifera</i>	Watsonia	Alien to Western Australia	 <p data-bbox="1142 913 1337 965">Photo: R. Randall (WA Herbarium n.d.)</p>



Figure 16: Location of Invasive Weed Species in Lilburne Park (Syrinx 2012)



WEED POLYGONS:      — — — — — STUDY AREA

Area	Species name	Common name		Species name	Common name
W1	<i>Trachyandra divaricata</i>	False Onion Weed	W9	<i>Hakea trifurcata</i>	Two-leafed Hakea
	<i>Solanum nigrum</i>	Blackberry		<i>Grevillea crithmifolia</i>	
	<i>Conyza bonariensis</i>	Fleabane		<i>Jacksonia furcellata</i>	Grey Stinkwood
	<i>Euphorbia terracina</i>	Geraldton Carnation Weed		<i>Kunzea ericifolia</i>	Spearwood
				<i>Hakea prostrata</i>	Harsh Hakea
W2	<i>Euphorbia terracina</i>	Geraldton Carnation Weed	W10	<i>Trachyandra divaricata</i>	False Onion Weed
	<i>Trachyandra divaricata</i>	False Onion Weed		<i>Pelargonium capitatum</i>	Rose Pelargonium
	<i>Conyza bonariensis</i>	Fleabane		<i>Euphorbia terracina</i>	Geraldton Carnation Weed
	<i>Pelargonium capitatum</i>	Rose Pelargonium		<i>Sonchus oleraceus</i>	Common Sowthistle
	<i>Sonchus oleraceus</i>	Common Sowthistle			
<i>Solanum nigrum</i>	Blackberry				
W3	<i>Conyza bonariensis</i>	Fleabane	W11	<i>Trachyandra divaricata</i>	False Onion Weed
				<i>Conyza bonariensis</i>	Fleabane
				<i>Pelargonium capitatum</i>	Rose Pelargonium
W4	<i>Conyza bonariensis</i>	Fleabane	<i>Euphorbia terracina</i>	Geraldton Carnation Weed	
	<i>Chamaelucium uncinatum</i>	Geraldton Wax			
	<i>Solanum nigrum</i>	Blackberry			
W5	<i>Pelargonium capitatum</i>	Rose Pelargonium	<b>Weed points</b>		
	<i>Conyza bonariensis</i>	Fleabane	<i>Grevillea crithmifolia</i>	Common name	
	<i>Trachyandra divaricata</i>	False Onion Weed	<i>Acacia iteaphylla</i>	Flinders range Wattle	
W6	<i>Pelargonium capitatum</i>	Rose Pelargonium	<i>Eremaea pauciflora</i> var <i>pauciflora</i>		
	<i>Lupinus</i> sp	Lupin	<i>Schinus terebinthifolius</i>	Japanese Pepper	
	<i>Trachyandra divaricata</i>	False Onion Weed	<i>Watsonia meriana</i> var. <i>bulbillifera</i>	Watsonia	
W7	<i>Banksia prionotes</i>	Acorn Banksia	<i>Agave americana</i>	Century Plant	
W8	<i>Trachyandra divaricata</i>	False Onion Weed			

Note: Subsequent to weed mapping conducted by Syrinx in February 2012, 360 Environmental conducted a vegetation condition assessment and noted prevalent weeds in September 2012. Additional weeds on site that were observed but not mapped were:

- Mediterranean Turnip (*Brassica tournefortii*);
- Freesia (*Freesia alba x leichtlinii*);
- Wild Radish (*Raphanus raphanistrum*); and
- Cape Bluebell (*Wahlenbergia capensis*).

Table 5: Weed Control Methodology

Species	Common Name	Treatment Number	Timing
<b>Highest Priority</b>			
<i>Avena barbata</i>	Bearded Oat	2	Mid-June to mid-Aug
<i>Brassica tournefortii</i>	Mediterranean Turnip	4	Aug-Sept
<i>Briza maxima</i>	Blowfly Grass	2	Mid-June to mid-Aug
<i>Bromus sp</i>	Brome Grass	1,2	Mid-June to mid-Aug
<i>Carpobrotus edulis</i>	Hottentot Fig (Pigface)	1,4	Anytime
<i>Ehrharta calycina</i>	Perennial Veldt Grass	2	Mid-June to mid-Aug
<i>Ehrharta longiflora</i>	Annual Veldt Grass	2	Mid-June to mid-Aug
<i>Eragrostis curvula</i>	African Lovegrass	1	Anytime
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	1,4,5	June-Oct spraying, anytime for hand weeding
<i>Ferraria crispera</i>	Black Flag	6	Aug-Oct - spraying
<i>Freesia alba x leichtlinii</i>	Freesia	6	Aug-Sept
<i>Fumaria capreolata</i>	Whiteflower Fumitory	4, 5 or 6	June/July spray, July-Oct hand weed
<i>Gladiolus caryophyllaceus</i>	Wild Gladiolus	4	Aug-Sept
<i>Lupinus consentinii</i>	Blue Lupin	1,4,5,6	July-Sept spraying, Sept/Oct hand weed
<i>Moraea flaccida</i>	One-leaf Cape Tulip	6	Aug/Sept for spraying. Can also hand wipe with Glyphosate in areas of limestone outcrops.
<i>Pelargonium capitatum</i>	Rose Pelargonium	1,4	Summer/Autumn – hand weed, Winter - spray
<i>Watsonia meriana</i> var. <i>bulbillifera</i>	Watsonia	1,4	Spring spraying, anytime for hand weeding
<b>Other</b>			
<i>Acacia iteaphylla</i>	Flinders Range Wattle	4	Anytime
<i>Agave americana</i>	Century Plant	3	Anytime, preferably in Autumn
<i>Chamaelucium uncinatum</i>	Geraldton Wax	4	Anytime
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	1,4	Nov-Apr spray, anytime for hand weeding
<i>Cynodon dactylon</i>	Couch	1,2	Spring
<i>Diplotaxis tenuifolia</i>	Sand Rocket	Not targeted	-
<i>Erodium sp</i>	Storkbill	1,5,6	Incidental spraying, winter hand weeding
<i>Gazania linearis</i>	Gazania	1,4	Summer/Winter/Spring – spray, anytime for hand weeding
<i>Hypochaeris glabra</i>	Smooth Catsear	1,4	Jun-Aug spray, anytime for hand weeding
<i>Hypochaeris radicata</i>	Flatweed	1,4	Jun-Aug spray, anytime for hand weeding
<i>Lysimachia arvensis</i>	Pimpernel	Not targeted	-
<i>Monoculus monstrosus</i>	Stinking Roger	5 or 6	Incidental spraying
<i>Oenothera stricta</i>	Evening Primrose	1,4	Winter to spring spraying, anytime for hand weeding
<i>Petrorhagia dubia</i>	Hairy Pink	Not targeted	-
<i>Romulea rosea</i>	Guildford Grass	Not targeted	-
<i>Schinus terebinthifolius</i>	Japanese Pepper	3,4	Feb/Mar – basal bark, Spring – cut and paint
<i>Silene gallica</i>	French Catchfly	Not targeted	-
<i>Solanum nigrum</i>	Black Berry Nightshade	1,4	Autumn spraying, anytime for hand weeding
<i>Sonchus oleraceus</i>	Common Sowthistle	5 or 6	June-Sept spraying
<i>Trachyandra divaricata</i>	False Onion Weed	1,4,6	Aug-Sept spraying, anytime for hand weeding
<i>Tribulus terrestris</i>	Caltrop	1,4	Nov-Dec spraying, Nov-April for hand weeding

Note: Grasses are the highest priority due to contributing to the high fuel load.

**Table 6: Weed Treatment Types**

Treatment Number	Treatment Type
1	Glyphosate
2	Quizalofop
3	Triclopyr / Picloram
4	Hand weeding (includes use of hoe, chainsaw or brush cutter)
5	Triasulfuron
6	Metsulfuron

### 3.2 Fungi

It is estimated that there are 10 times more species of fungi than plants in the world, equating to approximately 140,000 fungi and 14,000 plant species in Western Australia. The amount of species of fungi present in bushland can be an indicator of ecosystem health. Fungi are strongly interconnected with plants and animals as fungi are recyclers that break down litter and debris to provide nutrients for plants. Native plants such as eucalypts, wattles and orchids have beneficial partnerships with fungi. Fungi also provide food and/or habitat for fauna such as bandicoots and beetles.<sup>23,24,25</sup>

Fungi surveys are important in providing baseline information and to highlight changes in fungi occurrence over time. Undertaking surveys also enables comparison of ecological data with other City of Joondalup natural areas.

#### Fungi Survey Methodology

The City engaged consultants, Syrinx Environmental PL, to undertake a fungi survey of Lilburne Park in February 2012 and record all incidental sightings of fungi.

Due to time limitations, the fungi survey was conducted in summer. The optimum time for fungi surveys is in winter after substantial rainfall.

