City of Joondalup

Draft Hepburn Heights Conservation Area Management Plan

Contents

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Acronyms

Acronym / Abbreviation	Definition
AHD	Australian Height Datum
BoM	Bureau of Meteorology
CALM	Department of Conservation and Land Management
the City	City of Joondalup
CoJ	City of Joondalup
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFWA	Department of Agriculture and Food Western Australia
DEC	Department of Environment and Conservation
DEP	Department of Environmental Protection
DEPI	Department of Environment and Primary Industries
DFES	Department of Fire and Emergency Services
DoE	Department of Environment
DoW	Department of Water
DPaW	Department of Parks and Wildlife
DPI	Department of Primary Industries
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
EDOWA	Environmental Defender's Office Western Australia (Inc)
ELA	Eco Logical Australia
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
mAHD	Elevation in metres with respect to the Australian Height Datum
MRS	Metropolitan Region Scheme
NRM	Natural Resource Management
NWCPAG	National Wildlife Corridors Plan Advisory Group
PEC	Priority Ecological Community
Syrinx	Syrinx Environmental PL
TDS	Total Dissolved Solids
WA	Western Australia
WALGA	Western Australian Local Government Association
WONS	Weeds of National Signficance

Executive Summary

The Draft Hepburn Heights Conservation Area Management Plan outlines a framework for the environmental management of Hepburn Heights Conservation Area (referred to as Hepburn Heights) for the next five years.

Hepburn Heights is located approximately 10km north-west from the Perth Central Business District in the suburb of Padbury. The reserve covers approximately 22 hectares (ha) of bushland, and is bounded by Hepburn Avenue to the south and Walter Padbury Boulevard, Parkhurst Rise and Stonesfield Crescent to the east. The site connects to bushland areas surrounding the Water Corporation Water Supply and Telecommunications Facility and Pinnaroo Valley Memorial Park.

Hepburn Heights is classified as a Major Conservation Area and is ranked in the City of Joondalup's top five bushland natural areas due to the high biodiversity values of the area. Hepburn Heights contains regionally significant plant communities including *Banksia* Low Woodland and has been recognised for its regional environmental significance by being designated as a Bush Forever site by the Western Australian Planning Commission in 2000.

As part of the development of the Draft Hepburn Heights Conservation Area Management Plan, a flora, fauna and fungi survey was conducted in spring 2013. The results of this survey were combined with previous surveys to develop a comprehensive species list and ecological assessment of the site.

The majority of the native vegetation on site is in very good to excellent condition and surveys have identified 198 native flora species (including 1 priority species and 9 significant species), 14 native fungi species, 3 native mammals, 24 native birds (including 2 species of conservation significance), 19 native reptile species, 2 native amphibians, and 38 native invertebrates (including 1 species of conservation significance).

Environmental threats have the potential to degrade natural areas and reduce biodiversity values. Environmental threats addressed in this Plan include weeds, plant diseases, fire, non-native fauna species, human impacts, access and infrastructure. A total of 72 weed species, 5 non-native mammals, 6 non-native birds and 2 non-native invertebrates have been identified at Hepburn Heights.

In order to address the key environmental threats at Hepburn Heights a number of management actions are outlined within the Plan. Recommended management actions for the next five years include regular weed control, feral animal control, installation of new signage, annual fire fuel load assessments, conducting flora, weed, fungi, fauna, bat, invertebrates and user surveys and implementation of the City's Pathogen Management Plan. 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, with the Joondalup City Centre being located 30km from the Perth Central Business District. The City covers an area of 96.5km^2 which encompasses a diverse range of natural areas including 17km 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 16km 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 and a number of Bush Forever sites which contain species of high conservation value. Significant natural areas adjacent to the City include the Marmion Marine Park and the Neerabup National Park.

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 addressed in this Plan include weeds, plant diseases, fire, non-native fauna species, human impacts and access and infrastructure.

Natural Areas Management Plans describe the potential environmental impacts, risks and threats in natural areas and the associated management strategies that will be implemented to minimise potential impacts.

1.3 Study Area

The study area for the Hepburn Heights Management Plan is Hepburn Heights Conservation Area, Padbury. The site has been recognised for its regional environmental significance by being designated as a Bush Forever site (303) by the Government of Western Australia.[1,2]

1.3.1 Location

Hepburn Heights covers an area of approximately 22 hectares and is bounded by Hepburn Avenue, Parkhurst Rise, Stonesfield Court, Blackwattle Parade, Walter Padbury Boulevard, Holleton Terrace and O'Leary Road (as shown in Figure 2). Hepburn Heights is bordered by residential properties (north, east, south and west), Water Corporation Water Supply and Telecommunications Facility and Pinnaroo Valley Memorial Park (north), Hepburn Heights Shops and Medical Centre (southeast), Padbury Catholic Primary School (west) and Brazier

[1] Government of Western Australia (2000a)
[2] Government of Western Australia (2000b)

Park (northwest). Hepburn Heights is adjacent to Lilburne Park (south) and the two natural areas are separated by Hepburn Avenue.

1.3.2 History of the Site

Hepburn Heights was classified as a C Class Reserve under the *Land Act 1933*.

The Metropolitan Region Scheme (MRS) was established in 1962 by the then Metropolitan Regional Planning Authority. The MRS sets out the broad pattern of land use for the whole Perth Metropolitan Region. In 1962 Hepburn Heights was designated as Rural and in 1972 was rezoned as a Public Purposes Special Uses Reserve, with the intention of a tertiary education facility being developed on site.

In 1987, the State Government announced plans to develop Hepburn Heights for housing and concerned residents formed the Hepburn Woodlands Preservation Group. Several years of campaigning to protest against Hepburn Heights bushland being cleared were undertaken by the Hepburn Woodlands Preservation Group and other environmental groups.

The site was rezoned under the MRS in 1991 as Urban. Approximately 32 hectares of bushland was cleared in 1991 and 1992 to allow for the development of housing. The Australian Heritage Commission placed Hepburn Heights on the Interim List of the Register of the National Estate in 1992. The remaining bushland within the site (approximately 21 hectares) was set aside as an A Class Conservation Reserve in 1993, which was vested with the then City of Wanneroo. The Hepburn Woodlands Preservation Group changed its name in 1993 to Friends of Hepburn and Pinnaroo Bushland to reflect the group's new role in conserving and managing the conservation reserve.[3]

In 2000 the State Government endorsed the Bush Forever Strategy as a means of seeking the appropriate protection and management of areas of regionally significant bushland within the Perth Metropolitan Region. The Western Australian Planning Commission designated Hepburn Heights as a Bush Forever site (303) due to the regionally significant bushland found within the site.

Following the development of Bush Forever, the majority of the remaining bushland on site (21 ha) was rezoned as Parks and Recreation under the MRS in 2004. The Parks and Recreation zoning refers to land with regional significance for ecological, recreation or landscape purposes.

Table 1 outlines the key historical events that occurred at Hepburn Heights.

Year	Event
1962	Hepburn Heights designated as Rural under the MRS
1972	Hepburn Heights rezoned under the MRS as a Public Purpose Special Uses Reserve for tertiary education
1987	State Government announces plans to develop the site for urban housing
1987	Local residents form the Hepburn Woodlands Preservation Group and campaign to protest the development of the site
1991	The site was rezoned as Urban under the MRS

[3] Lloyd and Marwick (2009)

Year	Event
1991	Clearing of bushland onsite commences and is completed in 1992 (approximately 32 ha) to allow for housing development
1992	The Australian Heritage Commission places the site on the Interim List of the Register of the National Estate
1993	The current site was classified as an A Class Conservation Reserve
1993	Hepburn Woodlands Preservation Group changes its name to the Friends of Hepburn and Pinnaroo Bushland
2000	The Western Australian Planning Commission designated Hepburn Heights as a Bush Forever site (303) under the Bush Forever Strategy
2004	The majority of the bushland on site (21 ha) was rezoned as Parks and Recreation under the MRS

Table 1: Hepburn Heights Key Historical Events

1.3.3 Land Tenure

Hepburn Heights is Crown Land managed by the City of Joondalup and is reserved for the purposes of Parks and Recreation under the Metropolitan Region Scheme, apart from a small area that is zoned as Urban. The small area zoned as Urban was formerly designated land for the development of a power substation and fire station. The fire station was relocated to Lilburne Park.

City of Joondalup District Planning Scheme No. 2 Schedule 5

Planning for land use occurs under the District Planning Scheme No. 2. Schedule 5 (Clause 5.3.1) of the District Planning Scheme lists *Places and Objects Having Significance for the Purpose of Protection of the Landscape or Environment*, a mechanism to protect identified places of landscape or environmental value within the City.

Hepburn Heights is listed on the District Planning Scheme No. 2 Schedule 5 (Clause 5.3.1) as a place having significance for the purpose of protection of the landscape or environment.

1.3.4 Current Land Uses

The main uses of Hepburn Heights bushland are for passive recreational purposes such as walking, cycling, dog exercising or travel to and from Padbury Catholic Primary School, Hepburn Heights Shops and Medical Centre or Brazier Park. Nearby properties to Hepburn Heights are zoned as Low Density Residential.

Figure 1: Location of Hepburn Heights in City of Joondalup

Figure 2: Map of Study Area

1.4 Aim and Objectives

The aim of the Draft Hepburn Heights Conservation Area Management Plan is to provide a framework to protect and enhance biodiversity values whilst maintaining appropriate community access and awareness of the natural area.

The objectives of the Draft Hepburn Heights Conservation Area Management Plan are to:

- Establish a baseline description of the Hepburn Heights environment to guide future environmental planning and recommended management actions.
- Outline key environmental threats and the impact they have on conservation and recreation values.
- Outline management actions to address key environmental threats including monitoring and reporting.

1.5 Purpose

The purpose of the Draft Hepburn Heights Conservation Area 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 Hepburn Heights.

1.6 Strategic Context

The aim of the Draft Hepburn Heights Conservation Area Management Plan aligns with the City of Joondalup Strategic Environmental Framework outlined in Figure 3. Details of the relevant local, State and Federal legislation, policies, plans and strategies are outlined in Appendix 1.

Figure 3: City of Joondalup Strategic Environmental Framework

1.7 Stakeholder Consultation

Key external stakeholders to be consulted for the development of the Hepburn Heights Management Plan include:

- Department of Parks and Wildlife.
- Department of Fire and Emergency Services.
- Friends of Hepburn and Pinnaroo Bushland.

2.0 Description of the Physical Environment

2.1 Geology, Soils and Landforms

Soils of the Swan Coastal Plain

Hepburn Heights is situated in the City of Joondalup which is located within the Swan Coastal Plain. Hepburn Heights is characterised by regionally significant *Banksia* Low Woodland Communities, as well as examples of Jarrah woodland and limestone heath vegetation.[4] 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.[5]

Hepburn Heights 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.[6,7] 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 Spearwood Sand Phase is characterised by undulating dunes with rocky crests of Aeolian sand over limestone.[8] The environmental geological characteristics of Hepburn Heights include limestone in the north and sand in the south, impacting on the types of vegetation communities that exist on site, as in Figure 5.

The land contours of Hepburn Heights range from 13m to 53m Australian Height Datum (AHD), as shown in Figure 10.

Acid Sulfate Soils

Potential Acid Sulfate Soils are naturally occurring soils and sediments that contain iron sulphides. Potential Acid Sulfate Soils are predominantly found in low-lying coastal wetlands and tidal flats and are harmless when left undisturbed. Exposure to air can cause the iron sulfides in Potential Acid Sulfate Soils to react with oxygen and water producing Acid Sulfate Soils with high concentrations of iron and sulfuric acid, which can lead to other contaminants such as heavy metals and arsenic being released into the surrounding environment.[9]

Acid Sulfate Soils are categorised as Potential Acid Sulfate Soils or Actual Acid Sulfate Soils. Potential Acid Sulfate Soils have not been oxidised by exposure to air whilst Actual Acid Sulfate Soils have been disturbed or exposed to oxygen and become acidic.[9]

There is no known risk of Acid Sulfate Soils in Hepburn Heights.[7] The risk of Acid Sulfate Soils is based on the likelihood of Potential Acid Sulfate Soils occurring within soil profiles and has been mapped by the Department of Parks and Wildlife (DPaW) using available desk-top information and limited ground-truthing within areas where intensive on-ground soil mapping and soil analysis work has been undertaken. The mapping undertaken has found that Acid Sulfate Soils are not known or expected to occur in the environment of Hepburn Heights on the basis of the geological units present, depth to groundwater and partial "ground truthing" or onsite investigation. Within the City of Joondalup, areas of high to

[4] Syrinx (2014)
[5] Bolland (1998)
[6] McArthur and Bettenay cited in Syrinx (2012)
[7] DoW (2004)
[8] DAFWA cited in Eco Logical Australia (2013)
[9] DEC no date(a)

moderate acid sulfate soil risk are predominantly in wetlands or areas adjacent to wetlands, as shown in Figure 6.[9,10]

[10] Landgate (2006)

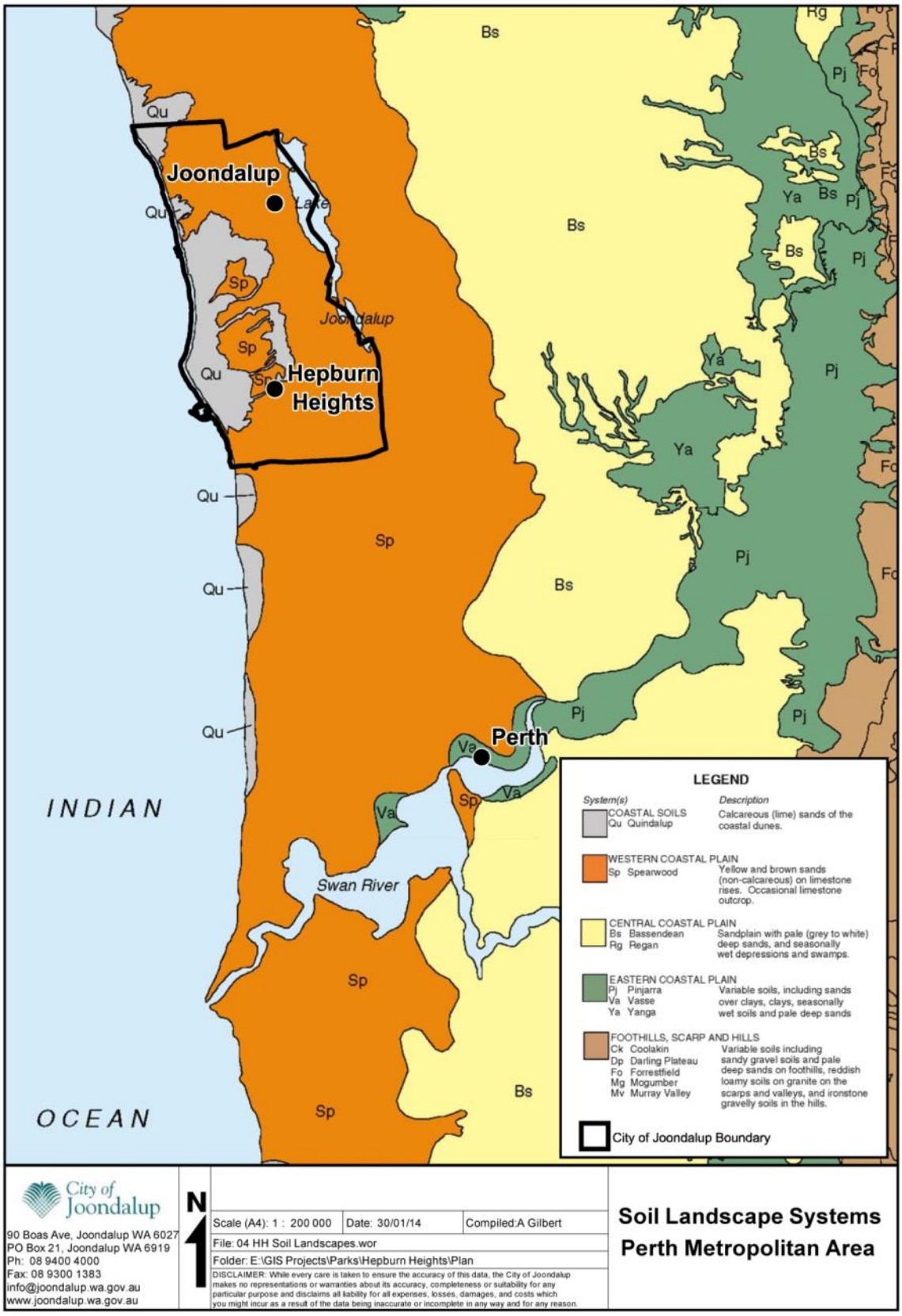

Figure 4: Soils of the Swan Coastal Plain (sourced from Department of Agriculture 2002)

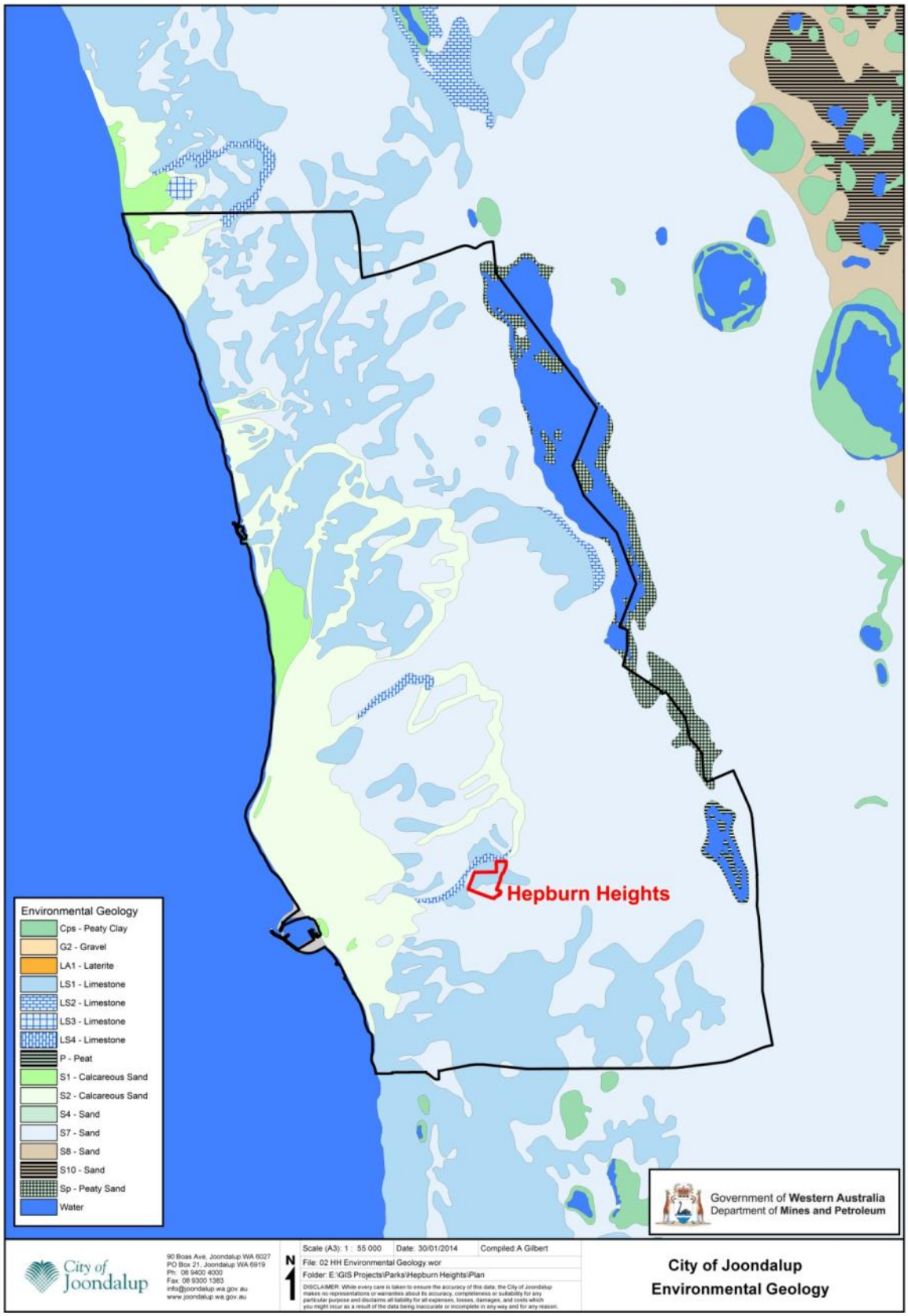

Figure 5: City of Joondalup Environmental Geology (sourced from Department of Mines and Petroleum 2013)