#### Fungi

One fungi species was observed in the field survey, which was identified as the Scarlet Bracket Fungus (*Pycnoporus coccineus*), as shown in Table 7.

During previous field assessments photographs were taken of several types of fungi such as Mushrooms with Gills, Bracket and Shelf Fungi and Jelly and Ear Fungi.

#### Current Management Approach


The City of Joondalup currently monitor fungi in Lilburne Park through surveying for incidental sightings of fungi species every 5 years.

#### Recommended Management Actions

To monitor fungi health in Lilburne Park, the following management action is proposed:

- Engage consultants to undertake a comprehensive fungi survey in winter after substantial rain, such as mid-June to end of July, to supplement previous incidental fungi survey.

**Table 7: Key Fungi Species at Lilburne Park (Syrinx 2012)**

Name	Common Name	Image
<i>Pycnoporus coccineus</i>	Scarlet Bracket Fungus	 <p>Photo: N.L. Bougher (Bougher 2009)</p>

<sup>23</sup> Bougher (2009)

<sup>24</sup> Robinson (n.d.)

<sup>25</sup> DEC (n.d.)b

### 3.3 Plant Diseases

Organisms such as fungi, bacteria and viruses that cause plant diseases are known as pathogens. Whilst some pathogens are naturally occurring within soil populations, others have been introduced to the environment through the movement of plant materials and soils.<sup>26</sup>

The symptoms produced by plants that are affected by pathogens vary depending upon the species of pathogen, host species, environment and climatic conditions. Some pathogens can cause rapid death of plants whilst others result in a slow, perennial decline in health.<sup>26</sup>

*Phytophthora* dieback refers to the disease caused by the introduced plant pathogen *Phytophthora*. While there are numerous species of *Phytophthora*, the most aggressive species affecting native plants throughout South-western Western Australia is *Phytophthora cinnamomi*.

Whilst *Phytophthora cinnamomi* is the most common species of *Phytophthora* dieback within Western Australia a second species of *Phytophthora*, *Phytophthora multivora* is common in urban areas of the Perth, particularly along the inland dune systems, and has been identified within the City's parks areas. *Phytophthora multivora* is named due to its wide host range, including *Banksia* and Eucalypt species. *Phytophthora multivora* can cause rapid death of plants, or a slow, perennial decline in health of the crown and is commonly associated with individual spot deaths and areas of tree decline.<sup>26</sup>

*Armillaria luteobubalina* has also been identified within a number of parks within the City of Joondalup. *Armillaria* is a soil-borne fungus that causes root rot of a wide variety of plants including many species of native flora. The fungus is native to Australia and can cause major damage to natural ecosystems. *Armillaria luteobubalina* is commonly known as the "Honey Fungus" due to the colour of the fruiting body seen above the ground during certain times of the year, as shown in Figure 17. Fruiting bodies (mushrooms) are not evident at all infected sites and their presence is usually a sign that the fungus is well established in that area.<sup>26</sup>

**Figure 17: Fruiting Bodies of *Armillaria luteobubalina* (CoJ 2012c)**

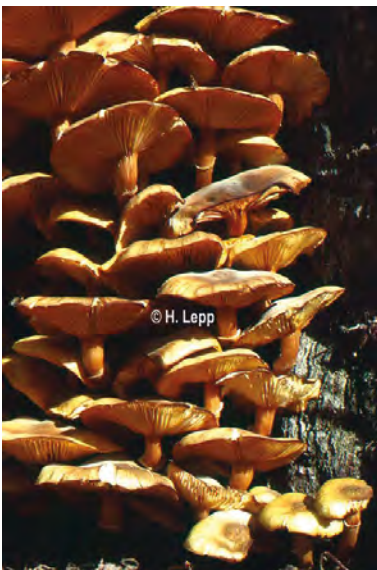


Photo: H. Lepp

At present there is no reliable mechanism for the complete eradication of *Phytophthora* species and the control of *Armillaria luteobubalina* is both expensive and labour intensive.<sup>26</sup>

There are currently no suspected plant diseases in Lilburne Park, however no soil or other sampling activities have been undertaken to confirm this. The closest site to Lilburne Park with a confirmed pathogen, *Phytophthora multivora*, is Granadilla Park in Duncraig, approximately 2km south of Lilburne Park. A desktop study was undertaken by Arbor Carbon<sup>27</sup> that identified Lilburne Park as a high risk priority area for further investigation. The criteria used in a pathogen risk analysis of natural areas included confirmed or suspected disease, connectivity to natural areas and Bush Forever sites and presence/absence of irrigation within the site or in connected sites.

#### Current Management Approach

In 2012/13 the City of Joondalup will develop a Pathogen Management Plan intended to establish the level of risk for areas to be infected by pathogens and detail preventative and management actions to be implemented within the City, including guidelines for dieback-free purchasing and a hygiene procedure.

In order to reduce the risk of spreading pathogens between vegetated areas, City of Joondalup staff currently spray vehicles, shoes and tools with methylated spirits before they enter any bushland reserves.

<sup>26</sup> CoJ (2012c)

<sup>27</sup> Arbor Carbon (2012)

## Recommended Management Actions

To prevent pathogen spread and protect biodiversity values at Lilburne Park, the following management action is proposed:

- Implement recommendations from the Pathogen Management Plan that are applicable to the management of Lilburne Park.

## 3.4 Fauna

Fauna surveys document components of biodiversity and make recommendations to minimise ecological impacts. The findings and recommendations from scientifically-based fauna surveys can be reflected in management planning decisions.<sup>19</sup>

### Fauna Survey Methodology

The City engaged consultants, Syrinx Environmental PL, to undertake a fauna survey of Lilburne Park in February 2012.

### Desktop study

A desktop study was undertaken by reviewing data provided by City of Joondalup and any additional relevant information.<sup>1</sup> Natural Area Initial Assessments were undertaken by the City of Joondalup in 2004 and 2011 and were reviewed as part of the desktop study. Natural Area Initial Assessments include documenting information such as threatened or significant fauna.

### Field Survey

Fauna trapping was undertaken over two nights, in conjunction with a bird census and one night of spotlighting for nocturnal species (including use of an Anabat bat call detector). This included a combination of pitfall, Elliot, funnel and cages with a total of four trap lines in the bushland, two in each vegetation community. Direct observations of fauna during daylight were carried out over four days in February 2012. Opportunistic observations of invertebrate fauna were recorded and a basic fauna habitat assessment was also undertaken.<sup>1</sup>

Due to time limitations, the fauna survey was conducted in summer. The optimum season for fauna detectability in the south west bioregions is spring. Trapping periods of 5 to 7 nights are recommended to show species diversity, richness trends and provide reliable indications of species composition and abundance data.

### Native Fauna

Fauna and flora are interconnected in complex relationships with each other and with factors such as soil, water, climate and landscape. The decline of native fauna can cause loss of plant species and changes to ecological communities.<sup>20</sup>

### Mammals

Two native mammals were recorded at Lilburne Park. Quenda diggings were recorded at several locations and the Grey Kangaroo was observed.

No bats have been identified in Lilburne Park. There are approximately 75 species of bat in Australia and these native mammals fall into two main groups: the megabats and the microbats. Two groups of bat occur in Western Australia: Flying-foxes (megabats) and insectivorous bats (microbats). Bats can be useful for pest control, feeding on moths, beetles, mosquitoes, invertebrate larvae, flying ants and other invertebrates.<sup>28</sup> A comprehensive bat survey would require a one week remote monitoring bat survey during summer.<sup>29</sup> Bats can be encouraged to roost in the area by installing bat boxes.

### Reptiles

Eight reptile species (lizards) were recorded at Lilburne Park, with the most common being the Striped Skink (*Ctenotus fallens*).

<sup>28</sup> DEC (2007)

<sup>29</sup> J Tonga 2012, pers. comm., 6 July

## Birds

A total of 19 native birds have been recorded as occurring in Lilburne Park, including the migratory Rainbow Bee-eater (*Merops ornatus*) and evidence of feeding by the endangered Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), as shown in Table 8 and Appendix 2. Lilburne Park is also an unconfirmed roost site for Carnaby's Black-Cockatoos.<sup>30</sup>

The most common native birds observed in Lilburne Park were Red Wattlebird (*Anthochaera carunculata*), Western Wattlebird (*Anthochaera superciliosus*), Australian Raven (*Corvus coronoides*), Singing Honeyeater (*Lichenostomus virescens*) and Brown Honeyeater (*Lichmera indistincta*).

## Invertebrates

Invertebrates are animals without backbones such as insects, worms and molluscs. Invertebrates constitute more than 95% of all living animal species, with Australia having documented 100,000 species and an estimated 200,000 undescribed invertebrate species.<sup>25</sup> Some invertebrates are important indicators of ecosystem health, such as ants (seed dispersers), bees (pollinators) or spiders (top invertebrate predators).<sup>31</sup>

A total of 37 native invertebrate species were recorded in Lilburne Park, as shown in Appendix 2. The majority of the invertebrates were spiders (such as wolf spider, golden orb weaver spider, white-tailed spider, jumping spider and huntsman spider) and ants (such as bull ant, meat ant and peaceful night ant).

As *Lomandra maritima* exists in Lilburne Park, it is possible that the threatened Graceful Sun Moth (*Synemon gratiosa*) also occurs on site. The Graceful Sun Moth is a small day-flying moth endemic to south-west Western Australia (between Quinns Rocks and Mandurah). The species is declared specially protected fauna being fauna that is rare or likely to become extinct under the *Wildlife Conservation Act 1950* and listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999*. The Graceful Sun Moth appears for a limited period each year (late February though early April) and utilises *Lomandra maritima* or *Lomandra hermaphrodita* as a larval host plant.<sup>32</sup>

## Threatened and Priority Fauna

Threatened and Priority fauna that are likely or have the potential to occur in Lilburne Park are shown in Table 8 and include:

- Carnaby's Black-Cockatoo;
- Forest Red-tailed Black-Cockatoo;
- Rainbow Bee-eater;
- Peregrine Falcon;
- Quenda; and
- the Graceful Sun Moth.

<sup>30</sup> T Kabat 2012, email, 20 June

<sup>31</sup> V Framenau 2012, email, 9 July

<sup>32</sup> Bishop et al. 2010

Table 8: Likely or Potential Threatened and Priority Fauna at Lilburne Park (Syrinx 2012)

Name	Common Name	Conservation Code	Likelihood	Image
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo	Schedule 1 ( <i>Wildlife Conservation Act</i> ), Endangered (DEC and EPBC)	Likely	 Photo: Raana Scott
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	Schedule 1 ( <i>Wildlife Conservation Act</i> ), Vulnerable (DEC and EPBC)	Likely	 Photo: Rick Dawson (DEC 2009)
<i>Merops ornatus</i>	Rainbow Bee-eater	Schedule 3 ( <i>Wildlife Conservation Act</i> ), Migratory (Japan-Australia Migratory Bird Agreement (JAMBA))	Likely	
<i>Falco peregrinus</i>	Peregrine Falcon	Schedule 3 ( <i>Wildlife Conservation Act</i> )	Potential	 Photo: Birds Australia n.d.
<i>Isodon obesulus fusciventer</i>	Southern Brown Bandicoot, Quenda	Priority 5 (DEC)	Likely	
<i>Synemon gratiosa</i>	Graceful Sun Moth	Schedule 1 ( <i>Wildlife Conservation Act</i> ), Endangered (DEC and EPBC)	Potential	

Note: For further explanations on Conservation Codes, refer to Appendix 2.



## Non-native Fauna

Non-native fauna impact native fauna and flora through predation, competition for food and shelter, spreading diseases and destroying habitat. These impacts can result in the diminishing or extinction of native species.<sup>17,20</sup>

Non-native animals such as cats, foxes, rabbits, birds and bees inhabit the City's bushland, wetland and coastal areas.

The European Rabbit is common within the City's coastal and bushland areas and has the potential to damage large areas of native vegetation. Rabbits also reduce the effectiveness of bushland rehabilitation activities by feeding on newly planted seedlings.

The European Honey Bee is also common within the City's natural areas and may impact upon native flora and fauna through competing with native fauna (including native bees) for floral resources, disrupting natural pollination processes and displacing endemic wildlife from tree hollows.

Domestic animals such as dogs can also cause damage to the City's natural environment, particularly when exercised unleashed within natural areas. Dogs can chase and harass native fauna often resulting in stress and harm to the animals. Dogs can also inadvertently spread pathogens if they disturb the soil, particularly around trees.

Domestic cats have the potential to cause significant environmental harm when enabled to roam within natural areas. Predation of wildlife by domestic cats is known to have serious impacts on the population of native mammals, reptiles and birds within bushland areas along the Swan Coastal Plain.<sup>17</sup>

## Mammals

Non-native mammals that were recorded during field surveys, or evidence indicated their presence include dog (*Canis lupus*), cat (*Felus cattus*), European rabbit (*Oryctolagus cuniculus*), house mouse (*Mus Musculus*), black rat (*Rattus rattus*) and red fox (*Vulpes vulpes*).

## Birds

A total of 5 non-native species of birds have been recorded as occurring in Lilburne Park including Little Corella (*Cacatua sanguinea*), Kookaburra (*Dacelo novaeguineae*), Spotted Turtledove (*Streptopelia chinensis*), Laughing Dove (*Streptopelia senegalensis*) and Rainbow Lorikeet (*Trichoglossus haematodus*), as shown in Appendix 2.

## Invertebrates

Two non-native invertebrate species were recorded in Lilburne Park, the European Honey Bee (*Apis mellifera*) and Portuguese millipede (*Ommatoiulus moreletii*).

## Fauna Habitat

Vegetation condition at Lilburne Park, in terms of fauna habitat, is considered moderate to very good. Whilst the site provides habitat for several small mammals and birds the inner metropolitan location of Lilburne Park and its small size limits the reserves use by fauna. The area is however in close proximity to Hepburn Conservation Area, Pinnaroo Valley Memorial Park and Craigie Open Space which provide habitat connectivity value.

## Ecological Corridor

Naturally connected landscapes and ecosystems are generally healthier, protect a diversity of species, provide pathways for species movement and can store carbon more effectively than degraded landscapes.<sup>33</sup> In urban areas where there is engineered infrastructure dividing the landscape, it may be necessary to provide wildlife crossings such as underpasses, tunnels, viaducts or overpasses to enable wildlife movement.

The location of Lilburne Park in relation to Hepburn Conservation Area, Pinnaroo Valley Memorial Park and Craigie Open Space creates an ecological corridor with two main roads dividing the landscape, as shown in Figure 18. Fauna crossings from Lilburne Park to Hepburn Conservation Area are via Hepburn Ave, an arterial road. Fauna crossings from Pinnaroo Valley Memorial Park to Craigie Open Space are also via an arterial road, Whitfords Ave.

The ecological corridor of Lilburne Park, Hepburn Conservation Area, Pinnaroo Valley Memorial Park and Craigie Open Space also extends to Woodvale Nature Reserve and is in close proximity to the north to south ecological corridor of Yellagonga Regional Park and Neerabup National Park.

<sup>33</sup> NWCPAG (2012)

### **Current Management Approach**

The City of Joondalup is implementing a number of management actions to address the environmental impacts of domestic and pest animals within the City's natural areas, including surveying and monitoring of native animal populations within reserves. Control of non-native fauna is undertaken annually within bushland, wetland and coastal areas. Control methods employed include biological and chemical control, trapping, baiting and exclusion methods such as fencing.

The City's current management practices have greatly reduced the incidence of pest animal populations within the City, however continued and coordinated action is required to ensure that populations remain at controllable numbers and that the impacts on natural areas remain at a minimum.

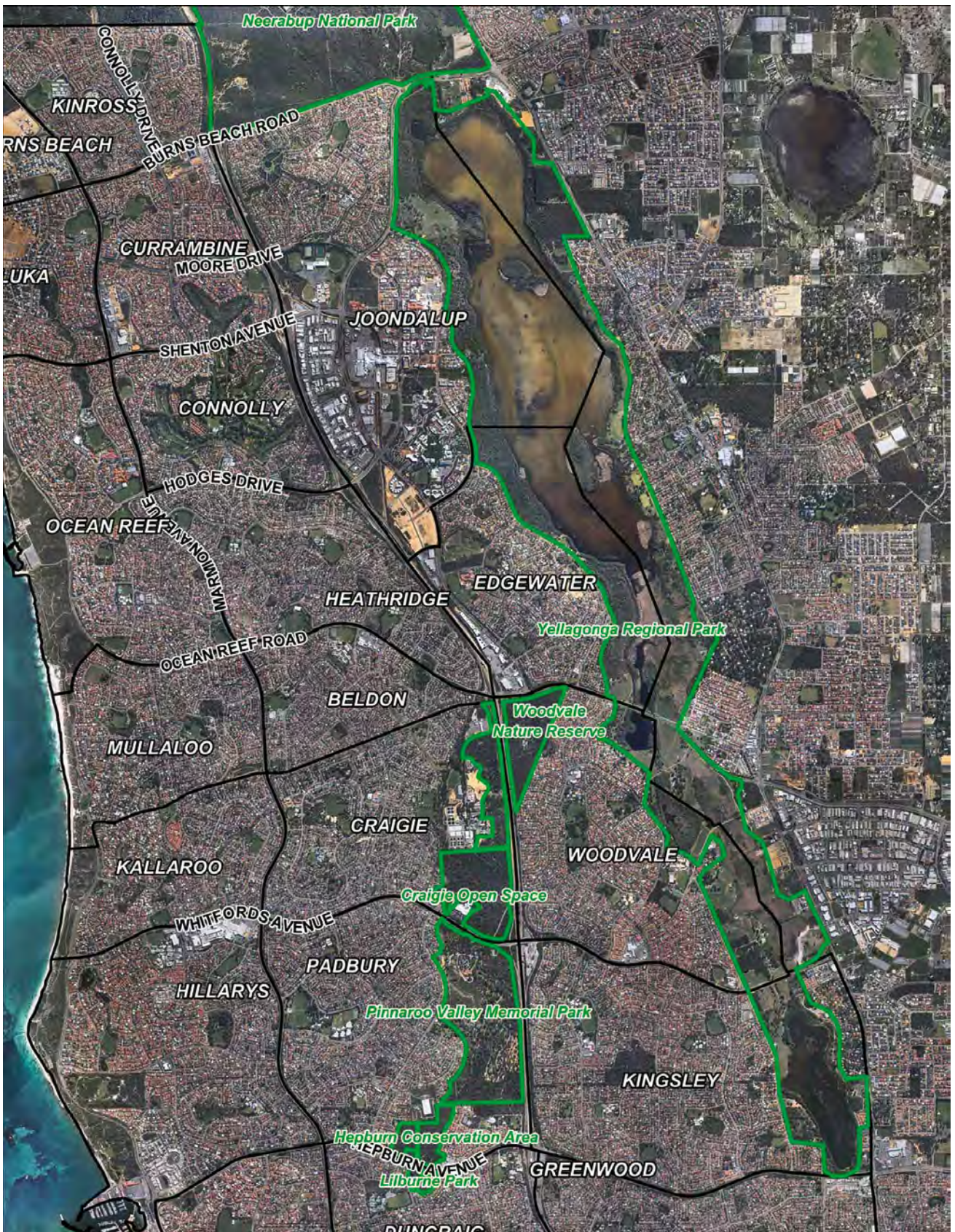
The City also promotes responsible pet ownership and encourages the community to ensure that domestic pets do not have a negative impact of the natural environment.