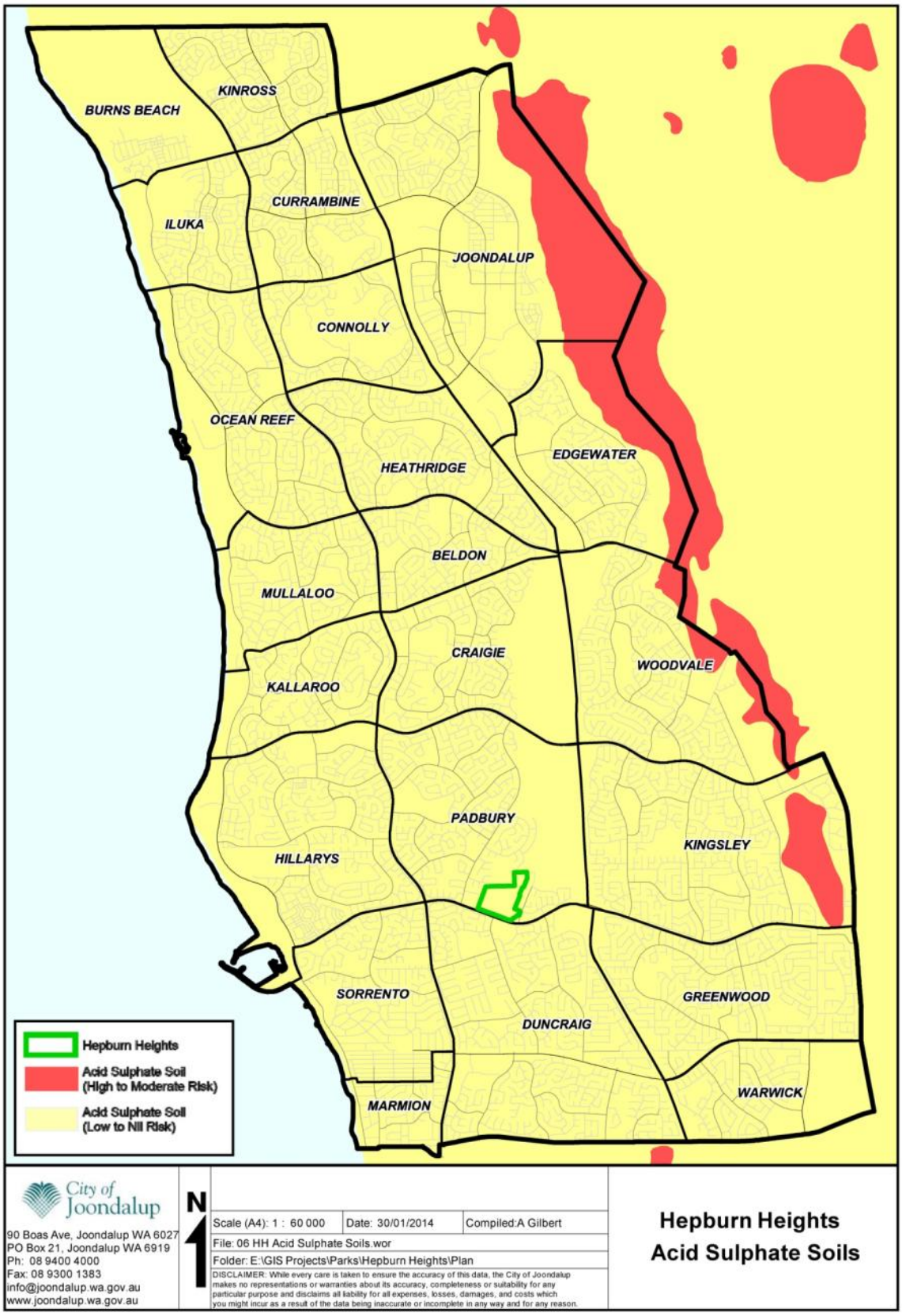

Figure 6: Hepburn Heights Acid Sulfate Soil Risk

2.2 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 7. Groundwater levels in the superficial aquifer have been declining over recent years due to pressure from extraction and the impacts of climate change, as shown in Figure 8.[11]

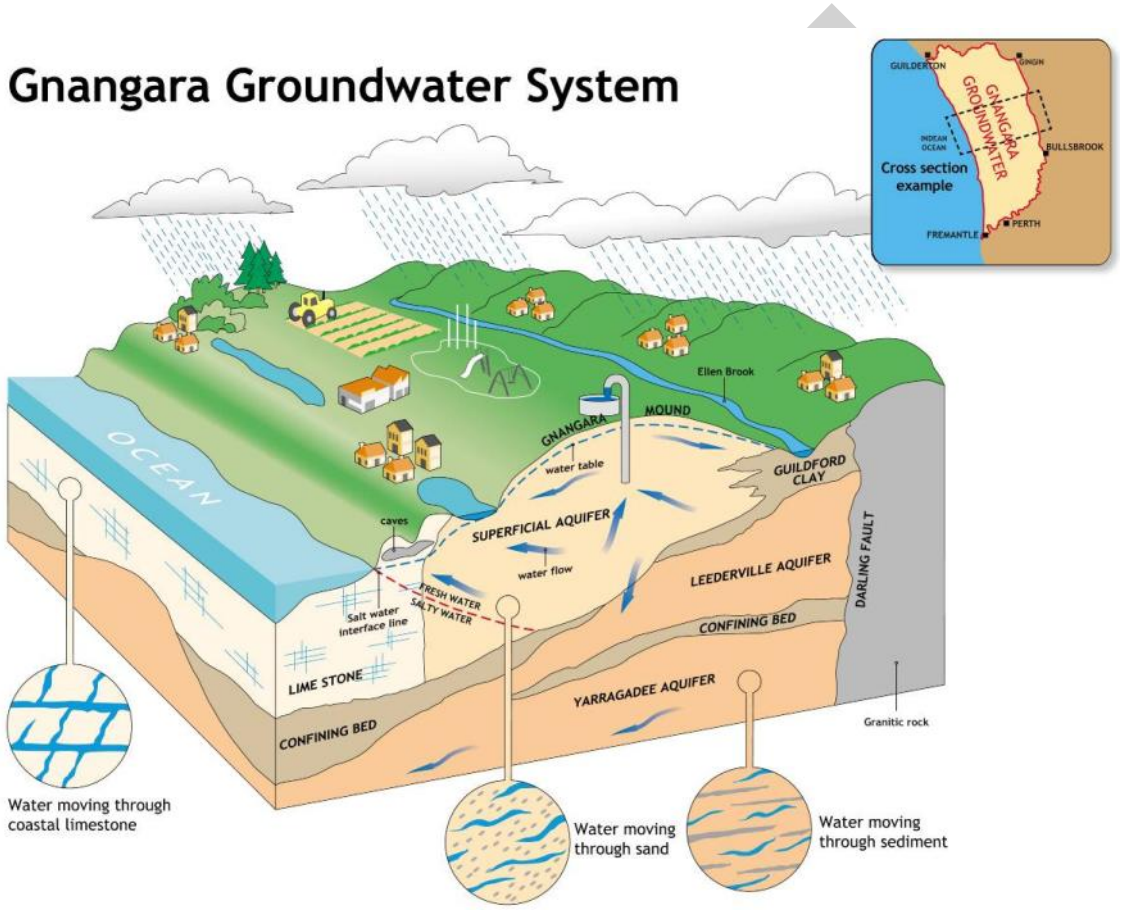

Figure 7: Gnangara Groundwater System (sourced from DoW no date)

There is a natural seasonal variance in Perth's groundwater system due to annual rainfall recharge, as shown in Figure 8.

[11] CoJ (2012a)

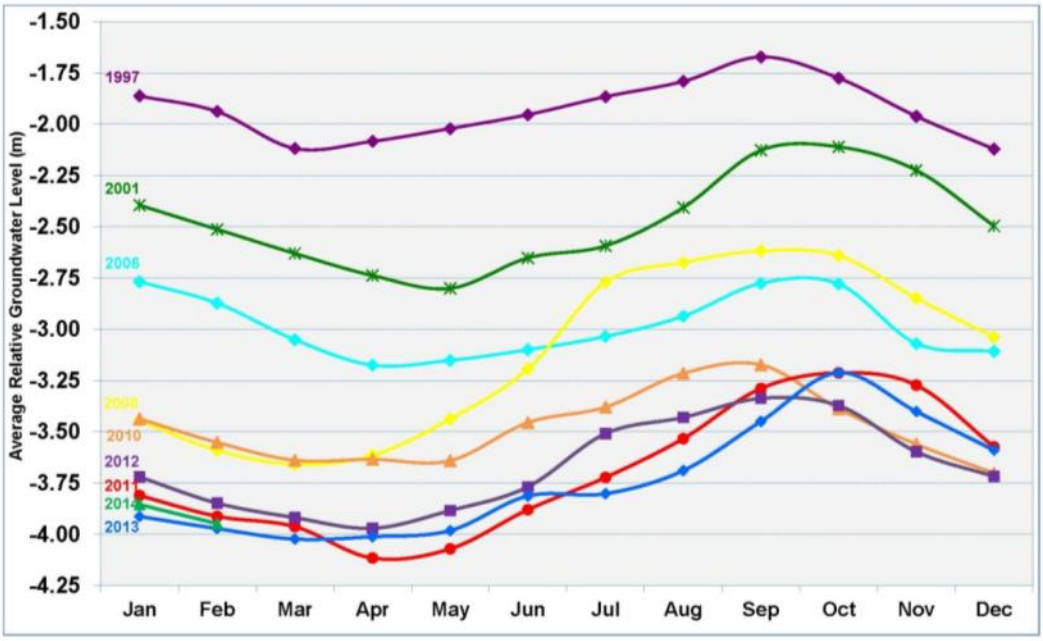

Figure 8: Gnangara Mound Average Relative Groundwater Levels (sourced from DoW no date)

It is likely that some plant species at Hepburn Heights use groundwater as the depth to water varies from 10.5m in the southeast corner up to 50m along the northern boundary, with a +/- range of 3m annual variance.[12] In general, some plant species (usually larger tree species) in the Perth metropolitan area within approximately 10m of groundwater are likely to access the water table.[13] Depth to water is the depth from the natural surface contours to the water table (see Figure 9). Groundwater salinity at Hepburn Heights is fresh (0 – 500 TDS in mg/L).

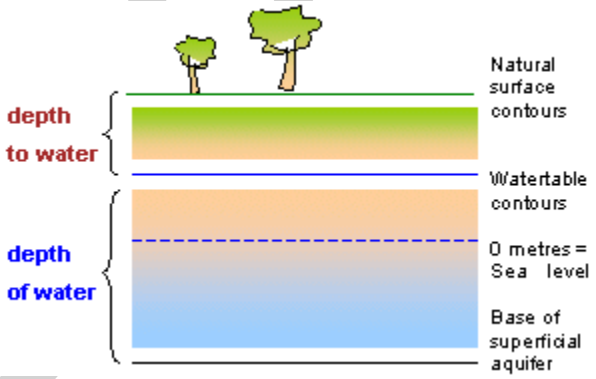

Figure 9: Groundwater Depth Explanation (sourced from DoW 2004)

No current information is available on groundwater levels located directly beneath Hepburn Heights. There are no groundwater monitoring bores located within Hepburn Heights. The closest groundwater monitoring bore is located at Padbury Catholic Primary School, however the last groundwater level measurement was taken in 1978. Several bores are located within the Water Corporation Water Supply and Telecommunications bores, however they are for production, investigation or water supply purposes.

[12] DoW (2004)
[13] A Paton (DoW) 2013, pers. comm., 26 March

The effect of long-term persistent hydrological change can cause changes in vegetation community composition and structure, with a potential loss of some species and a gradual replacement by more drought-tolerant species. The rate (m/yr) and magnitude (metres) of groundwater level change are also relevant to potential vegetation impact.[14]

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.[15]

Stormwater Drainage

Stormwater consists of runoff from rainfall and material mobilised and dissolved in its path of flow. Stormwater is channelled and collected in sumps and swales to recharge the superficial aquifer and prevent the spread of weeds, pollutants, pathogens and sediment to vegetation.[16]

Sumps allow some stormwater to infiltrate retention basins (sumps), detain the water, collect sediment 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.[17]

Swales are broad, shallow channels that are grassed or vegetated and used to collect and convey stormwater flows, promote infiltration and removal of sediment.[18]

There are no stormwater drainage lines through Hepburn Heights, however, the natural contours of the slope channel water to sumps in the south east of the site (on the corner of Hepburn Avenue and Walter Padbury Boulevard) or the northwest of the site (in Brazier Park), as shown in Figure 10.

The sump on the corner of Hepburn Avenue and Walter Padbury Boulevard receives water from the Walter Padbury Boulevard catchment (168,008 m^2 in area) and the sump in Brazier Park receives water from the Cleave Court Sump Catchment (85,318 m^2 in area).

[14] Loomes and Froend (no date)
[15] DoW (2004)
[16] DoE (2004)
[17] Grose and Hedgcock (no date)
[18] DoW (2011)

Figure 10: Hepburn Heights Drainage

2.3 Climate

The City of Joondalup experiences a Mediterranean climate of hot dry summers with an average temperature of 29°C during the day and mild wet winters with an average day time temperature of 19°C. The average annual rainfall from 2002 to 2013 was 700mm. Approximately 75% of the annual rain falls between the months of May and September, as shown in Figure 11.[19]

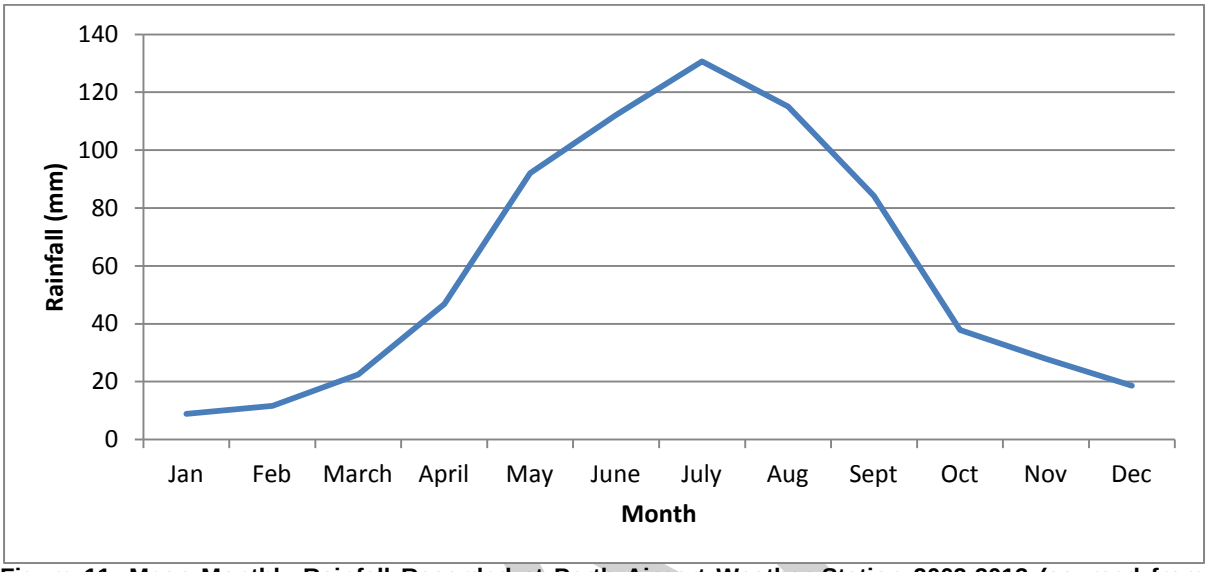

Figure 11: Mean Monthly Rainfall Recorded at Perth Airport Weather Station 2002-2013 (sourced from BoM 2014)

Current Climate Change

The City of Joondalup is located in the southwest of Western Australia, an area that is already being impacted by the effects of climate change particularly through rising temperatures and decreasing rainfall.

The long-term trend in WA's average temperature has been steadily increasing since the 1950's with overall temperature rising approximately 0.8°C in this time, as shown in Figure 12.[20]

[19] BoM (2013)
[20] Climate Commission (2011)

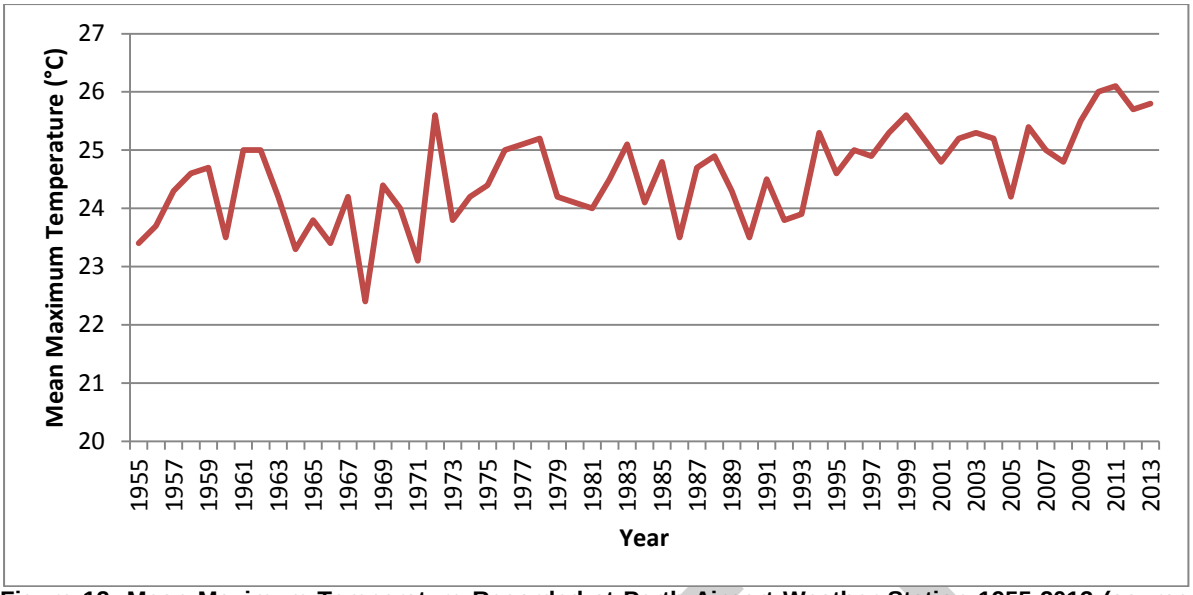

Figure 12: Mean Maximum Temperature Recorded at Perth Airport Weather Station 1955-2013 (sourced from BoM 2014)

In addition, the south-west of WA has had a 15% reduction in rainfall since the mid-1970s. This is a result of fewer winter low pressure systems, more prevalent high pressure systems and, since 2000, a decrease in the rainfall associated with each system, as shown in Figure 13.[21]

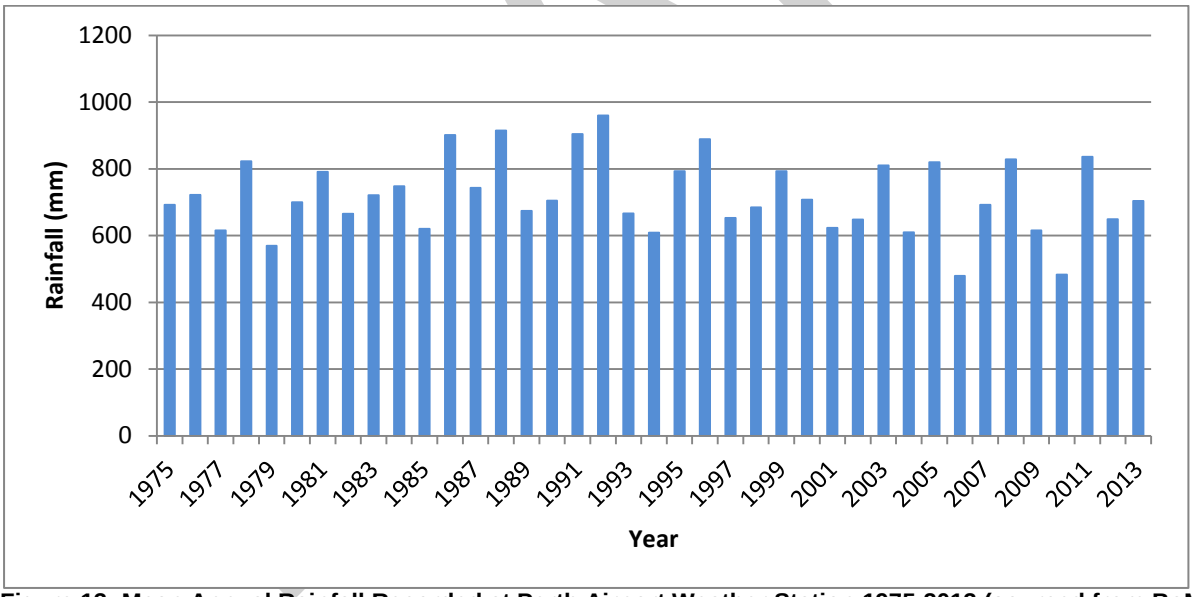

Figure 13: Mean Annual Rainfall Recorded at Perth Airport Weather Station 1975-2013 (sourced from BoM 2014)

Future Climate Change

This hotter drier climate has already impacted on bushland areas and ecosystems, particularly through reduced water availability. Adaptation to the drying climate is critical, particularly as the impacts of climate change will increase in the future.

[21] IOCI (2010)

The City has adopted a future climate scenario based on the best available science and best-practice climate adaptation planning. Under this scenario in 2070 the City of Joondalup will have hotter, drier and windier summers with the number of days over 35°C nearly doubling. Winters will be drier, warmer and less windy as a result of fewer low pressure systems, see Table 2. More extreme weather events are also predicted, including more frequent and severe droughts.[22]

Climate Change Scenario for the City of Joondalup in 2020
2.7°C ⇧ Temperature
Extreme Heat days ⇧ from 28 to 54
19% ⇩ Rainfall
7% ⇧ Potential Evaporation
Wind Speed ⇧ 8% in Summer ⇩ 14% in Winter
2% ⇩ Relative Humidity
1.4% Solar Radiation

Table 2: Climate Change Scenario for the City of Joondalup in 2070

Note: Climate Change projections for Perth in 2070 compared to 1990 under a high emissions scenario (A1FI). The projections have been generated using data from 23 climate models and global warming estimates IPCC Fourth Assessment Report 2007[22]

These future climate changes are expected to have the following impacts on local bushland areas:

- Future climatic conditions may increase threats to the natural environment such as weeds, fire and disease;
- A changing climate will change habitats and distribution patterns of species. A drier climate will mean reduced water availability for ecosystems and fauna and flora species; and
- Extreme weather events such as heat-waves and intense storms will threaten fauna and flora species.

2.4 Vegetation

Vegetation Complexes

Vegetation complexes are classified by the soil and landforms contained in medium to large areas along the Swan Coastal Plain. Regional scale mapping shows the study area is classified as having Cottesloe Complex - Central and South (see Figure 14). This complex is described as a “mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *Eucalyptus gomphocephala – Eucalyptus marginata – Eucalyptus calophylla* with a closed heath on the limestone outcrops”.[23]

[22] CSIRO (2007)
[23] Heddle et. al. cited in Syrinx (2014)

The State Government has established targets under Bush Forever which aim to protect at least 10% of each vegetation complex[24] in the Perth Metropolitan Region to achieve a comprehensive representation of all the ecological communities originally occurring in the region.[25]

Approximately 31% (10,606 ha) of the original vegetation complex extent of Cottesloe Complex – Central and South remains within the Perth Metropolitan Region, with 3% (345 ha) of this remaining vegetation existing within the City of Joondalup.

Due to the limited extent of the Cottesloe – Central and South vegetation complex remaining within the Perth Metropolitan Region, it is important to retain bushland within Hepburn Heights for its conservation value.

[24] Department of Planning (2000)
[25] WALGA (2010)

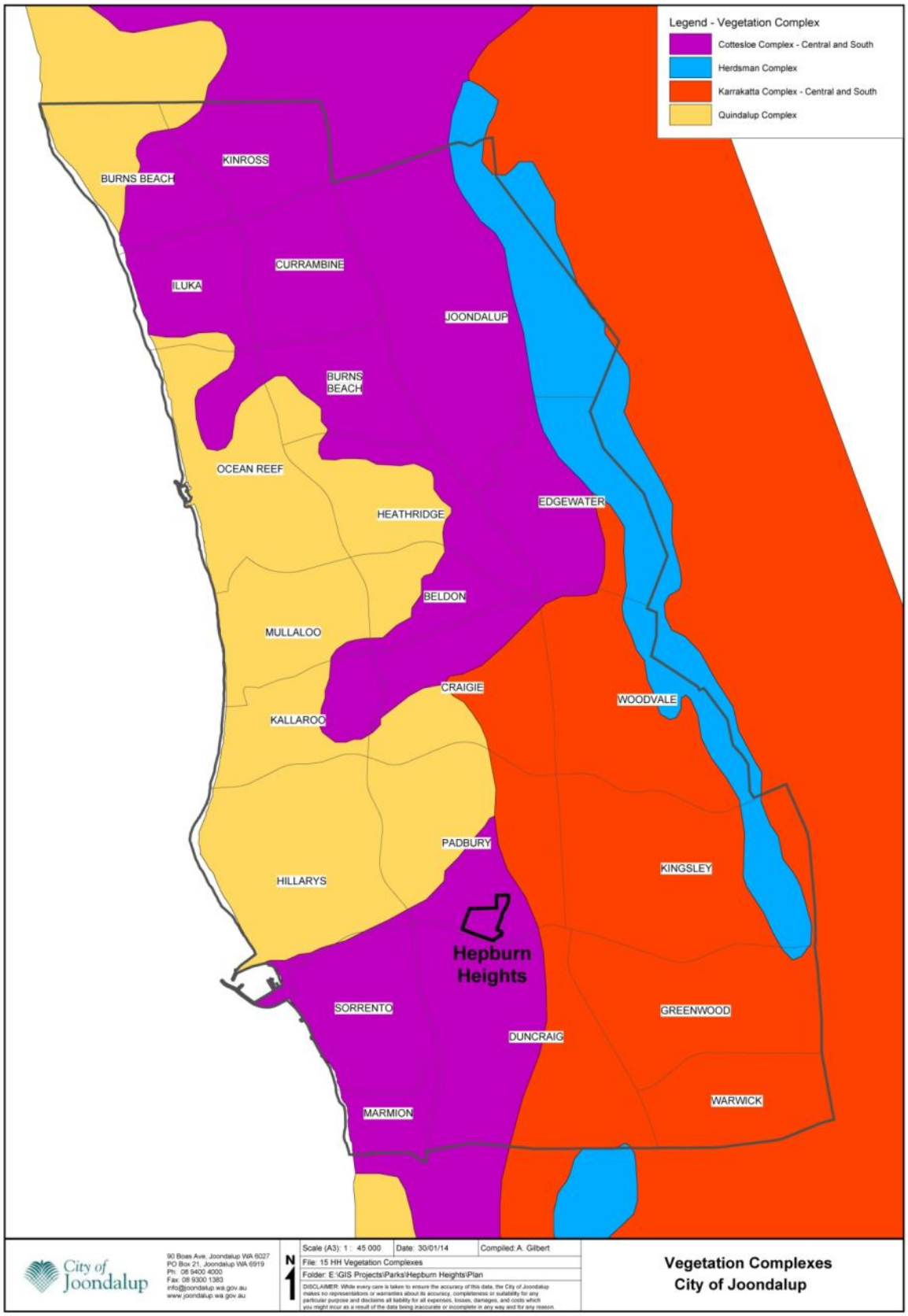

Figure 14: City of Joondalup Vegetation Complexes

Floristic Community Types

Floristic Community Types (FCTs) are generally groups of flora species that consistently occur together.

FCTs identified in Hepburn Heights are:

- FCT 24 - Northern Spearwood Shrublands and Woodlands; and
- FCT 28 - Spearwood *Banksia attenuata* or *Banksia attenuata* - *Eucalyptus* woodlands.[26]

Whilst FCTs can be a useful way of describing groups of flora species, or defining Threatened or Priority Ecological Communities on the Swan Coastal Plain, vegetation communities are more commonly used to define plant communities.

Vegetation Communities

The vegetation communities that exist within the *Banksia* Low Woodland of Hepburn Heights are of high conservation value and are described in Table 3 and shown in Figure 15.

Group	Vegetation Community Number	Vegetation Community Description	Site Coverage
Woodlands on Deep Sand of Consolidated Dunes	Community 1A	Woodland to Open Forest Jarrah *Eucalyptus marginata* subsp. *marginata* over Low Open Woodland *Banksia menziesii* and *Banksia attenuata* over Tall Open Shrubland *Xanthorrhoea preissii* over Low Shrubland *Hibbertia hypericoides,* Open Sedgeland *Mesomelaena pseudostygia* and a species rich Open Herbland.	3.7 ha or 17%
	Community 1B	Low Woodland to Low Open Forest of *Banksia menziesii, Banksia attenuata* and *Allocasuarina fraseriana* with scattered emergent Tuart *Eucalyptus gomphocephala* and patches of Jarrah *Eucalyptus marginata* subsp. *marginata* over Open Shrubland *Xanthorrhoea preissii* over Open Low Heath *Hibbertia hypericoides*, Very Open Sedgeland *Mesomelaena pseudostygia* and *Schoenus latitans* and a species rich mixed Open Herbland.	1.9 ha or 9%
	Community 1C	Woodland dominated by *Banksia prionotes* over Shrubland to Tall Shrubland of *Xanthorrhoea preissii* and *Allocasuarina humilis* over Open Shrubland to Low Heath of *Hibbertia hypericoides* over Open to Very Open Sedgeland *Mesomelaena pseudostygia*, scattered grasses and a species rich mixed Open Herbland.	10.9 ha or 50%
Woodlands and Shrublands on Shallow Sands over Limestone	Community 2A	Low Woodland to Low Open Forest *Eucalyptus decipiens* subsp *decipens* over Tall to Tall Open Shrubland and/or Shrubland of *Banksia sessilis* var. *cygnorum, Xanthorrhoea preissii* and *Templetonia retusa* over Low Shrubland *Hibbertia hypericoides*, Very Open Sedgeland of *Mesomelaena pseudostygia, Lepidosperma calcicola* and *Desmocladus flexuosus* and mixed species rich Herbland dominated by *Lomandra maritima, Trachymene pilosa* and *Opercularia vaginata*.	0.9 ha or 4%

[26] Syrinx (2014)

Group	Vegetation Community Number	Vegetation Community Description	Site Coverage
	Community 2B	Closed Heath to Tall Open Scrub *Banksia sessilis* var. *cygnorum* and *Xanthorrhoea preissii* over Open Shrubland to Shrubland *Melaleuca systena, Acacia truncata* and *Leucopogon parviflorus* over Low Shrubland dominated by *Hibbertia hypericoides, Grevillea preissii* and Open Sedgeland *Lepidosperma calcicola* and mixed, species rich Open Herbland dominated by *Lomandra maritima*, *Trachymene pilosa* and *Opercularia vaginata.*	1.3 ha or 6%
	Community 2C	Mixed Tall Shrubland (deeper soil) grading into a Shrubland (shallow soil) dominated by *Acacia rostellifera* and/or typical *Xanthorrhoea preissii, Spyridium globulosum, Templetonia retusa* and *Melaleuca systena* over a Low Shrubland to Open Low Heath dominated by *Hibbertia hypericoides, Banksia dallanneyi* var. *dallanneyi, Grevillea preissii* and *Phyllanthus calycinus*, Very Open Sedgeland of *Mesomelaena pseudostygia* and *Lepidosperma calcicola* and a mixed species rich Open Herbland.	0.9 ha or 4%

Note: The remaining vegetation on site has been cleared (2.2 ha or 10%).
Table 3: Vegetation Communities at Hepburn Heights

One Priority Ecological Community (PEC) was recorded from the survey area, PEC20 (SWAN): 'Northern Spearwood shrublands and woodlands ('community type 24')'. It is described as:

'Heaths with scattered *Eucalyptus gomphocephala* occurring on deeper soils north from Woodman Point. Most sites occur on the Cottesloe unit of the Spearwood system. The heathlands in this group typically include *Dryandra sessilis*, *Calothamnus quadrifidus*, and *Schoenus grandiflorus'*.

PEC20 is a Priority 3(i) community, which means that it is poorly known from several to many occurrences but does not appear to be under threat of habitat destruction or degradation. It is equivalent to Floristic Community Type 24 (FCT24) and is represented in the survey area by Plant Communities 2A to 2B.[27]

No Threatened Ecological Communities were identified within Hepburn Heights.[27]

Vegetation Condition

The Keighery Scale is a tool used to rate the condition of vegetation from pristine to completely degraded, as detailed in Appendix 5. The City of Joondalup conducted Natural Areas Initial Assessments in 2004 and 2012 to assess the vegetation condition at the site. Syrinx conducted a vegetation condition assessment in September 2013, with the majority of the vegetation condition being rated as "very good", followed by "very good to excellent", as shown in Table 4.

The vegetation condition at Hepburn Heights ranges from very good to excellent to completely degraded. The majority of the remnant vegetation is in very good condition, with the very good to excellent condition bushland being in the eastern section of the site. The good condition or degraded patches are generally near infrastructure and paths. Completely

[27] Syrinx (2014)

degraded areas are generally firebreaks or paths. Vegetation condition is shown in Table 4 and Figure 16.

Vegetation condition assessments include observations regarding the numbers of native species, weed cover, vegetation structure, species diversity, amount of understorey, health condition of most species' populations and physical disturbance. Since 2012 there has been a reduction in the amount of vegetation rated as "pristine" and "excellent" and an increase in the amount of vegetation rated as "very good to excellent". This difference is likely to be attributed to the differing interpretation of Keighery Scale definitions by assessors.

Year	Pristine	Excellent	Very Good to Excellent	Very Good	Good	Degraded	Completely Degraded
Sept 2013 (Syrinx)	0%	0%	36%	43%	15%	0%	6%
Dec 2012 (CoJ)	20%	35%	0%	25%	15%	5%	0%
April 2004 (CoJ)	20%	35%	0%	25%	15%	5%	0%

Table 4: Hepburn Heights Vegetation Condition Assessment using Keighery Scale (2004, 2012 and 2013)

Vegetation Cover

The height of the majority of vegetation cover at Hepburn Heights is 0-3m, with a small amount of vegetation predominantly in the south-east of the site with a height of 3-15m and a very minor amount of vegetation in the south of the site with a height of 15m or more, as shown in Figure 17.

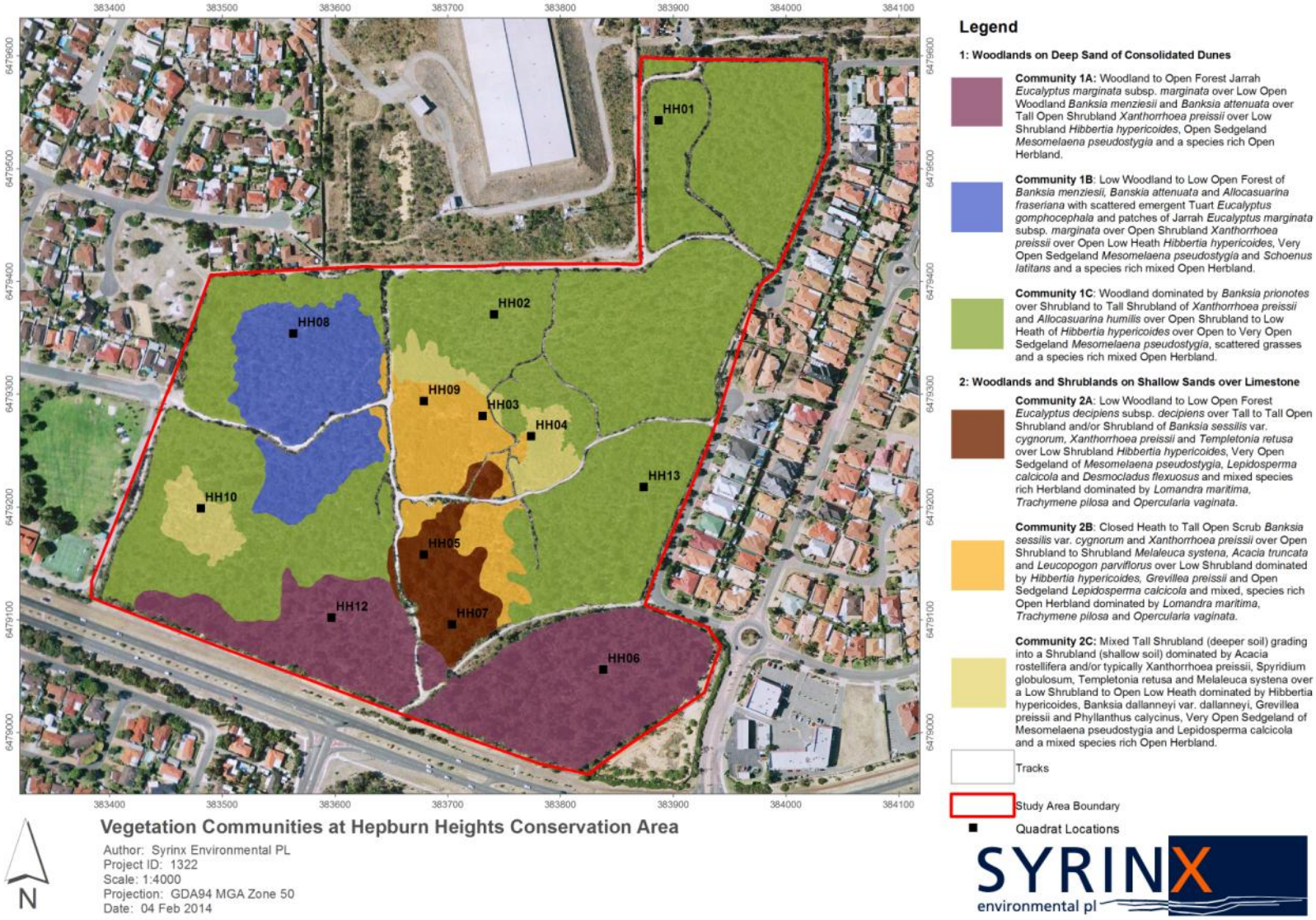

Figure 15: Hepburn Heights Vegetation Communities (sourced from Syrinx 2014)

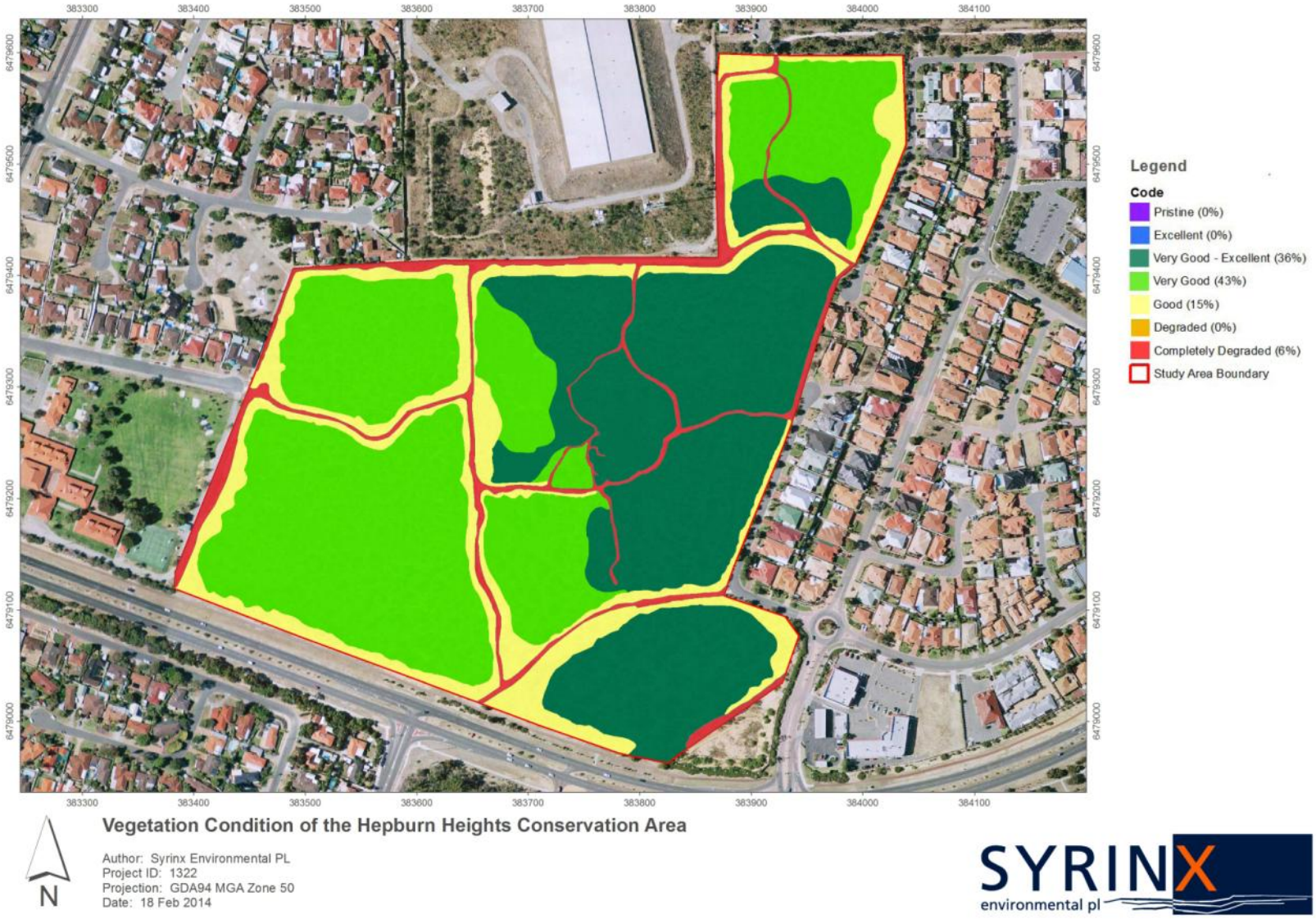

Figure 16: Hepburn Heights Vegetation Condition – September 2013 (sourced from Syrinx 2014)