### **Recommended Management Actions**

To monitor and protect native fauna in Lilburne Park, the following management actions are proposed:

- Engage consultants to undertake a follow up fauna survey in mid-late spring, with 5 to 7 nights trapping, to supplement previous fauna survey undertaken in summer.
- Engage consultants to undertake the Graceful Sun Moth surveys in accordance with the Survey Guidelines for the Graceful Sun Moth and Site Habitat Assessments.
- Engage consultants to undertake targeted survey for invertebrates in spring to supplement previous opportunistic invertebrate survey undertaken in summer.
- Engage consultants to undertake a one week remote monitoring bat survey in summer to supplement previous one night bat survey undertaken in summer.
- If bat survey indicates presence of bats, install five bat boxes to encourage bats to roost.
- Remove feral bee hive (if accessible) and implement fox control to reduce pressures on native fauna.
- In partnership with the DEC, undertake research to ascertain the benefits and costs associated with the installation of fauna crossings between Lilburne Park and Hepburn Conservation Area and from Pinnaroo Valley Memorial Park to Craigie Open Space to provide ecological linkages.

Figure 18: Ecological Linkages to Lilburne Park



## 3.5 Social and Built Environment

### History and Heritage

Lilburne Park is not listed on any State or Federal Indigenous or non-Indigenous heritage inventory or register.

### Social Value

The main uses of Lilburne Park are for purposes such as walking or dog walking. Lilburne Park is a thoroughfare for people walking from Duncraig to Hepburn Conservation Area.

There was previously a Friends of Lilburne Park group of community members actively involved in conservation of the Park, however the Friends of Lilburne Park group no longer exist. The closest Friends group is Friends of Hepburn Heights who focus on conservation actions within the Hepburn Conservation Area.

Key external stakeholders for the management of Lilburne Park include:

- DEC;
- FESA;
- Duncraig Senior High School; and
- City of Joondalup community.

### Access and Infrastructure

#### Parking

There is no specific designated parking for Lilburne Park, although the parking facilities located close to Lilburne Park are sufficient for the current usage of the site. Parking is available nearby at Lilburne Shopping Centre on the corner of Hilarion Road and Lilburne Road (see Figure 18).

#### Fencing

Fencing is used to restrict access and protect areas of bushland. Timber post and chain mesh fencing surrounds two sides of the outer perimeter of Lilburne Park (see Figure 19) with the other two sides being residential fencing. Fencing also surrounds the sump located on site.

Fencing is inspected on a monthly basis and repairs are conducted as required. Minimal amounts of fence repairs are required.

#### Signage

Signage is important to encourage community appreciation and inform the community of the ecological values of the site. There is a wooden sign on the west side of Lilburne Park (on Lilburne Road) near the pedestrian access gate and one on the north side of Lilburne Park (on Hepburn Ave), indicating the name of the Park, that it is a natural bush area and is owned by City of Joondalup (see Figure 19).

There are no interpretive or educational signs with Lilburne Park.

**Figure 19: Lilburne Park Signage, Fencing and Gate**



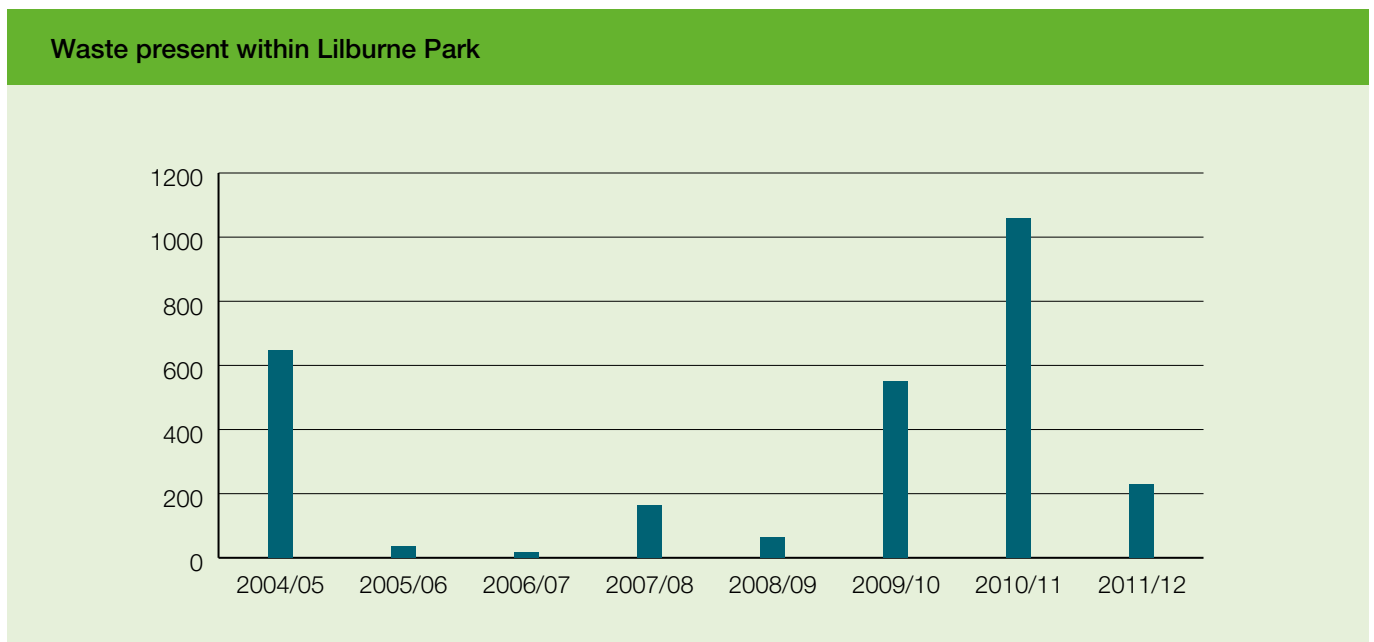
### Rubbish

Litter bins are generally installed in locations where people gather to socialise. There are no litter bins located in Lilburne Park as the site doesn't have infrastructure such as seating and tables which encourage people to socialise. There is a small amount of rubbish on site, mainly on the edges of the vegetation. Installation of a rubbish bin may reduce the amount of rubbish disposed of in the Lilburne Park bushland.

Rubbish is collected by the City of Joondalup on an as needed basis, sometimes in conjunction with hand weeding activities.

The City monitors the amount of waste present in Lilburne Park on an annual basis. There has been a decrease in the amount of waste present within Lilburne Park in 2011/12 due to targeted collections being conducted by the City of Joondalup while completing other works in the reserve (see Figure 20).

**Figure 20: Amount of Waste Present within Lilburne Park**



■ Items of Waste identified per hectare within Lilburne Park

## Fire Station

Duncraig Fire Station is located on the north side of Lilburne Park adjoining Hepburn Avenue, as shown in Figure 21 and Figure 23.

**Figure 21: Duncraig Fire Station**



## Access Points

Access points allow people to enter natural areas that are fenced off. There are five pedestrian access points (gates) into Lilburne Park, as shown in Figure 23.

## Paths

Paths in Lilburne Park are used for pedestrian access and bushland management and maintenance purposes. The paths in Lilburne Park are mostly used by pedestrians, dog walkers and a few cyclists. Lilburne Park can be used as a thoroughfare to Hepburn Conservation Area. There are two main limestone pedestrian paths at Lilburne Park, as shown in Figure 23. There is also an informal track. The existing paths in Lilburne Park are sufficient for the amount of usage the area receives.

## Access and Inclusion

Four million Australians (20%) reported having a disability in the Survey of Disability, Ageing and Carers conducted in 2009. The study considers disability to include any impairments, activity limitations and participation restrictions which impede everyday activities for a period of at least 6 months. In 15 years time the number of West Australians with a disability is expected to increase from 1 in 5 people (20%) to 1 in 4 people (25%).

The City of Joondalup has an *Access and Inclusion Plan 2012-2014*, outlining that 'the City is committed to ensuring that its activities and services are inclusive of all members, including people with disabilities and their families or carers, and people from culturally and linguistically diverse backgrounds'.

It is difficult for people with a disability to access Lilburne Park through the current gates or to use the limestone paths due to the uneven limestone surface. The Draft Joondalup Walkability Plan proposes that path replacement will occur in 2014/15.<sup>34</sup>

## Antisocial Behaviour

There is a history of cubby houses being built in Lilburne Park with resulting rubbish surrounding it. Monthly inspections are conducted and cubbies are dismantled by City of Joondalup as required.

<sup>34</sup> Grant and Bradshaw (2012)

## Water Sensitive Urban Design

Retrofitting the sump at Lilburne Park could improve the water quality of stormwater being discharged and enhance the visual appeal of the current sump area, incorporating it into public open space.<sup>10</sup> The fenced off sump at Lilburne Park is on Hepburn Ave, next to Duncraig Fire Station (see Figure 22).

The City of Joondalup undertakes a City Sump Improvement Program as part of the capital works Stormwater Drainage Program utilising Water Sensitive Urban Design and water quality improvement principles. Water Sensitive Urban Design incorporates water supply, wastewater, stormwater and groundwater management, urban design and environmental protection into an integrated design of the urban water cycle.<sup>35</sup> The sump in Lilburne Park could be included in the City Sump Improvement Program.

**Figure 22: Fenced Off Sump at Lilburne Park**



## Recommended Management Actions

To enhance the social and built environment in Lilburne Park, the following management actions are proposed:

- Maintain fencing on an as needed basis (informed by monthly inspections) to protect the native vegetation, flora and fauna from informal access.
- Upgrade signage in accordance with the City of Joondalup Signage Strategy (to be developed in 2013/14).
- Create interpretative signage on conservation significant and ecologically important features of the site such as Quenda, Carnaby's Cockatoos, Rainbow bee-eater and *Lomandra maritima* being the home for the Graceful Sun Moth. Locate signage at main entrances and/or the intersection of main paths.
- Install a rubbish bin at the main entrance to Lilburne Park on Lilburne Road and incorporate the bin into the City weekly bin emptying schedule.
- Future upgrades to Lilburne Park are to address access issues by providing gates and paths that can be used by people with a disability, as well as benefit other path users such as people with prams.
- Dismantle cubby houses as required to discourage the disposal of rubbish in this area.
- Consider including Lilburne Park sump in the City Sump Improvement Program to improve the water quality of the stormwater being discharged and enhance the visual appeal and community usability of the area.

Figure 23: Infrastructure at Lilburne Park





### 3.6 Fire Management

Fire is an important natural feature of the Western Australian landscape. Fire helps to shape the diversity of plant communities with many native plants having developed fire-related adaptations over time, for example fire expedites many species to flower or germinate. Human activity such as accidents and arson have resulted in increased incidences of fire within many urban bushland reserves, which can have a negative effect on biodiversity and encourage growth of highly flammable and invasive weeds.<sup>17</sup>

Bushfires are unplanned fires that can be caused by events such as lightning, planned burning operations, escape from industrial activities, damaged power transmission lines, discarded cigarette butts or deliberate arson. Bushfires can cause significant damage to people, property and the environment.<sup>36</sup>

Management of Lilburne Park is the responsibility of the City of Joondalup. The City of Joondalup has a “duty of care” to take all reasonable precautions to prevent any bushfire from spreading onto neighbouring property. The City of Joondalup does not currently have a prescribed burn management regime for the area.

#### Objectives

The objectives of fire management within Lilburne Park are to:

- Protect life, property and environment in adjacent residential areas and Duncraig Fire Station.
- Fulfil obligations under the fire related legislation.
- Protect the ecological and amenity values of Lilburne Park.
- Protect landscape values (including flora and fauna) from uncontrolled fire and inappropriate suppression techniques.
- Reduce the frequency, impact and area of unplanned fires.
- Minimise the spread of disease and weeds during fire fighting operations and when establishing firebreaks.
- Minimise impacts on air quality.

#### Fire Risk

A fire fuel load assessment was conducted at Lilburne Park in April 2012 which indicated that the site has an average fuel load of 19 tonnes / ha, as shown in Figure 1A (Appendix 1). The fuel load assessment was undertaken according to the methodology from the *FESA Visual Fuel Load Guide for the Scrub Vegetation of the Swan Coastal Plain*.<sup>37</sup>

#### Fire Prevention

The City of Joondalup undertakes a number of on ground measures to reduce the risk of fire, including:

- Controlled access;
- Non-native species management (weeds and fauna);
- Fuel load management;
- Emergency vehicle access;
- Fire access tracks (fire access ways and strategic firebreaks);
- Water supply (hydrants located close to Lilburne Park); and
- Evacuation of residents and visitors.<sup>17</sup>

The City of Joondalup will develop a Fire Management Plan in 2013/14, outlining the City’s strategy for assessing fire risk, prevention, response and recovery.

FESA have developed a *Fire Pre-Plan for the Urban Bushland Area of Lilburne Bushland*<sup>38</sup> that is updated annually in conjunction with key stakeholders including City of Joondalup.

#### Fire Occurrences

There are periodic fires at Lilburne Park, the majority of which are believed to be deliberately lit. The frequency of fires has lessened since the construction of the Fire Station adjoining the Park in 2005. Fire occurrences at Lilburne Park are detailed in Table 9. Figure 24 shows the result of a fire at Lilburne Park.

**Table 9: Fire Occurrences at Lilburne Park (FESA 2012)**

Dates	1 Jan 2012 – 23 May 2012	1 Jan 2011 – 31 Dec 2011	1 Jan 2010 – 31 Dec 2010	1 Jan 2009 – 31 Dec 2009	1 Jan 2008 – 31 Dec 2008
Fire Occurrences	2	3	0	0	1

<sup>36</sup> EDOWA (2011)

<sup>37</sup> FESA (2007)

<sup>38</sup> FESA (n.d.)

**Figure 24: Result of fire at Lilburne Park (photo taken May 2012)****Fire Response**

FESA are located on site at the Duncraig Fire Station and are responsible for suppressing fires within Lilburne Park.

**Fire Recovery**

Weed control is revised after fire incidents to aid regrowth by selecting appropriate chemicals, targeting weeds if safe to do so for new seedlings, and spraying grasses using backpacks.

**Recommended Management Actions**

To prevent fire occurrences and minimise the environmental impact of fire occurrences in Lilburne Park, the following management actions are proposed:

- Maintain fire access tracks and footpaths, including weed control and pruning of vegetation, by implementing Annual Bushland Schedule and Weekly Bushland Schedule.
- Annually assess fire fuel load to inform fire prevention actions required.
- Revise weed control after fire incidents to aid regrowth by selecting appropriate chemicals, targeting weeds if safe to do so for new seedlings, and spraying grasses using backpacks.
- Monitor fire occurrences through mapping and updating GIS layers detailing fire incidents and frequency.

### 3.7 Education and Training

#### Community Involvement

Environmental objectives cannot be achieved through the actions of the City alone; the community can also affect the local environment in both positive and negative ways. Environmental outcomes require the support of an engaged community that is aware and participating in environmental activities.

The community provides significant input into the protection and enhancement of the City's natural areas through the participation in environmental volunteer groups known as Friends Groups. The City of Joondalup also actively encourages participation within its community to raise awareness of key environmental issues within the City.<sup>17</sup>

#### Training and Education

The City of Joondalup Natural Areas Team currently conduct weekly plant identification training, including weed management. New members in the Natural Areas Team undertake training for the identification and management of pathogens.