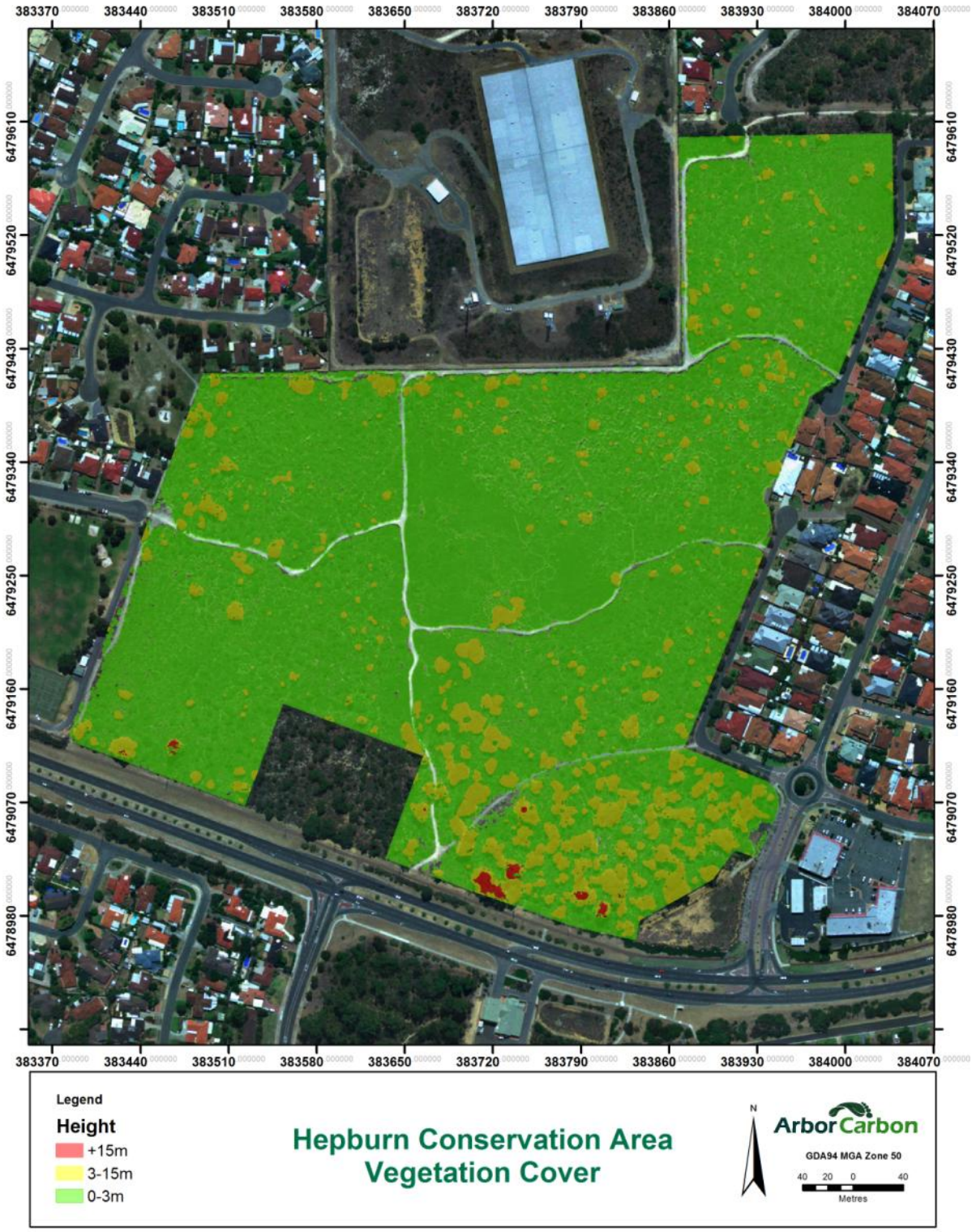

Figure 17: Hepburn Heights Vegetation Cover (Arbor Carbon 2014)

3.0 Biodiversity Management

Hepburn Heights supports an abundance of plant and animal species, including some endangered species. The long term protection of biodiversity values within Hepburn Heights is critical to ensure the conservation of this unique habitat. The protection and enhancement of biodiversity within Hepburn Heights also benefits the community through the provision of ecological services such as:

- the production of oxygen and capture of carbon dioxide;
- noise and air quality regulation;
- cooling of urban environments;
- regulation of freshwater supplies;
- generation and maintenance of topsoil;
- generation and recycling of nutrients;[28]
- control of pests and diseases;
- supporting seed dispersal and pollination;
- providing a genetic store;[29] and
- a number of recreational and cultural experiences.[30]

There are a number of environmental threats that pose a risk to the biodiversity of Hepburn Heights. The key environmental threats at Hepburn Heights addressed in this Section include:

- Weeds;
- Pathogens and disease;
- Non-native fauna species;
- Human impacts;
- Access and infrastructure; and
- Fire.

Management actions to address the key environmental threats have been established and are discussed in the following sections.

3.1 Flora

Hepburn Heights is located within the Southwest Australia biodiversity hotspot. Southwest Australia, from Shark Bay in the north to Israelite Bay in the south, is one of 34 biodiversity hotspots in the world with over 2,900 endemic plant species occurring in this region. Approximately 30% of the original vegetation extent of this area remains, with habitat loss being primarily due to agricultural and urban expansion.[31]

Flora surveys enable collection of scientific data related to the occurrence and distribution of flora species and vegetation communities. Information obtained from flora surveys is used as a baseline to monitor the ecological health of flora populations and vegetation communities.

The City engaged consultants, Syrinx Environmental PL, to undertake a desktop and field flora survey of Hepburn Heights in September 2013.

[28] Burbidge (2004)
[29] Millennium Ecosystem Assessment (2005)
[30] CoJ (2012b)
[31] Conservation International (2012)

The design of the flora survey was aligned with methodology outlined in EPA *Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (2004).

The methodology undertaken in conducting the survey included the use of 10m x 10m quadrats and opportunistic sampling of species not recorded within the quadrats. A minimum of two quadrats were established per vegetation community, with a total of thirteen quadrats established in total. Transects were also walked systematically across the survey area. A total of 256 flora species were recorded on site, including 186 (73%) native species and 70 (27%) introduced species.

Previous flora surveys conducted in Hepburn Heights include:

- City of Joondalup Natural Area Assessments (2004 and 2012).
- Alan Tingay and Associates (1993) Hepburn Heights Conservation Area Management Plan. This survey was conducted prior to the clearing of bushland at Hepburn Heights and therefore species identified during this survey are listed as potential unless recorded in the Syrinx survey (2013) or the City of Joondalup Natural Area Assessments (2004 and 2012).
- Keighery and Keighery (1991) Floristics of Reserves and Bushland Areas of the Perth Region (System 6), Parts II-IV, Wildflower Society of Western Australia, Nedlands. This survey encompassed Hepburn Heights, Pinnaroo Valley Memorial Park and Craigie Open Space and was conducted prior to the clearing of bushland at Hepburn Heights and therefore species identified during this survey are listed as potential unless recorded in the Syrinx survey (2013) or the City of Joondalup Natural Area Assessments (2004 and 2012).

The combination of results from Hepburn Heights flora surveys indicates that there are 270 flora species on site, including 198 (73%) native species and 72 (27%) introduced species. The optimal time for surveying is spring for native flora and winter for weeds.

Native Flora

Native flora is an important part of the Hepburn Heights 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 198 native flora species have been recorded at Hepburn Heights (see Appendix 2).

One naturally occurring priority species has been recorded in Hepburn Heights, *Acacia benthamii* (Priority Two – poorly known species).

Nine species in Hepburn Heights are listed as naturally occurring significant flora of the Perth Metropolitan Region:

- Cutleaf Hibbertia (*Hibbertia cuneiformis*);
- Rottnest Island Pine (*Callitris preissii*);
- *Ricinocarpos glaucus* (Wedding Bush);
- *Acacia benthamii*;
- Yellow Lechenaultia (*Lechenaultia linarioides*);
- Prickly Conostylis (*Conostylis aculeata* subsp. *cygnorum*);
- Common Popflower (*Glischrocaryon aureum*);
- Tree Smokebush (*Conospermum triplinervium*); and
- *Grevillea preissii.*[32]

[32] Syrinx (2014)

Populations of *Lomandra hermaphrodita* and *Lomandra maritima* were observed in Hepburn Heights, the food source for the threatened fauna species the Graceful Sun Moth (*Synemon gratiosa*).[33] The priority and significant flora species recorded in Hepburn Heights are shown in Appendix 3.

Tuart trees occur in Hepburn Heights. Mature Tuart trees (*Eucalyptus gomphocephala*) provide nesting hollows for Carnaby's Black Cockatoos. Tuarts take 200 years to develop hollows that are a suitable size for nesting.[34] Many Tuart trees on the Swan Coastal Plain have died in the past 20 years due to stress factors such as the lowering of the water table, insect infestations and fungal pathogens.[35] Planting of Tuart trees in Hepburn Heights may provide nesting habitat and a feeding and roosting resource in the long term for Carnaby's Black Cockatoos.

There are a few large *Eucalypt* trees at Hepburn Heights. Large *Eucalypt* trees (dead or alive) can provide nesting sites and shelter for fauna.

Weeds

Weeds are 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 water, wind and animals such as birds, fire, through dumping of garden refuse, human or vehicle movement in natural areas.

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

- displace native plant species;
- alter ecosystems, nutrient recycling and soil quality;
- harbour pests and diseases;
- increase fuel loads for fires;
- impact negatively on fauna and flora and their habitats; and
- compete with native species for space, water and nutrients.[36]

Over 28,000 known alien plant species have been introduced to Australia with approximately 10% now being established in the environment.[37] Garden plants are the main source of Australia's weeds, accounting for 66% of recognised weed species.[36]

A total of 72 weed species have been recorded at Hepburn Heights (see Appendix 2). The majority of the weed species were grasses from the Poaceae family and daisies from the Asteraceae family. Many of the weed species are located along disturbed tracks and vegetation edges on site. The most common weed species found in Hepburn Heights were Wild Gladiolus (*Gladiolus caryophyllaceus*) and One-leaf Cape Tulip (*Moraea flaccida*).[38]

Eleven weed species recorded in Hepburn Heights were rated as high priority in the Environmental Weed Strategy for WA (1999). Eight high priority rated weeds in the DPaW Weed Prioritisation Process for the Swan Region (2013) were recorded in Hepburn Heights. Key weed species existing at Hepburn Heights are shown in Appendix 3.

[33] Bishop et al. (2012)
[34] DEC (2010)
[35] Matusick, Hardy and Ruthrof (2012)
[36] DSEWPC (2012)
[37] Groves, Boden and Lonsdale (2005)
[38] Syrinx (2014)

Environmental weeds are classified as priority if they meet any of the following criteria:

- Weed species listed as a Weed of National Significance (WONS) under the National Weeds Strategy (1997).
- The weed species is listed as a Declared Pest Plant according to the Department of Agriculture and Food WA (2014).
- The weed species is a High Priority Weed according to the Environmental Weed Strategy for WA (DPaW 1999).
- The weed species is listed as Very High Priority or High Priority weed according to the DPaW Weed Prioritisation Process for the Swan Region (2013).
- The weed species is listed as a pest plant under the City's *Pest Plant Local Law 2012*.
- The City of Joondalup has determined that the weed species; poses a major threat to vegetation or the structure of vegetation communities; is likely to lead to a significant outbreak of individual weed species; and/or contribute to a high fuel load (e.g. grasses).

Identified priority weeds and their recommended weed treatment methodology is detailed in Appendix 6, which is used for City of Joondalup on ground management of weeds.

The Water Corporation Water Supply and Telecommunications Facility is located to the north of Hepburn Heights and is adjacent to the site. Weeds from the Water Supply and Telecommunications Facility can spread to Hepburn Heights via wind and have a negative effect on the native vegetation.

Current Management Approach

The City's current approach to monitoring, conserving and protecting native flora in Hepburn Heights is outlined below.

Site Assessments

Flora surveys are conducted approximately every 5 years in Hepburn Heights to record the occurrence and distribution of flora species and vegetation communities. Information obtained from flora surveys is used to monitor the ecological health of flora populations and vegetation communities on site.

Natural Areas Assessments are conducted approximately every 5-7 years in Hepburn Heights to assess site-specific ecological values, biodiversity significance and threatening processes, at a level that is consistent with regional scientific standards.[39]

Weed Management

The City undertakes an integrated approach to weed management, including:

- Preventing weed introduction through weed hygiene measures.
- Regular monitoring and reporting of weed populations.
- On ground weed control, including prioritisation of natural areas and priority weeds to target.
- Community education initiatives.
- Fire prevention measures.

[39] WALGA (no date)

Weed Monitoring

The following table outlines the various weed monitoring methods undertaken by the City in Hepburn Heights.

Weed Monitoring Method	Detail
Monthly weed inspections	Monthly weed inspections are conducted at Hepburn Heights to establish the extent and distribution of weed species and to identify priority weeds. Monthly weed inspections are used to inform on ground weed management programs.
Annual weed density monitoring	The City monitors the percentage density of environmental weeds in Hepburn Heights on an annual basis, measured on three transects within the reserve.
Flora surveys	Flora surveys are conducted every 5-7 years in Hepburn Heights. Flora surveys include mapping of priority weeds and a vegetation condition assessment. The vegetation condition assessment (see Figure 16) also informs weed management as the vegetation in the best condition can be prioritised for weed control.
Natural Area Assessments	Natural Area Assessments are conducted every 5-7 years at Hepburn Heights using a variety of ecological criteria to monitor the environmental health of the site, including identifying weed species.

Annual weed density monitoring is conducted in Hepburn Heights, measured on three transects within the reserve. There has been an increase in weed density in 2013/14, compared to 2012/13, due to a targeted focus on grass control rather than control of all weed species (see Figure 18). Other groups of weeds will be targeted in 2014/15.

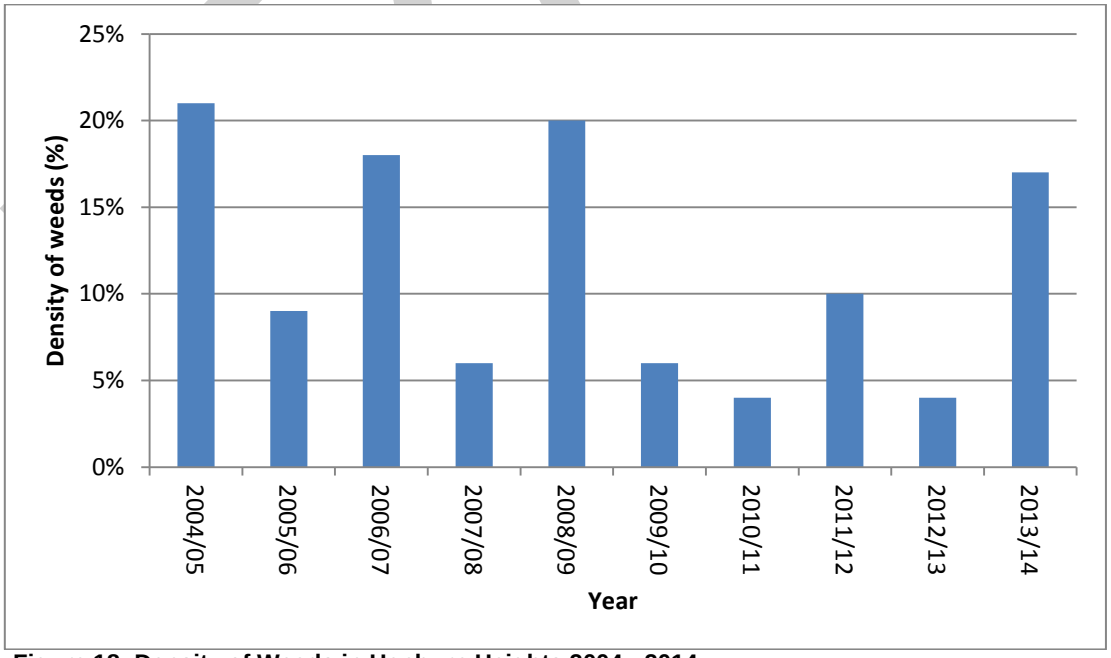

Figure 18: Density of Weeds in Hepburn Heights 2004 - 2014

Weed Control

In accordance with the City's Annual Bushland Schedule, on ground weed management occurs through weed spraying and hand weeding methods. In addition to this, contractors are engaged to spray weeds and hand weed. City of Joondalup staff use a weed spraying procedure and conduct weed control trials periodically to evaluate the most effective weed management methods. Resources, such as the DPaW's Florabase website or *Southern Weeds and their Control* (DAFWA Bulletin 4744), are consulted in regards to weed control. Weeds on verges within and surrounding Hepburn Heights are managed by mowing verges to reduce seed spread, spraying weeds and spreading certified mulch, where required.

A City of Joondalup Weed Management Plan is to be developed in 2014/15 to provide an ongoing strategic approach to weed management in the City to reduce the incidence of weeds.

Pest Plant Local Law 2012

The purpose of the *Pest Plant Local Law 2012* is to prescribe pest plants within the City of Joondalup that are likely to adversely affect the value of property in the district or the health, comfort or convenience of the inhabitants of the district.

Pest plants are generally highly adaptable and will establish quickly after a disturbance event such as fire, or through unrestricted access. If pest plants are allowed to establish they have the potential to out-compete the City's unique floral biodiversity.

The *Pest Plant Local Law 2012* requires the owner or occupier of private land within the City of Joondalup district to destroy, eradicate or otherwise control scheduled pest plants on notice by the City. Currently one weed species is scheduled under the Local Law – Caltrop (*Tribulus terrestris*). Caltrop has not been recorded at Hepburn Heights.

Community Education

A number of education initiatives are undertaken to raise the awareness of weeds in the community, these include:

- Delivery of Gardening Workshops;
- Development and distribution of two weed brochures – *Environmental Weeds* and *Garden Escapees* (available in hard copy and on the City's website); and
- Weed Education Workshops for Local Friends Groups.

Revegetation

The City of Joondalup encourages natural bushland regeneration through weed management and conservation fencing to allow the vegetation to re-establish itself and maintain species diversity and populations.

Revegetation is conducted on degraded or completely degraded areas using local provenance species, as required.