#### Recommended Management Actions

To increase community awareness and training opportunities regarding natural areas management, the following actions are proposed:

- Implement initiatives of a 'Think Green Biodiversity' campaign (part of the Environmental Education Program) targeting issues such as:
  - » pathogens;
  - » weeds;
  - » fire;
  - » flora and fauna awareness;
  - » prevention of hand feeding wildlife; and
  - » responsible pet ownership.
- Conduct guided nature tours for Duncraig Senior High School students to highlight the ecological value of the bushland.
- Conduct training with the Natural Areas Team regarding identifying and managing pathogens to prevent pathogen spread.
- Conduct Natural Areas Team weekly plant identification training, including weed management, to increase the effectiveness of weed control activities.
- Create Natural Areas Induction Manual to document on ground practices including information such as health and safety, personal protective equipment, responsibilities and procedures (e.g. weed management, pathogen management and pruning procedures).
- Seek interest in the establishment of a 'Friends of Lilburne Park' group to encourage community participation in the management of this natural area.

# 4.0 Implementation Plan

## 4.1 Auditing and Inspections

Inspections of Lilburne Park are conducted by the City of Joondalup once every 4 weeks.

## 4.2 Key Performance Indicators

The City annually reports against the following key performance indicators relating to natural areas:

- Percentage density of priority environmental weeds.
- Incidence of foreign material within natural area / ha.

## 4.3 Routine Reporting

Assessing the management of Lilburne Park will be undertaken through annually reporting progress against management of the completion of actions and Key Performance Indicators in this Plan.

## 4.4 Scientific Research and Monitoring

A Natural Areas Initial Assessment is to be conducted on Lilburne Park every 5 years. The most recent assessment was conducted in 2011/12. The next assessment is to be conducted in 2016/17, prior to the review of the Lilburne Park Management Plan.

Surveys in Lilburne Park of flora, weeds, fungi, fauna, invertebrates, bats and the Graceful Sun Moth are to be conducted by consultants in 2015/16 and 2016/17.

Research is to be undertaken to ascertain the benefits and costs associated with the installation of fauna crossings between Lilburne Park and Hepburn Conservation Area and from Pinnaroo Valley Memorial Park to Craigie Open Space to provide ecological linkages, by 2016/17.

Fire fuel load assessments of Lilburne Park are to be undertaken annually.

## 4.5 Management Plan Review

The Lilburne Park Management Plan is to be reviewed every 5 years. The next review is due in 2017/18.

#### 4.6 Implementation of Management Actions

Recommended Management Action	Biodiversity Conservation Area
Undertake regular weed control by implementing Annual Bushland Schedule and Weekly Bushland Schedule.	Flora
Maintain fire access tracks and footpaths, including weed control and pruning of vegetation by implementing Annual Bushland Schedule and Weekly Bushland Schedule.	Fire Management
Conduct Natural Areas Team weekly plant identification training, including weed management.	Education and Training
Annually assess and report on fire fuel load	Fire Management
Map fire incidents and update GIS layer detailing fire incidents and frequency.	Fire Management
Revise weed control after fire incidents to aid regrowth by selecting appropriate chemicals, targeting weeds if safe to do so for new seedlings and spraying grasses using backpacks.	Fire Management
Install a rubbish bin at the main entrance to Lilburne Park and incorporate the bin into the City weekly bin emptying schedule.	Social and Built Environment
Dismantle cubby houses as required.	Social and Built Environment
Maintain fencing on an as needed basis (informed by monthly inspections).	Social and Built Environment
Conduct training with new Natural Areas staff regarding identifying and managing pathogens.	Education and Training
Development of City of Joondalup Weed Management Plan.	Flora
Implementation of City of Joondalup Weed Management Plan.	Flora
Remove feral bee hive (if accessible) and implement fox control.	Fauna
Development and implementation of the Pathogen Management Plan.	Plant Diseases
<p>Implement initiatives of a 'Think Green Biodiversity' campaign (part of the Environmental Education Program) targeting issues such as:</p> <ul style="list-style-type: none"> <li>• pathogens;</li> <li>• weeds;</li> <li>• fire;</li> <li>• flora and fauna awareness;</li> <li>• prevention of hand feeding wildlife; and</li> <li>• responsible pet ownership.</li> </ul>	Education and Training
Development of hand weeding procedure.	Flora
Implementation of hand weeding procedure.	Flora
Update the City's weed spraying procedure.	Flora
Seek interest in the establishment of a 'Friends of Lilburne Park' group.	Education and Training
Upgrade signage in accordance with the City of Joondalup Signage Strategy (to be developed in 2013/14)	Social and Built Environment
Future upgrades to Lilburne Park are to address access issues by providing gates and paths that can be used by people with a disability, as well as benefit other path users such as people with prams.	Social and Built Environment
Consider including Lilburne Park sump in the City Sump Improvement Program.	Social and Built Environment
Engage consultants to undertake the Graceful Sun Moth surveys in accordance with the Survey Guidelines for the Graceful Sun Moth and Site Habitat Assessments.	Fauna
Engage consultants to undertake a flora survey in spring.	Flora
Conduct Natural Areas Initial Assessment in spring.	Flora

Recommended Management Action	Biodiversity Conservation Area
Engage consultants to undertake weeds survey in winter.	Flora
Engage consultants to undertake a fungi survey in winter after substantial rain.	Fungi
Engage consultants to undertake a fauna survey in mid-late spring with 5 to 7 nights trapping.	Fauna
Engage consultants to undertake a targeted survey for invertebrates in spring.	Fauna
Engage consultants to undertake a one week remote monitoring bat survey in summer.	Fauna
If bat survey indicates presence of bats, install five bat boxes to encourage bats to roost.	Fauna
In partnership with the DEC, undertake research to ascertain the benefits and costs associated with the installation of fauna crossings between Lilburne Park and Hepburn Conservation Area and from Pinnaroo Valley Memorial Park to Craigie Open Space to provide ecological linkages.	Fauna
Create interpretative signage on conservation significant and ecologically important features of the site such as Quenda, Carnaby's Cockatoos foraging, Rainbow bee-eater and Lomandra maritima being the home for the Graceful Sun Moth. Locate signage at main entrances and/or the intersection of main paths.	Social and Built Environment
Conduct guided nature tours for Duncraig Senior High School students to highlight the ecological value of the bushland.	Education and Training
Create Natural Areas Induction Manual including information such as health and safety, personal protective equipment, responsibilities and procedures (e.g. weed management, pathogen management and pruning procedures).	Education and Training

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# 6.0 Appendices

## Appendix 1

### Figures

Figure 1A: Lilburne Park Fuel Load Assessment – 11 April 2012



# Appendix 2

## Lilburne Park Flora and Fauna Species Lists

### Flora Species Represented in Quadrats

Family	Estimated Abundance per 100m <sup>2</sup>	% Coverage	Sept 2012 Survey	Feb 2012 Survey		2004/2011 Previous Surveys	Significance	Comments
				V1	V2			
Aizoaceae	2-10	<1	Opp	√				
Amaranthaceae	2-10	<1			√	√		
Amaranthaceae				Opp		√		
Amaranthaceae	2-10	<1			√	√		
Apiaceae					Opp			
Asparagaceae	2-10	2-10		√	Opp			
Asparagaceae	2-10	2-10		√	Opp	√		
Asparagaceae	2-10	<1		√	√			
Asteraceae	2-10	<1		√				
Asteraceae	2-10	<1		√				
Asteraceae	2-10	<1		√				
Asteraceae	2-10	<1		√	√			
Asteraceae						√		
Caryophyllaceae	2-10	<1		√				
Casuarinaceae	2-10	1		√	Opp	√		
Casuarinaceae	10-50	10-30		√		√		
Chenopodiaceae	2-10	1			√	√		
Colchicaceae	2-10	<1		√	√	√		Previously <i>Burchardia umbellata</i>
Cyperaceae	2-10	2-10		Opp	√			
Cyperaceae	10-50	2-10		√	√	√		
Cyperaceae	2-10	<1		√				
Cyperaceae						√		May be confused with <i>Tetralaria octandra</i>
Cyperaceae	2-10	2-10		√		√		
Dilleniaceae	2-10	10-30		√	√	√		

## Flora Species Represented in Quadrats

Family		Estimated Abundance per 100m <sup>2</sup>	% Coverage	Sept 2012 Survey	Feb 2012 Survey		2004/2011 Previous Surveys	Significance	Comments
					V1	V2			
Dilleniaceae	<i>Hibbertia racemosa</i>	2-10	<1		Opp	Opp	✓		
Ericaceae	<i>Conostephium pendulum</i>						✓		
Ericaceae	<i>Leucopogon propinquus</i>	2-10	10-30			✓	✓		
Euphorbiaceae	* <i>Euphorbia terracina</i>	2-10	<1		Opp				
Euphorbiaceae	<i>Ricinocarpos glaucus</i>	2-10	2-10			✓	✓		
Fabaceae	<i>Acacia pulchella</i>	2-10	<1		✓				
Fabaceae	<i>Acacia rostellifera</i>			Opp					
Fabaceae	<i>Acacia saligna</i>	2-10	<1		Opp	✓	✓		
Fabaceae	<i>Daviesia divaricata</i>	2-10	2-10			✓	✓		
Fabaceae	<i>Daviesia nudiflora</i> subsp. <i>Nudiflora</i>	2-10	<1		✓		✓		
Fabaceae	<i>Daviesia triflora</i>	2-10	2-10		✓	✓	✓		
Fabaceae	<i>Gastrolobium capitatum</i>	2-10	<1		✓	Opp			
Fabaceae	<i>Gompholobium tomentosum</i>	2-10	2-10		✓	✓	✓		
Fabaceae	<i>Hardenbergia comptoniana</i>	2-10	2-10		✓	✓			
Fabaceae	<i>Hovea trisperma</i>	2-10	2-10		✓	✓	✓		
Fabaceae	<i>Jacksonia calcicola</i>	2-10	2-10		✓			Previously recorded as <i>Jacksonia sericea</i>	
Fabaceae	<i>Jacksonia furcellata</i>					Opp	✓		
Fabaceae	<i>Kennedia prostrata</i>			Opp					
Geraniaceae	* <i>Pelargonium capitatum</i>	2-10	<1		✓	✓			
Goodeniaceae	<i>Lechenaultia linarioides</i>	2-10	2-10		✓		✓	p	
Goodeniaceae	<i>Scaevola canescens</i>	2-10	2-10		✓		✓		
Goodeniaceae	<i>Scaevola repens</i>				Opp		✓		
Haemodoraceae	<i>Anigozanthos humilis</i>			Opp					
Haemodoraceae	<i>Conostylis aculeata</i>	2-10	2-10		✓	✓	✓		
Haemodoraceae	<i>Conostylis aculeata</i> subsp. <i>cygnorum</i>	2-10	2-10		✓	✓		e	

## Flora Species Represented in Quadrats

Family	Species	% Coverage	Estimated Abundance per 100m2	Sept 2012 Survey	Feb 2012 Survey		2004/2011 Previous Surveys	Significance	Comments
					V1	V2			
Haemodoraceae	<i>Haemodorum paniculatum</i>	<1	2-10		✓	Opp	✓		Previously recorded as <i>Haemodorum Laxum</i>
Hemerocallidaceae	<i>Corynotheca micrantha</i> var <i>micrantha</i>	2-10	10-50		✓		✓		
Hemerocallidaceae	<i>Dianella revoluta</i>	2-10	2-10		✓	✓	✓		
Hemerocallidaceae	<i>Tricoryne elatior</i>	<1	2-10		✓		✓		
Iridaceae	* <i>Romulea rosea</i>	<1	2-10		✓	✓			
Iridaceae	* <i>Gladiolus caryophyllaceus</i>	<1	2-10	Opp	✓	✓			
Iridaceae	<i>Orthrosanthus laxus</i> var <i>laxus</i>	<1	2-10		✓	✓	✓		
Myrtaceae	<i>Calothamnus quadrifidus</i>	2-10	2-10		✓		✓		
Myrtaceae	<i>Corymbia calophylla</i>						✓		
Myrtaceae	* <i>Eremaea pauciflora</i> var <i>pauciflora</i>					Opp			Most likely planted
Myrtaceae	<i>Eucalyptus gomphocephala</i>	<1	2-10		Opp	Opp	✓		
Myrtaceae	<i>Eucalyptus marginata</i>	2-10	2-10			✓	✓		
Myrtaceae	<i>Kunzea ericifolia</i>					Opp			
Myrtaceae	<i>Melaleuca systena</i>	2-10	2-10		✓				
Orchidaceae	<i>Diuris magnifica</i>			Opp					
Orchidaceae	<i>Microtis media</i> subsp <i>media</i>	<1	2-10			✓			
Phyllanthaceae	<i>Phyllanthus calycinus</i>	2-10	2-10		✓	✓	✓		
Poaceae	* <i>Avena barbata</i>	<1	2-10		✓				
Poaceae	* <i>Ehrharta calycina</i>	<1	10-50		✓	✓			
Poaceae	* <i>Ehrharta longiflora</i>	<1	2-10		✓				
Poaceae	<i>Austrostipa flavescens</i>	<1	2-10			✓	✓		
Primulaceae	* <i>Lysimachia arvensis</i>	<1	2-10		✓				
Proteaceae	* <i>Banksia prionotes</i>	10-30	10-50		Opp		✓		
Proteaceae	<i>Banksia attenuata</i>	2-10	2-10		✓	Opp	✓		
Proteaceae	<i>Banksia dallanneyi</i> var <i>dallanneyi</i>	10-30	10-50		✓	✓	✓		Previously <i>Dryandra lindleyana</i>

## Flora Species Represented in Quadrats

Family	Species	% Coverage	Estimated Abundance per 100m <sup>2</sup>	Sept 2012 Survey	Feb 2012 Survey		2004/2011 Previous Surveys	Significance	Comments
					V1	V2			
Proteaceae	<i>Banksia grandis</i>				Opp				
Proteaceae	<i>Banksia sessilis</i>					✓	✓		Previously <i>Dryandra sessilis</i>
Proteaceae	<i>Banksia menziesii</i>	1	2-10		Opp		✓		
Proteaceae	* <i>Grevillea crithmifolia</i>					Opp			Most likely planted
Proteaceae	<i>Grevillea vestita</i>	10-30	2-10		✓		✓		
Proteaceae	<i>Hakea lissocarpha</i>	10-30	2-10		✓	✓	✓		
Proteaceae	<i>Hakea prostrata</i>	1	2-10		✓		✓		
Proteaceae	<i>Hakea trifurcata</i>					Opp			
Proteaceae	<i>Persoonia saccata</i>						✓		
Proteaceae	<i>Petrophile linearis</i>					Opp	✓		
Proteaceae	<i>Petrophile macrostachya</i>	2-10	2-10		✓	Opp	✓		
Proteaceae	<i>Stirlingia latifolia</i>	1	2-10			✓	✓		
Proteaceae	<i>Synaphea spinulosa</i>						✓		
Restionaceae	<i>Alexgeorgea nitens</i>	2-10	2-10		✓				
Restionaceae	<i>Desmodioides flexuosus</i>	2-10	10-50		✓	✓	✓		
Rubiaceae	<i>Opercularia vaginata</i>						✓		
Violaceae	<i>Hybanthus calycinus</i>			Opp					
Xanthorrhoeaceae	<i>Xanthorrhoea brunonis</i>	2-10	2-10		✓	✓			
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>	10-30	10-50		✓	✓	✓		
Zamiaceae	<i>Macrozamia riedlei</i>	2-10	2-10		Opp	Opp	✓		

\* non-native species to the local area

**Opp** Opportunistic collection – no abundance recorded  
**e** taxa endemic to the Swan Coastal Plain (DEP 2000)  
**p** considered to be poorly reserved (DEP 2000)

## Weed Species List

Family	Species	Common Name	EWSWA* Rating	Declared Weed DAFWA^	Recorded 2004	Recorded 2011	Recorded Feb 2012	Recorded Sept 2012
Aizoaceae	<i>Carpobrotus edulis</i>	Hottentot Fig	Moderate			√	√	√
Anacardiaceae	<i>Schinus terebinthifolius</i>	Japanese Pepper	Moderate				√	
Asphodelaceae	<i>Trachyandra divaricata</i>	False Onion Weed	Mild		√	√	√	√
Asparagaceae	<i>Agave americana</i>	Century Plant	Low				√	
Asteraceae	<i>Gazania linearis</i>	Gazania	Low				√	
Asteraceae	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Low				√	
Asteraceae	<i>Hypochoeris glabra</i>	Smooth Catsear	Moderate				√	
Asteraceae	<i>Hypochoeris radicata</i>	Flatweed	Not Listed		√		√	
Asteraceae	<i>Monoculus monstrosus</i>	Stinking Roger	Not Listed		√		√	
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle	Moderate			√	√	
Brassicaceae	<i>Brassica tournefortii</i>	Mediterranean Turnip	High					√
Brassicaceae	<i>Diplotaxis tenuifolia</i>	Sand Rocket	Low				√	
Brassicaceae	<i>Raphanus raphanistrum</i>	Wild Radish	Mild					√
Campanulaceae	<i>Wahlenbergia capensis</i>	Cape Bluebell	Moderate					√
Caryophyllaceae	<i>Silene gallica</i>	French Catchfly	Low				√	
Caryophyllaceae	<i>Petrohragia dubia</i>	Hairy Pink	Not Listed					
Euphorbiaceae	<i>Euphorbia terracina</i>	Geraldton Carnation Weed	High		√			
Fabaceae	<i>Lupinus consentinii</i>	Blue Lupin	High		√		√	√
Iridaceae	<i>Freesia alba x leichitini</i>	Freesia	Listed					√
Geraniaceae	<i>Erodium sp</i>	Storkbill	Listed			√		
Geraniaceae	<i>Pelargonium capitatum</i>	Rose Pelargonium	High		√		√	
Iridaceae	<i>Ferraria crispa</i>	Black Flag**	Listed				√	
Iridaceae	<i>Gladiolus caryophyllaceus</i>	Wild Gladiolus	Moderate			√	√	√
Iridaceae	<i>Moraea flaccida</i>	One-leaf Cape Tulip	High	Yes	√	√		√
Iridaceae	<i>Romulea rosea</i>	Guildford Grass	High		√		√	
Iridaceae	<i>Watsonia meriana var. bulbilifera</i>	Watsonia	High				√	√
Mimosaceae	<i>Acacia iteaphylla</i>	Flinders Range Wattle	Low				√	
Myrtaceae	<i>Chamelaucium uncinatum</i>	Geraldton Wax	Not Listed				√	