Recommended Flora Management Actions

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

Action	Details
Liaise with the Water Corporation	Liaise with the Water Corporation regarding weed control on the Water Supply and Telecommunications Facility located to the north of Hepburn Heights to protect biodiversity values.
Flora survey	Undertake a follow up flora survey in spring to supplement previous flora survey, within 5 years.
Weed survey	Undertake a follow up weed survey in winter to supplement previous weed survey, within 5 years.
Investigate planting *Eucalypt* trees	Investigate planting of Tuart trees (*Eucalyptus gomphocephala*) in Hepburn Heights to provide nesting habitat and a feeding and roosting resource in the long term for Carnaby's Black Cockatoos. Investigate planting other species of *Eucalypt* trees (such as Marri or Jarrah) to provide nesting sites and shelter for fauna.
Revegetation	Conduct revegetation on degraded or completely degraded areas using local provenance species, as required.
Monthly weed inspections	Conduct monthly weed inspections to establish the extent of weeds and to identify priority weed species.
Natural Areas Initial Assessment	Conduct five to seven yearly follow up of Natural Areas Initial Assessment to monitor ecological health of site.
Annual weed density monitoring and reporting	Monitor and report on the density of environmental weeds in Hepburn Heights on an annual basis, using three transects or quadrats.
Weed control	Undertake a coordinated approach to regular weed control by implementing the Annual Bushland Schedule.
Weed control on verges	Conduct weed management of weeds on verges within Hepburn Heights including mowing of verges to reduce seed spread, spraying of weeds and spreading of certified mulch, where required.
Weed Management Plan	Develop and implement a *City of Joondalup Weed Management Plan* to provide an ongoing strategic approach to the management of natural areas in order to reduce the incidence of weeds.

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.[40] 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.[41] Many native plants have beneficial partnerships with fungi, for example eucalypts, wattles and orchids. Fungi also provide food and/or habitat for fauna such as bandicoots and beetles.[42]

[40] Bougher (2009)
[41] Robinson (no date)
[42] DEC (no dateb)

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.

Syrinx Fungi Survey (2013)

The City engaged consultants, Syrinx, to undertake a fungi survey of Hepburn Heights in August and September 2013 and record all incidental sightings of fungi. Fourteen fungi species were recorded from the study area and are listed in Appendix 10, with some shown in Appendix 11.

Due to time limitations, the fungi survey was conducted in late winter and spring. The optimum time for fungi surveys is in autumn or winter after substantial rainfall.

Current Management Approach

The City of Joondalup currently monitor fungi in Hepburn Heights through recording incidental sightings of fungi species during the City's five yearly flora and fauna surveys.

Recommended Fungi Management Action:

To monitor fungi health in Hepburn Heights, the following management action is proposed:

Action	Details
Fungi survey	Undertake a comprehensive fungi survey in autumn or winter after substantial rain, to supplement previous incidental fungi survey, within 5 years.

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.[43]

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.[43]

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 Perth, particularly along the inland dune systems, and has been identified within the City's park 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.[43]

[43] CoJ (2012c)

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 19. 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.[43]

Figure 19: Fruiting Bodies of *Armillaria luteobubalina* (sourced from CoJ 2012c)

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.[43]

Current Management Approach

The City of Joondalup has developed a Pathogen Management Plan to protect native vegetation and ecosystems by establishing the level of risk for areas to be infected by pathogens, prioritise areas and detail preventative and management actions to be implemented within the City, including guidelines for dieback-free purchasing and a hygiene procedure. The City is currently developing Pathogen and Weed Hygiene Guidelines and Purchasing of Landscaping Materials Guidelines.

Pathogen sampling was undertaken in Hepburn Heights in May 2014 and no pathogens were identified on site.

The closest site to Hepburn Heights with confirmed fungi pathogens, Sporothrix-like sp.; unknown fungal sp. *and Botryosphaeriaceae* sp., is Shepherd's Bush Park in Kingsley, approximately 2km north-east of Hepburn Heights.[44]

Recommended Pathogen Management Action:

To prevent pathogen and weed spread and protect biodiversity values at Hepburn Heights, the following management actions are proposed:

Action	Details
Pathogen Management	Implement recommendations from the Pathogen Management Plan that are applicable to the management of Hepburn Heights.
Hygiene Guidelines	Develop and implement *Pathogen and Weed Hygiene Guidelines* and *Purchasing of Landscaping Materials Guidelines* to prevent the introduction or spread of weed or pathogens into Hepburn Heights.

[44] Arbor Carbon (2014)

3.4 Fauna

Fauna surveys document the occurrence, distribution and population of fauna species. Information from fauna surveys is used as a baseline to monitor the health of fauna species.

The City engaged consultants, Syrinx, to undertake a fauna survey of Hepburn Heights in October and November 2013. As part of the fauna survey, Syrinx reviewed data from previous surveys provided by City of Joondalup to compile a complete data set to be used in the development of this Plan.

The fauna survey design was aligned with *EPA Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (2004), the principles outlined in *EPA Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection*, and the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*.

The fauna survey method included a variety of sampling techniques, both systematic and opportunistic. Trapping was conducted over 5 nights in October 2013 and 4 nights in November 2013 using a combination of pitfall traps, Elliot box traps and funnel traps in three trapping transects. Other fauna survey methods included a bird census at each transect, a bat survey (January 2014), opportunistic sampling and sightings, hand searches, motion sensor cameras (over six nights) and a nocturnal search (January 2014).

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.

Previous fauna surveys at Hepburn Heights include:

- City of Joondalup Natural Area Assessments (2004 and 2012).
- How and Dell (2000) Ground Vertebrate Fauna of Perth Survey.
- Alan Tingay and Associates (1993) Hepburn Heights Conservation Area Management Plan.

There was no specific fauna survey undertaken as part of the Alan and Tingay Hepburn Heights Management Plan (1993). The Plan's fauna list was based on a fauna list compiled from research in 1988 in an unspecified area, therefore species listed in the Plan's fauna list are listed as potential unless recorded in the Syrinx survey (2013), the City of Joondalup Natural Area Assessments (2004 and 2012) or the How and Dell survey (2000).

The combination of results from Hepburn Heights fauna surveys indicates that there have been 3 native mammals, 24 native birds (including 2 species of conservation significance), 19 native reptile species, 2 native amphibians and 38 native invertebrates (including 1 species of local conservation significance) recorded. In addition, 5 non-native mammals, 6 non-native birds and 2 non-native invertebrates have been identified at Hepburn Heights.

Fauna Habitat

The vegetation condition at Hepburn Heights ranges from excellent to degraded. Plants, trees, leaf litter and soil at Hepburn Heights provides habitat for fauna to nest, forage and roost. The *Banksia* species on site are important foraging plants for Carnaby's Black-Cockatoos and several honeyeater species.

Whilst the site provides habitat for several small mammals and birds, the inner metropolitan location of Hepburn Heights, introduced animals, its small size and limited connectivity limits the reserves use by fauna. The Syrinx fauna survey in 2013 highlighted that there was a distinct lack of species recorded on site that would usually be considered relatively common in urban bushland areas, such as small woodland birds (e.g. wrens or robins), the Moaning Frog, Tawny Frogmouth, Boobook Owl, possums, several bat species, trapdoor spiders. There were also very few mammals recorded on site, which aligns with the general decline of native mammals in the Perth Metropolitan Region. Native reptiles and birds (particularly the Brown Honeyeater) were well represented on site with introduced bird numbers appearing to be low.

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.[45] Alternatively, the decline of native flora can cause loss of fauna species.

Mammals

Three native mammals were recorded at Hepburn Heights, the Western Grey Kangaroo (*Macropus fuliginosus*), Gould's Wattled Bat (*Chalinolobus gouldii*) and White-striped Bat (*Austronomous australis*).

The Western Grey Kangaroo (*Macropus fuliginosus*) was observed in pairs or small groups on site.

Gould's Wattled Bat (*Chalinolobus gouldii*) and the White-striped Bat (*Austronomous australis*) are microbats and two of approximately 75 species of bat in Australia. 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.[46] A comprehensive bat survey would require a one week remote monitoring bat survey during summer.[47] Bats can be encouraged to roost in the area by installing bat boxes.

Reptiles

Nineteen native reptile species were recorded at Hepburn Heights, with the most common being skinks.

Amphibians

Two native amphibians were recorded at Hepburn Heights, the Turtle Frog (*Myobatrachus gouldii*) and the Western Banjo Frog (*Limnodynastes dorsalis*). The Turtle Frog is relatively common on the coastal plain and is one of the few frogs that does not undergo the tadpole stage and can inhabit sandy areas without free standing water. Western Banjo Frogs are often found a considerable distance away from permanent water and spend a large part of the year buried in sandy soils. Western Banjo Frogs also produce a white foamy mass during mating and lay their eggs in the foam nest.[48]

[45] DSEWPC (2012)
[46] DEC (2007)
[47] J Tonga (2012), pers. comm., 6 July
[48] WA Museum (2010a)

Birds

A total of 24 native birds have been recorded as occurring in Hepburn Heights, including the endangered Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and the migratory Rainbow Bee-eater (*Merops ornatus*) of conservation significance, as shown in Appendix 7 and Appendix 8.

Carnaby's Black-Cockatoos

Carnaby's Black-Cockatoos are endemic to the south-west of Western Australia. The *Banksia*, *Hakea* and Marri species on site provide a significant food source which Carnaby's use for foraging. Carnaby's Black-Cockatoos nest in hollows of smooth-barked eucalypts, including Tuarts (*Eucalyptus gomphocephala*) and Marris (*Corymbia calophylla*) which are found on site.[49]

Artificial hollows could be installed in trees such as Tuart or Marri to encourage Carnaby's Black-Cockatoos or Forest Red-tailed Black Cockatoos to nest, however research indicates that they are most successful when placed where Carnaby's are already known to breed. Further research is still required to ascertain whether it is possible to encourage the birds to breed in areas where they currently aren't breeding. Artificial hollows have been used successfully at Murdoch University and resulted in the breeding of Forest Red-tailed Black Cockatoos. Artificial hollows require regular monitoring due to competitors for nests including European Honey Bees, non-native Galahs, non-native Corellas and Rainbow Lorikeets.[50]

Rainbow Bee-eaters

The Rainbow Bee-eater builds nests in sandy banks and digs tunnels approximately 90 cm long which lead to a nesting chamber, making it vulnerable to trampling by humans or dogs or predation by foxes.[51] Monitoring for Rainbow Bee-eater nesting sites through monthly inspections and the installation of fencing and signage around exposed nesting sites may decrease trampling of nests by humans or dogs.

Common Native Birds

The most common native birds observed in Hepburn Heights were the nectar feeders Brown Honeyeater (*Lichmera indistincta*), followed by the opportunistic insectivores such as the Weebill (*Smicrornis brevirostris*), Silvereye (*Zosterops lateralis*) and Rufous Whistler (*Pachycephala rufiventris*).

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.[52] Some invertebrates are important indicators of ecosystem health, such as ants (seed dispersers), bees (pollinators) or spiders (top invertebrate predators).[53]

A total of 38 native invertebrate species were recorded in Hepburn Heights, as shown in Appendix 7.

[49] DEC (2011a)
[50] DEC (2011b)
[51] Birdlife Australia (no date)
[52] DEC (no dateb.)
[53] V Framenau (2012), email, 9 July

An undescribed millipede *Antichiropus* sp. nov. of local conservation significance was recorded on site. At the time of the fauna survey (2013), the undescribed millipede was known only from the single (male) specimen recorded at Hepburn Heights. Subsequent to this survey, some specimens were also recorded at Mt Henry Peninsula, Salter Point.[54]

The majority of the invertebrates identified were spiders (such as golden orb weaver spider), ants (such as meat ant) and beetles.

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.[55]

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

Mammals

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

Several foxes have been identified in Hepburn Heights. Foxes (*Vulpes vulpes*) are common within the City's bushland areas and have caused the decline of many native birds, reptiles and small mammals.[56]

Several rabbits have been identified in Hepburn Heights, although not in the most recent Syrinx 2013 fauna survey. The rabbit (*Oryctolagus cuniculus*) 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 and provide a source of food for foxes.

Domestic animals such as dogs (*Canis lupus*) can also cause damage to the City's natural environment, particularly when exercised unleashed within natural areas. Dogs can harass native fauna often resulting in stress and harm to the animals. Dogs can also spread pathogens if they disturb the soil, particularly around trees which may contain soil-based diseases. Dog droppings, if not removed, contribute a significant amount of nutrients to the site, encouraging weed growth and potentially polluting groundwater. Some dog droppings contain harmful bacteria.[57]

Domestic cats (*Felis catus*) have the potential to cause significant environmental harm when allowed 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.

Birds

A total of 6 non-native species of birds have been recorded in Hepburn Heights including Long-billed Corella (*Cacatua tenuirostris*), Spotted Turtle-Dove (*Streptopelia chinensis*), Laughing Turtle-Dove (*Streptopelia senegalensis*), Laughing Kookaburra (*Dacelo*

[54] Dr M Harvey, WA Museum (2014), email, 16 July
[55] DSEWPC (2012)
[56] DPI (2012)
[57] DEPI (2013)

novaeguineae), Superb Parrot (*Polytelis swainsonii*) (probably an aviary escapee) and Rainbow Lorikeet (*Trichoglossus haematodus*), as shown in Appendix 7.

Invertebrates

Two non-native invertebrate species were recorded in Hepburn Heights, the European honey bee (*Apis mellifera*) and Portuguese millipede (*Ommatoiulus moreletii*).

Portuguese millipedes were first recorded in Western Australia in 1986 and are now widespread in the south-west of the State. They feed on organic matter such as leaf litter and are not known to impact native flora or fauna. Portuguese millipedes can reach high population levels and be a domestic nuisance when they invade homes and gardens.[58]

Several European honey bees have been identified on site. The European honey bee (*Apis mellifera*) is 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. European honey bees are feral animals, however, European honey bees are important to Australian horticulture and agricultural industries with approximately 65% of agricultural production in Australia being dependent on pollination by European honey bees.[59]

Ecological Linkages

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.[60] 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.

Hepburn Heights is in the southerly part of an ecological linkage thread with Lilburne Park (further south), and Pinnaroo Valley Memorial Park, Craigie Open Space, Water Corporation land and Woodvale Nature Reserve to the north, with two main arterial roads and the Mitchell Freeway dividing the landscape, as shown in Figure 20.

The ecological corridor is also in close proximity to the north-south ecological corridor of Yellagonga Regional Park and Neerabup National Park.

Some species require larger areas of habitat than are provided by Hepburn Heights alone. The ability of species to move between adjacent natural areas increases the potential genetic diversity. Fencing has been installed to separate the north of Hepburn Heights and the south of Pinnaroo Valley Memorial Park. There is a narrow strip of land between Hepburn Heights and the Pinnaroo Valley Memorial Park that is owned by the Water Corporation. Investigations could be undertaken with Pinnaroo Valley Memorial Park and the Water Corporation to determine the feasibility of increasing connectivity and allow easier movement for fauna such as mammals and woodland birds between the two sites. However, Western Grey Kangaroos would need to be monitored if they were able to move more easily between Hepburn Heights, Water Corporation land and Pinnaroo Valley Memorial Park as an increase in their population may lead to a decrease in vegetation condition and fauna habitat for other species.

Current Management Approach

[58] M. Widmer (2006)
[59] Rural Industries Research and Development Corporation (no date)
[60] NWCPAG (2012)

The City of Joondalup is implementing a number of management actions to monitor native fauna and address the environmental impacts of domestic and pest animals within the City's natural areas. Monitoring of native fauna occurs through fauna surveys. Control of non-native fauna such as foxes and rabbits is undertaken annually within selected bushland, wetland and coastal areas. Fox and rabbit control methods employed include biological and chemical control, trapping, baiting and exclusion methods such as fencing. Fox control has not been conducted in Hepburn Heights.

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 acceptably low.

The City also promotes responsible pet ownership and encourages the community to ensure that domestic pets do not have a negative impact on the natural environment. Hepburn Heights is designated as a place where dogs must be on a leash at all times by Council resolution in accordance with the *Dog Act 1976*. Cats may be seized where they are found wandering in public areas, such as Hepburn Heights, in accordance with the *Cat Act 2011*.

Recommended Fauna Management Actions:

To monitor and protect native fauna in Hepburn Heights, the following management actions are proposed:

Action	**Details**
Fauna survey	Undertake a follow up fauna survey, in mid-late spring to supplement previous fauna survey, within 5 years.
Bat survey	Undertake a one week remote monitoring bat survey in summer to supplement previous one night bat survey undertaken in spring.
Installation of bat boxes	If bat survey indicates presence of bats, consider installing bat boxes to encourage bats to roost.
Artificial hollows	Investigate installation of artificial hollows in trees such as Tuart or Marri to encourage Carnaby's Black-Cockatoos or Forest Red-tailed Black Cockatoos to nest.
Rainbow Bee-eater nesting sites	Monitor for Rainbow Bee-eater nesting sites through monthly inspections and install fencing and signage around exposed nesting sites to decrease trampling of nests by humans or dogs.
Invertebrates survey	Undertake targeted survey for invertebrates in spring to supplement previous opportunistic invertebrate survey undertaken, particularly for the presence of the undescribed millipede *Antichiropus* sp. nov., within 5 years.
Feral animal control	Implement regular fox control (and rabbit control if required) to reduce pressures on native fauna and flora.
Ecological connectivity	Undertake investigations with Pinnaroo Valley Memorial Park and Water Corporation to determine the feasibility of increasing connectivity and allow easier movement for fauna such as mammals and woodland birds between Hepburn Heights, Water Corporation land and Pinnaroo Valley Memorial Park.

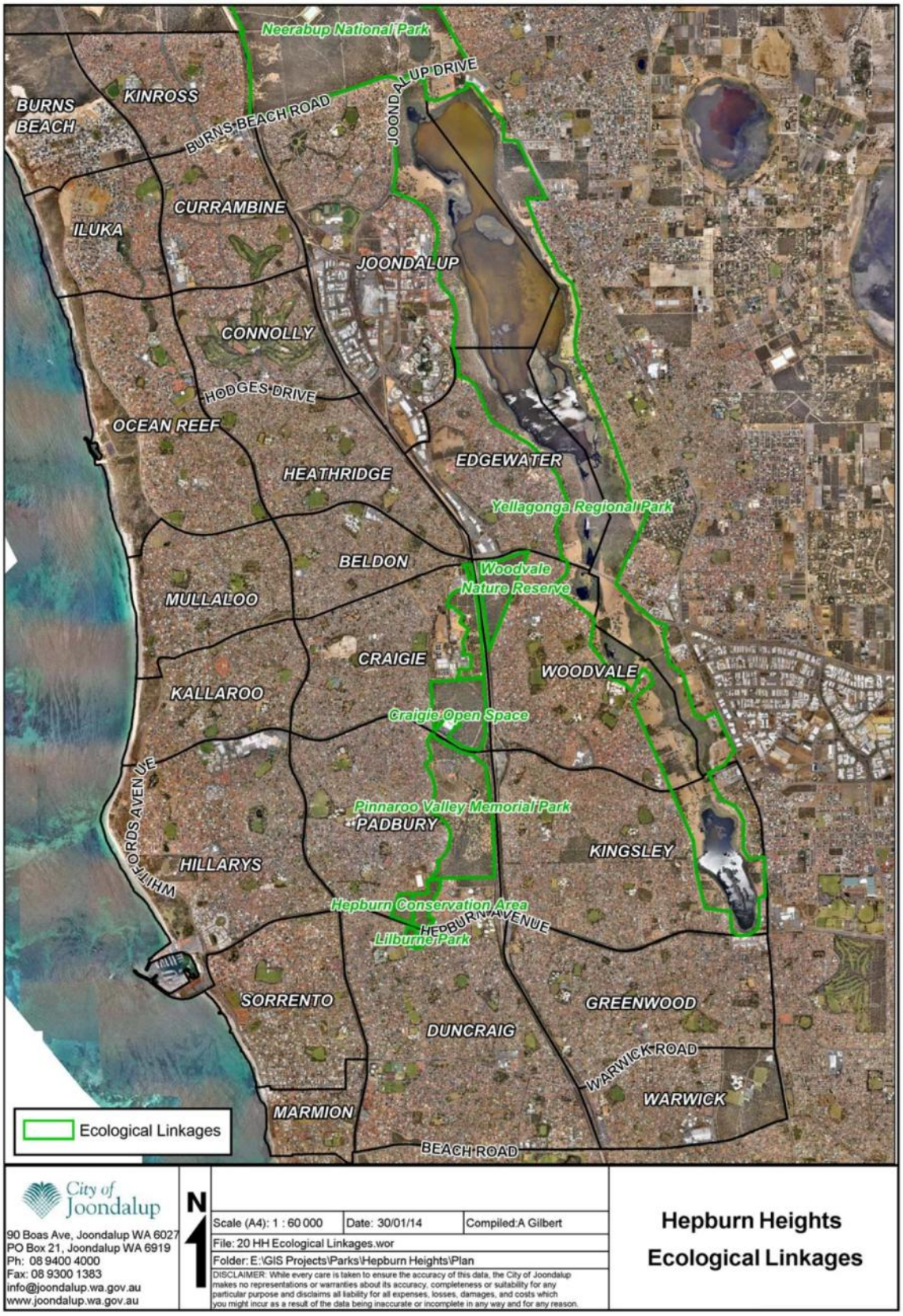

Figure 20: Ecological Linkages to Hepburn Heights

3.5 Social and Built Environment

History and Heritage

Hepburn Heights is listed on the Register of the National Estate (place number 4522), a State cultural heritage register, due to the social and ecological significance of the site. Hepburn Heights is not listed on any State or Federal Indigenous heritage inventory or register.

Social Value

Urban natural areas can provide social, psychological, physical and spiritual benefits and play a role in community health, wellbeing and quality of life. Some of the benefits of urban natural areas for the community include:

- Reduce mental fatigue and stress
- Encourage more effective patterns of coping
- Increase levels of cognitive functioning
- Provide opportunities for reflective thought, peace and quiet
- Create opportunities for informal social interactions
- Provide opportunities for activities that can increase physical health
- Assists to reduce the crime rate by relaxing people and encouraging people to be outdoors.[61]

The main uses of Hepburn Heights are for purposes such as walking, cycling or dog exercising. Hepburn Heights may also be used as a thoroughfare for people walking to and from Padbury Catholic Primary School, Hepburn Heights Shops and Medical Centre, Brazier Park and residential homes. User surveys would provide information on the reasons why people visit Hepburn Heights, the number of people and frequency of visits and enable a more targeted environmental education campaign regarding bushland management.

The Friends of Hepburn and Pinnaroo Bushland formed in 1987 as the Hepburn Woodland Preservation Group and changed their name in 1993 to the Friends of Hepburn and Pinnaroo Bushland. The Friends of Hepburn and Pinnaroo Bushland work for the protection, rehabilitation and conservation of biodiversity of the Hepburn Heights and Pinnaroo Bushland and undertake activities such as surveys, plant seedlings for revegetation of degraded areas, weed control and removal of litter.

Access and Infrastructure

Hepburn Heights contains power, lighting, telecommunications, water and sewerage utilities, and infrastructure (such as fencing, paths and seating).

There are also several key properties located adjacent to the site (detailed in Appendix 12), including:

- Pinnaroo Valley Memorial Park
- Padbury Catholic Primary School
- Water Supply and Telecommunications Facility
- Brazier Park
- Lilburne Park

[61] Tarran (2006)

- Duncraig Fire Station
- Hepburn Heights Shops and Medical Centre.

Utilities

Several public utilities operate within or surrounding Hepburn Heights, as shown in Figure 21, Figure 22 and Figure 23.

Power, Lighting and Telecommunications

Hepburn Heights has power, lighting and telecommunications infrastructure surrounding the site, as shown in Figure 21. There is an overhead powerline to the south of the site on Hepburn Avenue that Western Power is responsible for maintaining.

A Water Supply and Telecommunications Facility is located to the north of Hepburn Heights and is owned by the Water Corporation. Three telecommunications towers are located on site.

Water

Figure 22 outlines the public hydrants and distribution mains within and surrounding Hepburn Heights. There are three public hydrants to the east of Hepburn Heights that are owned, serviced and maintained by the DFES in conjunction with the Water Corporation. A water distribution main pipeline runs from north to south in the centre of Hepburn Heights. The Water Corporation access this pipeline if maintenance or upgrades are required.

Sewerage

Figure 23 shows the Water Corporation sewerage infrastructure in place surrounding Hepburn Heights. The Water Corporation maintain the sewerage infrastructure on an as required basis.

Figure 21: Hepburn Heights Power, Lighting and Telecommunications Utilities

Figure 22: Hepburn Heights Water Utilities

Figure 23: Hepburn Heights Sewerage Utilities

Conservation Fencing

Conservation fencing is used to restrict access and protect areas of bushland. Timber post and plastic coated galvanized chain mesh fencing surrounds the outer perimeter of Hepburn Heights (see Figure 24 and Figure 28). Fencing also surrounds the sump on site.

Fencing is inspected on a monthly basis and repairs are conducted as required.

Figure 24: Conservation Fencing on the Perimeter of Hepburn Heights

Access Points

Access points allow people to enter natural areas that are fenced off and often give access to paths. There are numerous access points in Hepburn Heights, as shown in Figure 28. Some of these access points have turnstyle gates, whilst others have vehicular gates, farm gates or chained gates. Access gates prevent unauthorised vehicle and motorbike access.

Paths and Trails

Paths in Hepburn Heights are used for pedestrian access, fire access ways and bushland management and maintenance purposes. The paths in Hepburn Heights are mostly used by pedestrians, dog walkers and students from Padbury Catholic Primary School. There are several limestone and asphalt paths in Hepburn Heights. There are also a few informal tracks. The use of informal tracks can spread and establish weeds and reduce the vegetation condition.

The City's *Walkability Plan 2013-2018* includes a recommendation to 'establish a dual-use pathway within Hepburn Heights Reserve to enable improved usability of the area by walkers and cyclists'. A dual use pathway made of asphalt runs from west (O'Leary Road) to east (Parkhurst Rise) on site and has recently been constructed. The current gates are

difficult for cyclists to use, however gates that allow cyclists easy access on site would also allow motorbikes to enter.

The City's *Walkability Plan 2013-2018* also includes a recommendation to 'review access points to natural bushland areas utilising "crime prevention through environmental design" principles'. The principles of "crime prevention through environmental design" rely on the ability to influence offender decisions that precede criminal acts by enhancing the perceived risk of being caught; and hence, deterring criminal activities.[62]

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 Hepburn Heights through the current gates or to use the limestone paths on site due to the uneven limestone surface. The *Walkability Plan 2013-18* includes a recommendation to 'maintain existing internal and external trails to meet trail useability and accessibility standards'.[62]

Signage

Signage is important to encourage use of the site and inform the community of the ecological values of the site. There are numerous signs at Hepburn Heights on the periphery of the site and near the main entrances, detailing information such as the name of the site, pathway and vegetation community maps and that the site is managed by City of Joondalup.

Directional signage uses maps to indicate trails, entrances and infrastructure. Interpretive signage increases awareness of the ecological values of the bushland. There are currently several directional signs at Hepburn Heights with the name of the site and a map showing the vegetation communities, pathways and entrances, however they require upgrading. There is currently no interpretive signage on site. The City is developing a *Signage Strategy* in 2014/15 to guide the provision of information and interpretive messages within the City's natural areas. The *Signage Strategy* will be used to develop and install a Bushland Signage System. The City will be installing new directional and interpretive signage at Hepburn Heights in 2014/15.

Toilets

There are no toilet facilities on site due to the site mainly being used for short periods by walkers.

[62] CoJ (2013)

Parking

There are no car parks on site at Hepburn Heights. Street parking is available along O'Leary Road, Parkhurst Rise, Stonesfield Court and Holleton Terrace. The Hepburn Heights Shops and Medical Centre is located close to the site on Blackwattle Parade and contains a number of car parking spaces which could be used by visitors to the site (see Figure 28).

Seating

Hepburn Heights contains two bench seats, as shown in Figure 25 and Figure 28. Installation of an extra bench seat on site towards the top of the hill could take advantage of the views and encourage people to spend more time in Hepburn Heights.

Figure 25: Seating at Hepburn Heights

Rubbish

Rubbish bins are generally installed in locations where people gather to socialise or undertake recreational activities. Dog poo bins are generally installed in locations where people walk their dogs. There is a dog poo bin located on the edge of the north of the site near Holleton Terrace (see Figure 28). There is no rubbish bin on site due to the lack of infrastructure encouraging people to gather or socialise. Dumping of rubbish and garden waste occasionally occurs on the verges surrounding Hepburn Heights. Garden waste can spread weeds and diseases into natural areas.

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

The City monitors the amount of litter present in Hepburn Heights bushland on an annual basis, measured on three transects within the reserve. There has been a decrease in the amount of litter present within Hepburn Heights in 2013/14, as compared to 2012/13 (see Figure 26).

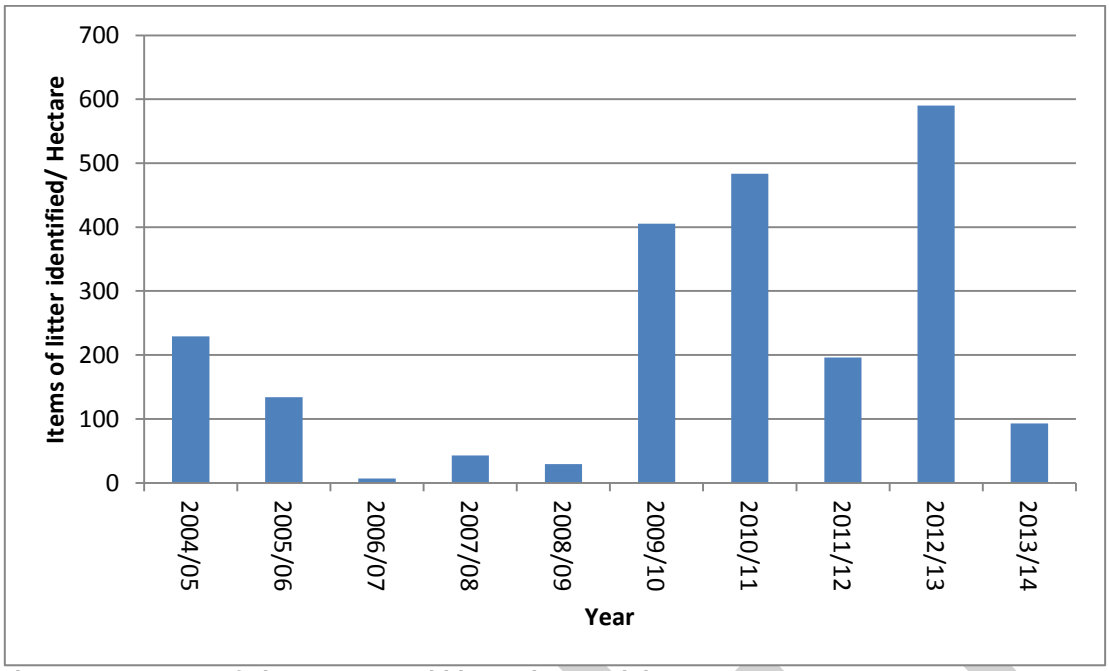

Figure 26: Amount of Litter Present within Hepburn Heights

Antisocial Behaviour

There is a history of cubby houses and BMX tracks being built in Hepburn Heights with resulting damage to the surrounding vegetation and littering. Monthly inspections are conducted and cubbies and BMX tracks are dismantled by City of Joondalup as required.

Water Sensitive Urban Design

A fenced off sump is located at Hepburn Heights on the corner of Hepburn Avenue and Walter Padbury Boulevard (see Figure 27). The sump in Hepburn Heights was assessed for the City's Sump Improvement Program but will not be included in the program due to the site contours and other site attributes.

Figure 27: Fenced off Sump at Hepburn Heights

Recommended Social and Built Environment Management Actions:

To enhance the social and built environment in Hepburn Heights, the following management actions are proposed:

Action	Details
User survey	Conduct user surveys, as required, to provide information on the reasons why people visit Hepburn Heights, the number of people and frequency of visits and enable a more targeted environmental education campaign regarding bushland management.
Maintain conservation fencing	Maintain conservation fencing on an as needed basis (informed by monthly inspections) to protect the native vegetation, flora and fauna from informal access.
Investigate closure and rehabilitation of informal tracks	Investigate closure and rehabilitation of informal tracks that are used infrequently to protect vegetation.
Implement *Walkability Plan 2013-2018*	Implement recommendations from the *Walkability Plan 2013-2018* that are applicable to the management of Hepburn Heights.
Install new signage	Install new directional and interpretive signage on site to encourage use of the site and raise awareness of the ecological values of the bushland.
Investigate installation of a new bench seat	Investigation installation of an additional bench seat on site towards the top of the hill to take advantage of the views and encourage people to spend more time in Hepburn Heights.
Monitor and report litter	Monitor and report the amount of litter present in Hepburn Heights bushland on an annual basis.
Dismantle cubby houses and BMX tracks	Dismantle cubby houses and BMX tracks as required to discourage littering in the surrounding area.

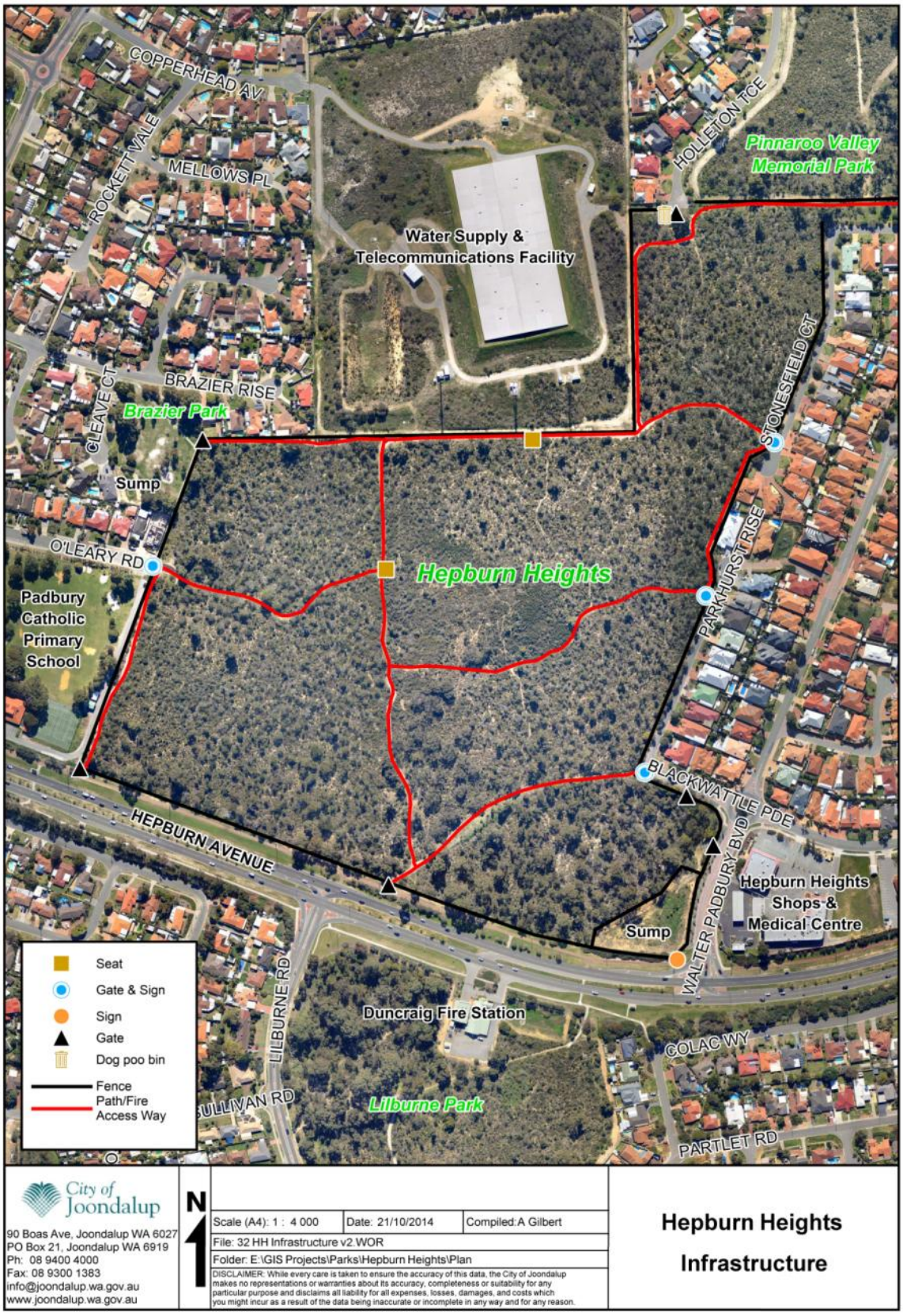

Figure 28: Infrastructure at Hepburn Heights

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.

Bushfires are unplanned fires that can be caused by events such as lightning, unplanned effects from controlled 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.[63]

Management of Hepburn Heights 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.

DFES work with the community and government to prevent, prepare for, respond to and recover from a diverse range of emergencies.[64]

The DFES have developed a *Fire Pre-Plan for the Urban Bushland Area of Hepburn Heights*[65] including site specific information on ecologically sensitive areas, risk management strategies, hazards, communications plan and fire suppression strategy and tactics. The Fire Pre-Plan is updated by the DFES annually in conjunction with key stakeholders including City of Joondalup.

There are numerous public water hydrants located around Hepburn Heights which are installed and maintained by the Water Corporation and DFES, as shown in Figure 22.

Undertaking fire management within Hepburn Heights will help to:

- Protect life, property and environment in Hepburn Heights and adjacent residential areas and privately owned buildings.
- Fulfil obligations under the *Bushfires Act 1954*.
- Protect the ecological and amenity values of Hepburn Heights bushland.
- 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 Hepburn Heights in October 2013 by the City of Joondalup which indicated that the site has a very high fuel load of 30 tonnes / ha. The fuel load assessment was undertaken according to the methodology from the Fire and Emergency Services Australia (FESA) *Visual Fuel Load Guide for the Scrub Vegetation of*

[63] EDOWA (2011)
[64] DFES (2013a)
[65] DFES (no date)

the Swan Coastal Plain.[66] Fuel load assessments are conducted annually at Hepburn Heights and the results used to inform fire management of the site.

A recent fire in Hepburn Heights on 10 January 2015 in the north-west of the site has substantially reduced the fuel load in approximately 1-2 hectares.

Fire Occurrences

There have been a few fires at Hepburn Heights, the majority of which are believed to have been deliberately lit. The frequency of fires has lessened since 2002-03. This could be due to factors such as the DFES bushfire awareness campaigns. Fire occurrences at Hepburn Heights are detailed in Table 5. Monitoring of fire occurrences and detailing fire incidents and frequency through mapping and updating the City's Geographic Information System (GIS) layer could inform fire prevention actions.

Dates	**2013**	**2012**	**2011**	**2010**	**2009**	**2008**	**2007**	**2006**	**2005**	**2004**	**2003**	**2002**
Fire Occurrences	0	0	1	0	0	1	0	0	0	1	4	2

Table 5: Fire Occurrences at Hepburn Heights (DFES 2014)

Fire Response

The closest branch of the DFES is located at the Duncraig Fire Station on Hepburn Avenue in Duncraig and they are responsible for suppressing fires within Hepburn Heights. The Western Australia Police are responsible for the evacuation of residents and visitors, if required.

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 weedy grasses using backpacks.

Current Management Approach

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

- Controlled access;
- Weed species management;
- Fuel load assessment and management; and
- Maintenance and installation of fire access tracks (fire access ways and strategic firebreaks).

Fuel load assessments are conducted annually at Hepburn Heights and the results used to inform fire management of the site.

Weed control and maintenance of fire access tracks are conducted in accordance with the City's Annual Bushland Schedule. The City of Joondalup will develop a Bushland Fire

[66] FESA (2007)

Management Plan in 2014/15, outlining the City's strategy for assessing fire risk, prevention, response and recovery.

The City is also developing some Fire Weed Management Guidelines to mitigate the impact of weeds within the post fire environment of the City's natural areas. These Guidelines will be implemented within the City's natural areas after a fire event.

Recommended Fire Management Actions:

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

Action	Details
Assess fire fuel load	Annually assess and report fire fuel load using the FESA *Visual Fuel Load Guide for the Scrub Vegetation of the Swan Coastal Plain* to inform fire prevention actions.
Maintain fire access tracks and footpaths	Maintain fire access tracks and footpaths, including weed control and pruning of vegetation, by implementing the Annual Bushland Schedule.
Develop and implement Bushland Fire Management Plan	Develop and implement a *Bushland Fire Management Plan*, outlining the City's strategy for assessing fire risk, prevention, response and recovery.
Monitor fire occurrences	Monitor fire occurrences through mapping and updating Geographic Information System (GIS) layers detailing fire incidents and frequency to inform fire prevention actions.
Revise weed control after fire incidents	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 weedy grasses using backpacks.
Develop and implement Fire Weed Management Guidelines	Develop and implement the Fire Weed Management Guidelines, when required, to reduce the infestation of weeds in natural areas after a fire.

3.7 Education and Training

An important component of this Plan is to ensure that the local community, visitors to the City's natural areas and those that manage the City's natural areas have the necessary awareness, knowledge, motivation and behaviour to assist in protecting the City's natural areas.