## Weed Species List

Family	Species	Common Name	EWSWA* Rating	Declared Weed DAFWA^	Recorded 2004	Recorded 2011	Recorded Feb 2012	Recorded Sept 2012
Onagraceae	<i>Oenothera stricta</i>	Evening Primrose	Low				√	
Papaveraceae	<i>Fumaria capreolata</i>	Whiteflower Fumitory	Mild			√		√
Poaceae	<i>Avena barbata</i>	Bearded Oat	Moderate	√		√	√	
Poaceae	<i>Briza maxima</i>	Blowfly Grass	Moderate				√	
Poaceae	<i>Bromus sp</i>	Brome Grass	Listed			√		
Poaceae	<i>Cynodon dactylon</i>	Couch	Moderate				√	
Poaceae	<i>Ehrharta calycina</i>	Perennial Veldt Grass	High		√	√	√	
Poaceae	<i>Ehrharta longiflora</i>	Annual Veldt Grass	Moderate			√	√	
Poaceae	<i>Eragrostis curvula</i>	African Lovegrass	High		√		√	
Primulaceae	<i>Lysimachia arvensis</i>	Pimpernel	Not Listed			√	√	
Solanaceae	<i>Solanum nigrum</i>	Black Berry Nightshade	Moderate			√	√	√
Zygophyllaceae	<i>Tribulus terrestris</i>	Caltrop	Not Listed			√	√	

\* EWSWA - Ratings from the Environmental Weed Strategy for WA (DEC 1999)

\*\* Identified during Natural Areas Site Inspection (August 2012)

^ DAFWA - Declared Weeds Database (2010)

## Conservation Codes for Western Australian Fauna

### Commonwealth Environment Protection and Biodiversity Conservation Act 1999 and WA Wildlife Conservation Act 1950 – Threatened Species Codes

Category	Code	Description
Extinct	EX	Taxa not definitely located in the wild during the past 50 years.
Extinct in the wild	EW	Taxa known to survive only in captivity.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	EN	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable	VU	Taxa facing a very high risk of extinction in the wild in the medium-term future.
Conservation Dependent	CO	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.

### WA Department of Environment and Conservation – WA Threatened Fauna Categories

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

### WA Department of Environment and Conservation and Land Management Priority Species – Priority Codes

Category	Code	Description
Priority 1		Taxa with few, poorly known populations on threatened lands.
Priority 2		Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3		Taxa with several, poorly known populations, some on conservation lands.
Priority 4		Taxa in need of monitoring.
Priority 5		Conservation dependent species.

Note: species not listed under the WA Wildlife Conservation Act 1950, but for which there is some concern.



## Vertebrate Fauna Species List

Scientific Name	Common name	Comments	Recorded 2011	Conservation Status
<b>Reptiles</b>				
<i>Christinus marmoratus</i>	Marbled Gecko	1 head-torched at night		Native
<i>Cryptoblepharus buchananii</i>	Fence skink	observed active on trees and pit-trapped		Native
<i>Ctenotus fallens</i>	Striped Skink	common throughout, trapped and observed active		Native
<i>Hemiergis quadrilineata</i>	Two-toed Garden Skink	one found in soil under leaf litter		Native
<i>Lerista praepedita</i>	Burrowing Skink	one found in soil under leaf litter		Native
<i>Lialis burtonis</i>	Burton's Legless Lizard	1 juvenile observed active		Native
<i>Menetia greyii</i>	Common Dwarf Skink	1 pit trapped, 1 observed active		Native
<i>Tiliqua rugosa</i>	Bobtail	sloughed skin		Native
<b>Mammals</b>				
<i>Canis lupus</i>	Dog	scats and tracks		Non-native
<i>Felus cattus</i>	Cat	1 head-torched at night		Non-native
<i>Isoodon obesulus</i>	Quenda	foraging signs identified in several locations in southern portion		Priority 5
<i>Macropus fuliginosus</i>	Grey kangaroo	1 adult observed active, and extensive scats identified		Native
<i>Mus musculus</i>	House mouse	several Elliot and Pit-fall trapped		Non-native
<i>Rattus rattus</i>	Black Rat	footprints in sand identified		Non-native
<i>Vulpes vulpes</i>	Red fox	an active warren		Non-native
<b>Birds</b>				
<i>Anthochaera carunculata</i>	Red Wattlebird	common throughout	√	Native
<i>Anthochaera superciliosus</i>	Western Wattlebird	common throughout		Native
<i>Barnardius zonarius</i>	Australian Ringneck	several observed and heard calling		Native
<i>Cacatua roseicapilla</i>	Galah	several heard calling	√	Native
<i>Cacatua sanguinea</i>	Little Corella	several heard calling		Native to WA but not to Perth
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo	evidence of feeding - chewed Banksia prionotes cones		EN, T
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo Shrike	several heard calling		Native
<i>Corvus coronoides</i>	Australia Raven	common throughout		Native
<i>Cracticus tibicen</i>	Magpie	1 family group observed		Native
<i>Cracticus torquatus</i>	Grey Butcherbird	1 heard calling		Native
<i>Dacelo novaeguineae</i>	Kookaburra	several heard calling		Non-native
<i>Gerygone fusca</i>	Western Gerygone	heard calling		Native
<i>Grallina cyanoleuca</i>	Magpie-lark	several heard calling		Native
<i>Lichenostomus virescens</i>	Singing Honeyeater	common throughout	√	Native
<i>Lichmera indistincta</i>	Brown Honeyeater	common throughout	√	Native
<i>Merops ornatus</i>	Rainbow Bee-eater	one heard calling	√	IA, Migratory
<i>Ninox novaeseelandiae</i>	Boobook Owl	1 observed in Tuart woodland area in northern portion		Native
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	several in southern portion	√	Native
<i>Rhipidura leucophrys</i>	Willie Wagtail	several observed		Native
<i>Smicromis brevirostris</i>	Weebill	several groups observed and heard calling		Native
<i>Streptopelia chinensis</i>	Spotted Turtledove	several observed		Non-native

### Vertebrate Fauna Species List

Scientific Name	Common name	Comments	Recorded 2011	Conservation Status
<i>Streptopelia senegalensis</i>	Laughing Dove	common throughout	√	Non-native
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	several heard calling		Non-native
<i>Zosterops lateralis</i>	Silvereeye	several heard calling		Native

### Invertebrate Fauna Species List

Common name	Order: Family	Family/Genus
Woodlice (Slater)	Isopoda	
Scorpion - species 1	Buthionae	Buthidae
Scorpion - species 2	Arachnida: Scorpionidae	Urodachus
Millipede - species 1	Polydesmida	Ommatoiulus
Millipede - species 2	Polydesmida	
Tick	Arachnida	Acarina
Wolf Spider species 1	Arachnida	Lycosidae
Wolf Spider species 2	Arachnida	Lycosidae
Spider 1	Arachnida	
Spider 2	Arachnida	
Spider 3	Arachnida	
Golden Orb Weaver	Arachnida	
White-tailed spider	Arachnida	Lampona
Huntsman Spider	Arachnida	
Jumping Spider species 1	Arachnida	
Jumping Spider species 2	Arachnida	
Katidid - species 1 green	Orthoptera	Tettigoniidae
Katidid - species 2 fawn	Orthoptera	Tettigoniidae
Grass hopper	Orthoptera	
Cricket	Orthoptera	
Centipede	Chilopoda	
Moth species 1	Lepidoptera	
Moth species 2	Lepidoptera	
Butterfly - Monarch	Lepidoptera	Nymphalidae
Weevil species 1	Coleoptera	Curculionoidae
Weevil species 2	Coleoptera	Curculionoidae
Earwig species 1	Dermaptera	
Earwig species 2	Dermaptera	
Fly	Diptera	
Ant – bull ant	Hymenoptera	formicidae
Ant - meat ant	Hymenoptera	formicidae
Ant - small black sp 1	Hymenoptera	formicidae
Ant - small black sp 1	Hymenoptera	formicidae
Ant - peaceful night ant	Hymenoptera	formicidae
Native Bee sp 1	Hymenoptera	
Native Bee sp 2	Hymenoptera	
European Bee	Hymenoptera	
Assassin Bug	Hemiptera	Reduviidae
Stink Bug	Hemiptera	

# Appendix 3

## Keighery Scale Definitions

Vegetation Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

(Sourced from Department of Planning 2000)



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