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 local community can protect and enhance Hepburn Heights through the following actions:

- Participation in an environmental volunteer groups such as the Friends of Hepburn and Pinnaroo Bushland to assist with bushland restoration and maintenance activities.

- Minimising access and disturbance to the site by staying on paths, not taking vehicles into natural areas, and not allowing dogs to run off-leash.
- Contain cats, particularly at night, and ensure they stay out of Hepburn Heights.
- Planting local, native species in gardens where possible.
- Avoid touching or feeding wildlife and picking wildflowers or native plants.
- Undertaking appropriate hygiene practices such as cleaning footwear when entering and leaving the site, removing any weed seeds attached to clothing and removing and disposing appropriately of dog excrement (may contain weed seed).
- Not dumping garden rubbish or littering on site. Litter could be collected from site when spotted, or people could organise or get involved with a Clean Up Australia Day event.

Schools are also an important avenue for raising awareness and interest in environmental issues and creating future community members that are aware of, appreciate and actively participate in local environmental management. Padbury Catholic Primary School is located adjacent to Hepburn Heights which creates possible bushland learning opportunities for students. Duncraig Senior High School is also located nearby.

The City's Friends Groups help to protect, preserve and enhance significant bushland areas within the City and can also benefit from training related to pathogen hygiene and weed management. The Friends of Hepburn and Pinnaroo Bushland operate within Hepburn Heights.

Current Management Approach

The City implements an Annual Environmental Education Program to address key environmental issues and encourage greater environmental stewardship by the community. The Environmental Education Program includes a Think Green Biodiversity campaign, focussed on raising awareness of key environmental issues within the City and encouraging community participation in protecting the natural environment.

As part of the Environmental Education Program, the City is currently developing an Adopt a Bushland program for students from years 3 to 7 to provide an interactive bushland management program. The Adopt a Bushland program could be trialled with students from years 3 to 6 at Padbury Catholic Primary School.

In order to educate the community about how they can protect natural areas, the City has developed a number of key brochures titled '*Being WEEDwise: Garden Escapees in the City of Joondalup*', '*Being WEEDwise: Environmental Weeds in the City of Joondalup*' and '*Protecting our Natural Areas and Parks'*.

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

Recommended Education and Training Management Actions:

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

Action	Details
Environmental Education Program	Implement initiatives of a 'Think Green Biodiversity' campaign (part of the Environmental Education Program) targeting environmental issues such as: • pathogens; • weeds; • fire; • flora, fungi and fauna awareness; • preventing hand feeding of wildlife; and • responsible pet ownership.
Support 'Friends of Hepburn and Pinnaroo Bushland'	Support the 'Friends of Hepburn and Pinnaroo Bushland' group and encourage community participation in the management of this natural area.
Adopt a Bushland program	Develop and implement an Adopt a Bushland program for students to provide an interactive bushland management program.
Liaise with Padbury Catholic Primary School	Liaise with Padbury Catholic Primary School to increase awareness of the bushland ecological values.
Natural Areas Team training	Conduct regular Natural Areas Team plant identification training, including weed management, to increase the effectiveness of weed control activities, as required.
Friends Groups training	Conduct pathogen hygiene or weed management training with City of Joondalup Friends Groups, including Friends of Hepburn and Pinnaroo Bushland.

4.0 Implementation Plan

To ensure the Hepburn Heights Conservation Area Management Plan is being implemented in an effective and timely manner the following steps will be undertaken:

- Monthly weed inspections;
- Annual reporting;
- Scientific research and monitoring; and
- Review of the Management Plan.

4.1 Monthly Weed Inspections

Weed inspections of Hepburn Heights are conducted by the City of Joondalup once every 4 weeks.

4.2 Annual Reporting

The implementation of the Hepburn Heights Management Plan and the delivery of positive outcomes will be undertaken through annually reporting progress against recommended management actions and the following Key Performance Indicators:

- Percentage density of environmental weeds.
- Incidence of litter within natural area / ha.

4.3 Scientific Research and Monitoring

A Natural Areas Initial Assessment is to be conducted on Hepburn Heights every 5 years. The most recent assessment was conducted in 2012/13. The next assessment is to be conducted in 2017/18, prior to the review of the Hepburn Heights Conservation Area Management Plan.

Surveys in Hepburn Heights of flora, weeds, fungi, fauna, invertebrates and bats are to be conducted in 2018/19 and 2019/20.

Fire fuel load assessments of Hepburn Heights are to be undertaken annually.

4.4 Management Plan Review

The Hepburn Heights Conservation Area Management Plan is to be reviewed every 5 years. The next review is due in 2019/20.

4.5 Summary of Recommended Management Actions

Biodiversity Conservation Area	Recommended Management Action	Detail
Flora	Liaise with the Water Corporation	Liaise with the Water Corporation regarding weed control on the Water Supply and Telecommunications Facility located to the north of Hepburn Heights to protect biodiversity values.
	Flora survey	Undertake a follow up flora survey in spring to supplement previous flora survey undertaken, within 5 years.
	Weed survey	Undertake a follow up weed survey in winter to supplement previous weed survey, within 5 years.
	Investigate planting *Eucalypt* trees	Investigate planting of Tuart trees (*Eucalyptus gomphocephala*) in Hepburn Heights to provide nesting habitat and a feeding and roosting resource in the long term for Carnaby's Black Cockatoos. Investigate planting other species of *Eucalypt* trees (such as Marri or Jarrah) to provide nesting sites and shelter for fauna.
	Revegetation	Conduct revegetation on degraded or completely degraded areas using local provenance species, as required.
	Monthly weed monitoring	Conduct monthly weed inspections to establish the extent of weeds and to identify priority weed species.
	Natural Areas Initial Assessment	Conduct five to seven yearly follow up of Natural Areas Initial Assessment to monitor ecological health of site.
	Annual weed monitoring and reporting	Monitor and report on the density of environmental weeds in Hepburn Heights on an annual basis, using three transects or quadrats.
	Weed control	Undertake coordinated approach to regular weed control by implementing Annual Bushland Schedule.
	Weed management on verges	Conduct weed management of weeds on verges within Hepburn Heights consisting of mowing of verges to reduce seed spread, spraying of weeds and spreading of certified mulch, where required.
	Weed Management Plan	Develop and implement a *City of Joondalup Weed Management Plan* to provide an ongoing strategic approach to the management of natural areas in order to reduce the incidence of weeds.
Fungi	Fungi survey	Undertake a comprehensive fungi survey in autumn or winter after substantial rain, to supplement previous incidental fungi survey, within 5 years.
Pathogens	Pathogen management	Implement recommendations from the Pathogen Management Plan that are applicable to the management of Hepburn Heights.
	Hygiene Guidelines	Develop and implement *Pathogen and Weed Hygiene Guidelines* and *Purchasing of Landscaping Materials Guidelines* to prevent the introduction or spread of weed or pathogens into Hepburn Heights.
Fauna	Fauna survey	Undertake a follow up fauna survey, in mid-late spring to supplement previous fauna survey, within 5 years.
	Bat survey	Undertake a one week remote monitoring bat survey in summer to supplement previous one night bat survey undertaken in spring.
	Installation of bat boxes	If bat survey indicates presence of bats, consider installing bat boxes to encourage bats to roost.

Biodiversity Conservation Area	Recommended Management Action	Detail
Fauna	Artificial hollows	Investigate installation of artificial hollows in trees such as Tuart or Marri to encourage Carnaby's Black-Cockatoos or Forest Red-tailed Black Cockatoos to nest.
	Rainbow Bee-eater nesting sites	Monitor Rainbow Bee-eater nesting sites through monthly inspections and install fencing and signage around exposed nesting sites to decrease trampling of nests by humans or dogs.
	Invertebrates survey	Undertake targeted survey for invertebrates in spring to supplement previous opportunistic invertebrate survey undertaken, particularly for the presence of the undescribed millipede *Antichiropus* sp. nov., within 5 years.
	Feral animal control	Implement regular fox control (and rabbit control if required) to reduce pressures on native fauna and flora.
	Ecological connectivity	Undertake investigations with Pinnaroo Valley Memorial Park to determine the feasibility of increasing connectivity and allow easier movement for fauna such as mammals and woodland birds between Hepburn Heights and Pinnaroo Valley Memorial Park.
Social and Built Environment	User survey	Conduct user surveys, as required, to provide information on the reasons why people visit Hepburn Heights, the number of people and frequency of visits and enable a more targeted environmental education campaign regarding bushland management.
	Maintain conservation fencing	Maintain conservation fencing on an as needed basis (informed by monthly inspections) to protect the native vegetation, flora and fauna from informal access.
	Investigate closure and rehabilitation of informal tracks	Investigate closure and rehabilitation of informal tracks that are used infrequently to protect vegetation.
	Implement *Walkability Plan 2013-2018*	Implement recommendations from the *Walkability Plan 2013-2018* that are applicable to the management of Hepburn Heights.
	Install new signage	Install new directional and interpretive signage on site to encourage use of the site and raise awareness of the ecological values of the bushland.
	Investigate installation of a new bench seat	Investigation installation of an additional bench seat on site towards the top of the hill to take advantage of the views and encourage people to spend more time in Hepburn Heights.
	Monitor and report litter	Monitor and report the amount of litter present in Hepburn Heights on an annual basis.
	Dismantle cubby houses and BMX tracks	Dismantle cubby houses and BMX tracks as required to discourage littering in the surrounding area.
Fire Management	Assess fire fuel load	Annually assess and report fire fuel load using the FESA *Visual Fuel Load Guide for the Scrub Vegetation of the Swan Coastal Plain* to inform fire prevention actions required.
Fire Management	Maintain fire access tracks and footpaths	Maintain fire access tracks and footpaths, including weed control and pruning of vegetation, by implementing Annual Bushland Schedule.
	Develop and implement Fire Management Plan	Develop and implement a *City of Joondalup Fire Management Plan*, outlining the City's strategy for assessing fire risk, prevention, response and recovery.

Biodiversity Conservation Area	Recommended Management Action	Detail
	Monitor fire occurrences	Monitor fire occurrences through mapping and updating Geographic Information System (GIS) layers detailing fire incidents and frequency to inform fire prevention actions.
	Revise weed control after fire incidents	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 weedy grasses using backpacks.
	Develop and implement Fire Weed Management Guidelines	Develop and implement the Fire Weed Management Guidelines, when required, to reduce the infestation of weeds in natural areas after a fire.
Education and Training	Environmental Education Program	Implement initiatives of a 'Think Green Biodiversity' campaign (part of the Environmental Education Program) targeting environmental issues such as: • pathogens; • weeds; • fire; • flora, fungi and fauna awareness; • prevention of hand feeding wildlife; and • responsible pet ownership.
	Support 'Friends of Hepburn and Pinnaroo Bushland'	Support the 'Friends of Hepburn and Pinnaroo Bushland' group and encourage community participation in the management of this natural area.
	Consider developing Adopt a Bushland program	Develop and implement an Adopt a Bushland program for students to provide an interactive bushland management program.
	Liaise with Padbury Catholic Primary School	Liaise with Padbury Catholic Primary School to increase awareness of the bushland ecological values.
	Natural Areas Team training	Conduct regular Natural Areas Team plant identification training, including weed management, to increase the effectiveness of weed control activities, as required.
	Friends Groups training	Conduct pathogen hygiene or weed management training with City of Joondalup Friends Groups, including Friends of Hepburn and Pinnaroo Bushland.

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6.0 Appendices

Appendix 1 – Relevant Local, State and Federal Legislation, Policies, Plans and Strategies

Appendix 2 – Hepburn Heights Flora Species Lists

Appendix 3 – Hepburn Heights Key Flora Species

Appendix 4 - Conservation Codes for Western Australian Flora

Appendix 5 – Keighery Scale Definitions

Appendix 6 – Hepburn Heights High Priority Weed Species Management

Appendix 7 – Hepburn Heights Fauna Species Lists

Appendix 8 – Hepburn Heights Key Fauna Species

Appendix 9 – Conservation Codes for Western Australian Fauna

Appendix 10 – Hepburn Heights Fungi Species List

Appendix 11 – Hepburn Heights Fungi Species

Appendix 12 – Hepburn Heights Surrounding Land Use

Appendix 1 – Relevant Local, State and Federal Legislation, Policies, Plans and Strategies

Local Government

The purpose of the Natural Areas Weed Management Plan aligns with the environmental aims and objectives of a number of City of Joondalup Plans including:

Strategic Community 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 2014-2019* provides strategic direction in the delivery of environmental initiatives within 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.

City of Joondalup District Planning Scheme No. 2 Schedule 5

Planning for land use occurs under the District Planning Scheme No. 2. Schedule 5 (Clause 5.3.1) of the District Planning Scheme lists Places and Objects Having Significance for the Purpose of Protection of the Landscape or Environment.

Hepburn Heights is listed within Schedule 5 of the District Planning Scheme No 2.

City of Joondalup Pest Plant Local Law 2012

Under the *Biosecurity and Agriculture Management Act 2007* and the *Local Government Act 1995*, the Council of the City of Joondalup made the *Pest Plant Local Law 2012* to require the owner or occupier of private land within the City of Joondalup district to destroy, eradicate or otherwise control pest plants within a specified time. Caltrop (*Tribulus terrestis*) is designated as a pest plant.

Caltrop has not been identified in Hepburn Heights.

Local Biodiversity Program (formerly Perth Biodiversity Project)

The City of Joondalup is one of 32 local governments participating in the Western Australian Local Government Association's (WALGA's) Local Biodiversity Program. The aim of the Local Biodiversity Program 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 Local Biodiversity Program, the City of Joondalup assessed all natural areas from 2004 onwards using the ecological criteria of the Natural Area Assessment process, 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.

Natural Area Assessments include a desktop assessment and field survey and document information such as:

- vegetation complexes;
- threatened or significant flora or ecological communities;
- structural plant communities;
- weed species;
- vegetation condition assessment;
- ecological criteria rankings;
- a viability estimate; and
- fauna species observed.

Hepburn Heights is one of the City's five Major Conservation Areas due to the high biodiversity values of the area.

State Government

Relevant Legislation, Policies and Documents

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.

Hepburn Heights is not listed on any State or Federal Indigenous heritage inventory or register.

Biosecurity and Agriculture Management Act 2007

The Act gives provision to control the entry, establishment, spread and impact of certain organisms that have or may have an adverse effect on other organisms, human beings, the environment, agricultural activities or related commercial activities. Pests, including plants, are declared under the Act as prohibited organisms.

One declared pest plant has been recorded in Hepburn Heights, Doublegee (*Emex australis*).[67]

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.

Cat Act 2011

The Act makes provision for the control and management of cats and promotes and encourages the responsible ownership of cats.

Cats may be seized where they are found wandering in public areas, such as Hepburn Heights, in accordance with the *Cat Act 2011*.

[67] Syrinx (2014)

Dog Act 1976

The Act makes provisions for the control of dogs in public and private spaces and promotes the responsible ownership of dogs.

Hepburn Heights is designated as a place where dogs must be on a leash at all times by Council resolution in accordance with the *Dog Act 1976*.

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.

Heritage of Western Australia Act 1990

The Act provides for and encourages the conservation of places which have significance to the cultural heritage in the State.

Hepburn Heights is listed on the Register of the National Estate (place number 4522), a State cultural heritage register.

Wildlife Conservation Act 1950

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

Two fauna species listed under the *Wildlife Conservation Act 1950* utilise Hepburn Heights, the threatened Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and the migratory species Rainbow Bee-eater (*Merops ornatus*).[68]

Government of Western Australia "Bush Forever" Strategy 2000

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

Hepburn Heights is designated as a Bush Forever site (303). Seven species identified in Hepburn Heights are listed as naturally occurring significant flora of the Perth Metropolitan Region, Waldjumi *(Jacksonia sericea), Conostylis aculeata* subsp *cygnorum*, *Sarcozona bicarinata*, *Lechenaultia linarioides*, *Ricinocarpus glaucus*, *Grevillea preissii* and *Hibbertia cuneiformis*.

State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region

The *State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region* aims 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.

[68] Syrinx (2014)

Environmental Weed Strategy for Western Australia 1999

The Department of Conservation and Land Management (CALM) (now Department of Parks and Wildlife (DPaW)) developed an Environmental Weed Strategy for Western Australia (WA) (1999). The Strategy prioritises 1,350 weed species using the criteria of invasiveness, distribution and environmental impacts to rate weeds as high, moderate, mild or low priority. High ratings were issued to 34 weed species.[69]

Hepburn Heights contains 12 high priority rated weeds in the Environmental Weed Strategy for WA.

DPaW Weed Prioritisation Process 2013

The DPaW conducted a weed prioritisation process for weeds in each DPaW region, with the aim being to establish a species-led and an asset-protection-based approach to weed management, focussing on infestations of species which are considered to be high impact, rapidly invasive and still at a population size which is feasible to eradicate or contain to a manageable size. The weed prioritisation process is based on the Environmental Weed Census and Prioritisation, Swan Natural Resource Management Region project (Bettink and Keighery 2008) and the Environmental Weed Strategy of Western Australia (DPaW 1999). The assessment prioritises weeds using criteria of potential distribution, current distribution, ecological impact, invasiveness and feasibility of control to rate weeds as very high, high, medium, low, negligible, further assessment required or alert. The DPaW Swan Region weed prioritisation process rated 765 weed species.

Hepburn Heights contains 7 high priority weeds in the DPaW Weed Prioritisation Process for the Swan Region.

Federal Government

Relevant Legislation and Strategies

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 have been recorded in Hepburn Heights, the endangered Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and the migratory species Rainbow Bee-eater (*Merops ornatus*).[70]

Australia's Biodiversity Conservation Strategy 2010-2030

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

[69] DPaW (1999)
[70] Syrinx (2014)

National Weeds Strategy 1997

The National Weeds Strategy provides a strategic framework for managing weeds at a national level. As part of the implementation of the National Weeds Strategy, 32 Weeds of National Significance are identified as nationally agreed priority plant species for control and management based on the criteria of invasiveness and impact characteristics, potential and current area of spread and economic, environmental and social impacts.

Hepburn Heights contains no known Weeds of National Significance.

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 has been recorded in Hepburn Heights, Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*).[70]

Appendix 2 – Hepburn Heights Flora Species Lists

Flora species list for the Hepburn Heights Conservation Area

Family	Species Name	Common Name (as per FloraBase)	Conservation Status / Introduced (Weeds)	City of Joondalup		DPaW		DAFWA	Federal	Recorded or Potential	Syrinx, 2014	NAIA, 2004 & 2012	Keighery & Keighery, 1991	Tingay, 1993	Previous Nomenclature (Name Changes)	Notes
				Target Weeds (HHCA)	Pest Plant Local Law (2012)	WAEWA (1999)	Swan Region Weeds DPaW (2013)	Declared Pest Plant	WONS (2013)							
AIZOACEAE	*?Aptenia cordifolia*		Introduced							R	X					
AIZOACEAE	*Carpobrotus edulis*	Hottentot Fig	Introduced			Mo	M (D,E,F)			R		X	X			
AIZOACEAE	*Carpobrotus* sp. (sterile)	-								R	X					Likely to be **C. edulis*
AIZOACEAE	*Sarcozona bicarinata*	-	**Priority 3, BF**							P			X	X	*Carpobrotus* cf. *modestus, C.* sp. Hepburn (G.J. Keighery 11518)	
AIZOACEAE	*Galenia pubescens var. pubescens*	-	Introduced				FAR			R	X					
AMARANTHACEAE	*Ptilotus drummondii* var. *drummondii*	Pussytail								R	X		X	X	*Ptilotus drummondii*	
AMARANTHACEAE	*Ptilotus manglesii*	Pom Poms, Mulamula								R	X		X	X		
AMARANTHACEAE	*Ptilotus polystachyus*	Prince of Wales Feather								R	X	X	X	X		
AMARANTHACEAE	*Ptilotus stirlingii* subsp. *stirlingii*	-								P			?		*Ptilotus stirlingii*	
ANACARDIACEAE	*Schinus terebinthifolius*	Japanese Pepper	Introduced	*		Mo	M (D,E,F)			R	X	X				
APIACEAE	*Daucus glochidiatus*	Australian Carrot								R	X		X			
APIACEAE	*Eryngium pinnatifidum* subsp. *pinnatifidum* ms	(Blue Devils)								R	X	X	X	X	*Eryngium pinnatifidum, Eryngium rostratum*	
APIACEAE	*Foeniculum vulgare*	Fennel	Introduced	*			N (A)			R	X					
APIACEAE	*Homalosciadium homalocarpum*									R	X		X			
APIACEAE	*Xanthosia huegelii*	-								R	X		X			
ARALIACEAE	*Hydrocotyle blepharocarpa*	-								R	X					
ARALIACEAE	*Trachymene coerulea* subsp. *coerulea*	-								R	X					
ARALIACEAE	*Trachymene pilosa*	Native Parsnip								R	X		X			
ASPARAGACEAE	*Acanthocarpus preissii*	-								R	X	X		X		
ASPARAGACEAE	*Dichopogon capillipes*	-								P			?		*Arthropodium capillipes*	
ASPARAGACEAE	*Lachenalia reflexa*	Cape Cowslip	Introduced	*		H	H (H,I)			R	X					
ASPARAGACEAE	*Lomandra ?hermaphrodita*	-								R	X		X			
ASPARAGACEAE	*Lomandra ?micrantha* subsp. *micrantha* (sterile)	Small Flowered Mat Rush								R	X					
ASPARAGACEAE	*Lomandra caespitosa*	Tufted Mat Rush								R	X	X		X		
ASPARAGACEAE	*Lomandra hermaphrodita*	-								P				X		
ASPARAGACEAE	*Lomandra maritima*	-								R	X	X	X	X		
ASPARAGACEAE	*Lomandra micrantha* subsp. *micrantha*									R		X			*Lomandra micrantha*	
ASPARAGACEAE	*Lomandra preissii*	-								P			?			
ASPARAGACEAE	*Lomandra* sp. *caespitosa/suaveolens* (sterile)	-								R	X					
ASPARAGACEAE	*Lomandra suaveolens*	-								R	X		X	X		
ASPARAGACEAE	*Sowerbaea laxiflora*	Purple Tassels								R	X		X			
ASPARAGACEAE	*Thysanotus arenarius*	-								R	X		X			
ASPARAGACEAE	*Thysanotus manglesianus*	Fringed Lily								R	X					T.patersonii/manglesianus complex

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ASPARAGACEAE	*Thysanotus patersonii*	-								P			X	X		T.patersonii/mangl esianus complex
ASPARAGACEAE	*Thysanotus sparteus*	-								R	X	X	X	X		
ASPARAGACEAE	*Thysanotus triandrus*	-								P			?			
ASPHODELACAE	*Trachyandra divaricata*	False Onion Weed	Introduced	*		Mi	L (D)			R	X					
ASTERACEAE	*?Chrysanthemum* sp. (garden escape)	-	Introduced							R	X					
ASTERACEAE	*Arctotheca calendula*	Cape Weed	Introduced			Mo	L (D,E)			R	X		X			
ASTERACEAE	*Centaurea melitensis*	Maltese Cockspur	Introduced			Mo	M (D,E,F)			P			?			
ASTERACEAE	*Conyza albida*	Tall Fleabane	Introduced			L				P			?			
ASTERACEAE	*Conyza bonariensis*	Flax leaf Fleabane	Introduced			L	N (A)			R	X					
ASTERACEAE	*Cotula australis*	Common Cotula								R	X					
ASTERACEAE	*Dimorphotheca ecklonis*	-	Introduced			L	L (B,C,D)			R	X				*Olearia ecklonis*	
ASTERACEAE	*Dittrichia graveolens*	Stinkwort	Introduced			Mi	M (D,E,F)			P			?			
ASTERACEAE	*Gazania linearis*	-	Introduced	*		L	H (H,I)			R	X					
ASTERACEAE	*Hypochaeris glabra*	Smoot Cats Ear	Introduced			Mo	L (D)			R	X		X			
ASTERACEAE	*Hypochaeris radicata*	Flat Weed	Introduced				L (D)			R	X					
ASTERACEAE	*Lactuca serriola*	Prickly Lettuce	Introduced			Mo	M (D,E,F)			R	X					
ASTERACEAE	*Lagenophora huegelii*									R	X		X		*Lagenifera huegelii*	
ASTERACEAE	*Millotia tenuifolia ?var. tenuifolia*	Soft Millotia								P			?		*Millotia tenuifolia*	
ASTERACEAE	*Monoculus monstrosus*	-	Introduced			Mi	L (B,C)			R	X		X		**Osteospermum clandestinum*	
ASTERACEAE	*Olearia axillaris*	Coastal Daisybush								R	X	X	X	X		
ASTERACEAE	*Pithocarpa cordata*	-								R	X	X	X	X	*Helichrysum cordatum, Ozothamnus cordatus*	
ASTERACEAE	*Podolepis gracilis*	Slender Podolepis								R	X		X			
ASTERACEAE	*Podotheca angustifolia*	Sticky Longheads								R	X		X			
ASTERACEAE	*Podotheca chrysantha*	Yellow Podotheca								R	X		X			
ASTERACEAE	*Podotheca gnaphalioides*	Golden Longheads								R	X					
ASTERACEAE	*Quinetia urvillei*	-								R	X		X			
ASTERACEAE	*Senecio pinnatifolius* var. *latilobus*	-								R	X		X		*Senecio lautus*	
ASTERACEAE	*Senecio* sp. (unresolved taxonomy)(WAH)	-								R	X					
ASTERACEAE	*Siloxerus humifusus*	Procumbent Siloxerus								P			X			
ASTERACEAE	*Sonchus oleraceus*	Common Sowthistle	Introduced			Mo	N (B)			R	X		X			
ASTERACEAE	*Urospermum picroides*	False Hawkbit	Introduced			Mo	L (D)			R	X					
ASTERACEAE	*Ursinia anthemoides*	Ursinia	Introduced			Mo	N (B)			R	X		X			
ASTERACEAE	*Waitzia suaveolens* var. *suaveolens*	Fragrant Waitzia								R	X	X	X		*Waitzia suaveolens*	
BRASSICACEAE	*Brassica tournefortii*	Mediterranean Turnip	Introduced	*		H	L (D)			R	X		X			
BRASSICACEAE	*Heliophila pusilla*	-	Introduced			Mo	N (B)			R	X		X			
CAMPANULACEAE	*Cuscuta epithymum*	Lesser Dodder, Greater Dodder	Introduced			Mo	N (B)			R	X		X			
CAMPANULACEAE	*Isotoma hypocrateriformis*	Woodbridge Poison								P			?			
CAMPANULACEAE	*Lobelia tenuior* subsp. ?	Slender Lobelia								P			?		*Lobelia tenuior*	

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CAMPANULACEAE	*Wahlenbergia capensis*	Cape Bluebell	Introduced			Mo	L (B,C)			R	X		X			
CAMPANULACEAE	*Wahlenbergia gracilenta*	Annual Bluebell								R	X					
CAMPANULACEAE	*Wahlenbergia preissii*	-								P			?			Likely same entity as *W. gracilenta*
CAPRIFOLIACEAE	*Centranthus macrosiphon*	-	Introduced	*		L	H (H,I)			R	X					
CARYOPHYLLACEAE	*Cerastium glomeratum*	Mouse Ear Chickweed	Introduced			L	L (D)			R	X		X			
CARYOPHYLLACEAE	*Petrorhagia dubia*	Hairy Pink	Introduced			Mi	L (D)			R	X		X		*Petrorhagia velutina*	
CARYOPHYLLACEAE	*Sagina apetala*	Annual Pearlwort								P			?			
CARYOPHYLLACEAE	*Silene gallica* var. *gallica*	French Catchfly	Introduced			L	N (B)			R	X					
CARYOPHYLLACEAE	*Stellaria media*	Chickweed	Introduced			L	N (B)			R	X					
CASUARINACEAE	*Allocasuarina fraseriana*	Kondil								R	X	X	X	X		
CASUARINACEAE	*Allocasuarina humilis*	Dwarf Sheoak								R	X	X	X	X		
CENTROLEPIDACEAE	*Centrolepis drummondiana*	-								R	X		X			
CHENOPODIACEAE	*Rhagodia baccata* subsp. *baccata*	Berry Saltbush								R	X		X		*Rhagodia baccata*	
COLCHICACEAE	*Burchardia congesta*	-								R	X	X	X	X	*Burchardia umbellata*	
COLCHICACEAE	*Wurmbea* sp.	-								P			?			
COMMELINACEAE	*Cartonema philydroides*	-								P			?			
CRASSULACEAE	*Crassula colorata* var. *colorata*	(Dense Stonecrop)								R	X		X		*Crassula colorata*	
CRASSULACEAE	*Crassula decumbens*	Rufous Stonecrop								R	X					
CRASSULACEAE	*Crassula exserta*	-								P			?			
CRASSULACEAE	*Crassula glomerata*	-	Introduced			Mo	FAR			R	X					
CUPRESSACEAE	*Callitris preissii*	Rottnest Island Pine, Maro	**BF**							R	X					
CYPERACEAE	*Isolepis cernua* var. *?*	Nodding Club-rush								P			?	X		
CYPERACEAE	*Isolepis marginata*	Coarse Club-rush	Introduced				N (B)			R	X					
CYPERACEAE	*Lepidosperma calcicola*	-								R	X	X	X	X	*L. angustatum, L. squamatum, L. pubisquameum*	
CYPERACEAE	*Lepidosperma costale*	-								R		X				Likely to have been *L. scabrum*
CYPERACEAE	*Lepidosperma leptostachyum*	-								R		X	X	X		Likely to have been *L. calcicola.*
CYPERACEAE	*Lepidosperma scabrum*	-								R	X	X				Probably same entity as *L. costale*
CYPERACEAE	*Lepidosperma squamatum*	-								R	X					
CYPERACEAE	*Mesomelaena pseudostygia*	-								R	X	X	X	X	*Mesomelaena stygia*	
CYPERACEAE	*Schoenus clandestinus*	-								R	X		X			
CYPERACEAE	*Schoenus curvifolius*	-								R	X		X			
CYPERACEAE	*Schoenus grandiflorus*	Large Flowered Bogrush								R	X	X	X	X		
CYPERACEAE	*Tetraria octandra*	-								R	X		X	X		
DILLENIACEAE	*Hibbertia cuneiformis*	Cutleaf Hibbertia	**BF**							R	X					
DILLENIACEAE	*Hibbertia hypericoides*	Yellow Buttercups								R	X	X	X	X		
DILLENIACEAE	*Hibbertia racemosa*	Stalked Guineaflower								R	X	X	X	X		
DROSERACEAE	*Drosera erythrorhiza* subsp. *erythrorhiza*	Red Ink Sundew								R	X		X	X	*Drosera erythrorhiza*	
DROSERACEAE	*Drosera glanduligera*	Pimpernel Sundew								R	X		X			

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DROSERACEAE	*Drosera macrantha* subsp. *macrantha*	Bridal Rainbow								R	X		X	X	*Drosera macrantha*	
DROSERACEAE	*Drosera pallida*	Pale Rainbow								R	X		X			
DROSERACEAE	*Drosera stolonifera*	Leafy Sundew								P			?			
ERICACEAE	*Astroloma ciliatum*	Candle Cranberry								R	X		X			
ERICACEAE	*Astroloma pallidum*	Kick Bush								R		X		X		
ERICACEAE	*Conostephium pendulum*	-								R		X		X		Has been split, see *C. preissii*
ERICACEAE	*Conostephium preissii*	-								R	X	X	X	X		Was included in *Conostephium pendulum*
ERICACEAE	*Leucopogon australis*	Spiked Beard-heath								P			?			
ERICACEAE	*Leucopogon parviflorus*	Coast Beard-heath								R	X	X	X	X		
ERICACEAE	*Leucopogon polymorphus*	-								R	X	X				
ERICACEAE	*Leucopogon propinquus*	-								R	X	X	X	X		
ERICACEAE	*Leucopogon sprengelioides*	-								P			?	X		
EUPHORBIACEAE	*Euphorbia peplus*	Petty Spurge	Introduced			Mo	N (B)			R	X		X			
EUPHORBIACEAE	*Euphorbia terracina*	Geraldton Carnation Weed	Introduced	*		H	M (D,E,F, G)			R	X	X	X			
EUPHORBIACEAE	*Monotaxis grandiflora* var. *grandiflora*	Diamond of the Desert								R	X		X		*Monotaxis grandiflora*	
EUPHORBIACEAE	*Ricinocarpos glaucus*	-	**BF**							R	X	X	X			
FABACEAE	*Acacia benthamii*	-	**Priority 2, BF**							R	X					
FABACEAE	*Acacia cochlearis*	Rigid Wattle								R	X		X	X		
FABACEAE	*Acacia cyclops*	Coastal Wattle								R	X		X	X		
FABACEAE	*Acacia dealbata*	-	Introduced			Mi	M (D,E,F)			R	X					
FABACEAE	*Acacia iteaphylla*	-	Introduced	*		L	H (G,H,I)			R	X					
FABACEAE	*Acacia lasiocarpa* var. ?	-								P			?	X	*Acacia lasiocarpa*	
FABACEAE	*Acacia longifolia* subsp. *sophorae*	-	Introduced	*			H (G,H,I)			R	X					
FABACEAE	*Acacia pulchella* var. *glaberrima*	-								R	X	X	X	X	*Acacia pulchella*	
FABACEAE	*Acacia rostellifera*	Summer-scented Wattle								R	X	X	X	X		
FABACEAE	*Acacia saligna* subsp. *saligna*	Orange Wattle, Kudjong								R	X		X	X	*Acacia saligna*	
FABACEAE	*Acacia truncata*	-								R	X	X	X	X		
FABACEAE	*Acacia willdenowiana*	Grass Wattle								R	X	X		X		
FABACEAE	*Bossiaea eriocarpa*	Common Brown Pea								R	X		X	X		
FABACEAE	*Daviesia decurrens* subsp. *decurrens* ms	Prickly Bitter-pea								P			?		*Daviesia decurrens*	
FABACEAE	*Daviesia divaricata* subsp. *divaricata*	Marno								R	X		X	X	*Daviesia divaricata*	
FABACEAE	*Daviesia nudiflora* subsp. *nudiflora*	-								R	X	X	X	X	*Daviesia nudiflora*	
FABACEAE	*Daviesia triflora*	-								R	X	X	X	X		
FABACEAE	*Gastrolobium capitatum*	-								R	X	X	X		*Oxylobium capitatum, Nemcia capitata*	

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FABACEAE	*Gastrolobium nervosum*	-								P			?		*Oxylobium reticulatum, Nemcia reticulata*	
FABACEAE	*Gompholobium tomentosum*	Hairy Yellow Pea								R	X	X	X	X		
FABACEAE	*Hardenbergia comptoniana*	Native Wisteria								R	X	X	X	X		
FABACEAE	*Hovea pungens*	Devil's Pins, Puyenak								R	X		X	X		
FABACEAE	*Hovea trisperma* var. *trisperma*	Common Hovea								R	X	X	X	X	*Hovea trisperma*	
FABACEAE	*Isotropis cuneifolia* subsp. *cuneifolia*	Granny Bonnets								R	X		X		*Isotropis cuneifolia*	
FABACEAE	*Jacksonia calcicola*									R	X					
FABACEAE	*Jacksonia furcellata*	Grey Stinkwood								R	X		X			
FABACEAE	*Jacksonia sericea*	Waldjumi	**Priority 4, BF**							P		X	X	X		Similar to *Jacksonia calcicola.* Species collected in Syrinx (2014) survey were confirmed by WA Herbarium as being *Jacksonia calcicola.*
FABACEAE	*Jacksonia sternbergiana*	Stinkwood, Kapur								R	X	X	X	X		
FABACEAE	*Kennedia prostrata*	Scarlet Runner								R	X		X	X		
FABACEAE	*Lupines mutabilis*	-	Introduced							P			?			Excluded from Florabase
FABACEAE	*Lupinus cosentinii*	Western Australian Blue Lupin	Introduced	*		H	H (G,H,I)			R	X		X			
FABACEAE	*Medicago polymorpha*	Burr Medic	Introduced			Mi				P			?			
FABACEAE	*Sphaerolobium medium*	-								R	X		X			
FABACEAE	*Templetonia retusa*	Cockies Tongues								R	X	X	X	X		
FABACEAE	*Trifolium arvense* var. *arvense*	Hare's Foot Clover	Introduced			Mo	FAR			R	X		X		**Trifolium arvense*	
FABACEAE	*Trifolium campestre*	Hop Clover	Introduced			Mo	FAR			R	X		X			
FABACEAE	*Trifolium glomeratum*	Cluster Clover	Introduced			Mo	FAR			P			?			
FABACEAE	*Trifolium tomentosum*	Woolly Clover	Introduced			L				P			?			
FABACEAE	*Vicia sativa*	Common Vetch	Introduced	*		Mo	N (B)			R	X		X			
GERANIACEAE	*?Pelargonium capitatum* (immat.)	Rose Pelargonium	Introduced	*		H	L (D,E)			R	X					
GERANIACEAE	*Erodium botrys*	Long Storksbill	Introduced			L	N (B)			R	X					
GERANIACEAE	*Erodium cicutarium*	Common Storksbill	Introduced			Mo	N (B)			P			?			
GERANIACEAE	*Geranium solanderi*	Native Geranium	Introduced			L				P			?		**Geranium pilosum*	
GERANIACEAE	*Pelargonium capitatum*	Rose Pelargonium	Introduced	*		H	L (D,E)			R	X	X	X			
GOODENIACEAE	*Dampiera linearis*	Common Dampiera								R	X	X	X	X		
GOODENIACEAE	*Lechenaultia linarioides*	Yellow Lechenaultia	**BF**							R	X	X	X	X		
GOODENIACEAE	*Scaevola ?thesioides* subsp. *thesioides* (sterile)	-								R	X					
GOODENIACEAE	*Scaevola canescens*	Grey Scaevola								R	X	X	X	X		
GOODENIACEAE	*Scaevola paludosa*	-	**Priority 2**							P			?	X		P2 Flora known from Esperance
GOODENIACEAE	*Scaevola repens* var. *angustifolia*	-								R		X				Likely to be *Scaevola canescens* (green

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																growth)
GOODENIACEAE	*Scaevola thesioides* subsp. *thesioides*	-								R	X		X	X	*Scaevola thesioides*	
GYROSTEMONACEAE	*Tersonia cyathiflora*	Button Creeper								R	X		X	X		
HAEMODORACEAE	*Anigozanthos humilis* subsp. *humilis*	Catspaw								R	X		X		*Anigozanthos humilis*	
HAEMODORACEAE	*Anigozanthos manglesii*	(Mangles Kangaroo Paw, Kurulbrang)								R	X		X			
HAEMODORACEAE	*Conostylis aculeata* subsp. *cygnorum*	Prickly Conostylis	BF							R	X	X	X	X	*Conostylis aculeata*	
HAEMODORACEAE	*Conostylis candicans* subsp. ?	Grey Cottonhead								P			?		*Conostylis candicans*	
HAEMODORACEAE	*Haemodorum laxum*	-								P			?			
HAEMODORACEAE	*Haemodorum paniculatum*	Mardja								R	X	X	X	X		
HAEMODORACEAE	*Haemodorum spicatum*	Mardja								R	X		X	X		
HALORAGACEAE	*Glischrocaryon aureum*	Common Popflower	BF							R	X	X	X			
HEMEROCALLIDACEAE	*Caesia micrantha*	Pale Grass Lily								R	X		X			
HEMEROCALLIDACEAE	*Corynotheca micrantha* var. *micrantha*	Sand Lily								R	X	X	X	X	*Corynotheca micrantha*	
HEMEROCALLIDACEAE	*Dianella revoluta* var. *divaricata*	Blueberry Lily								R	X	X	X	X	*Dianella revoluta*	
HEMEROCALLIDACEAE	*Tricoryne elatior*	Yellow Autumn Lily								R	X		X			
IRIDACEAE	*Ferraria crispa*	Black Flag	Introduced							R		X				
IRIDACEAE	*Freesia alba X leichtlinii*	-	Introduced	*		H	L (D,E)			R	X					
IRIDACEAE	*Gladiolus caryophyllaceus*	Wild Gladiolus	Introduced	*		Mo	M (D,E,F)			R	X	X	X			
IRIDACEAE	*Ixia maculata*	Yellow Ixia	Introduced			L	H (H,I)			R	X					
IRIDACEAE	*Moraea flaccida*	One-leaf Cape Tulip	Introduced	*		H	L (D,E)			R	X	X	X		*Homeria flaccida	
IRIDACEAE	*Orthrosanthus laxus* var. *laxus*	Morning Iris								R	X	X	X		*Orthrosanthus laxus*	
IRIDACEAE	*Patersonia occidentalis* var. *occidentalis*	Purple Flag, Koma								R	X		X	X	*Patersonia occidentalis*	
IRIDACEAE	*Romulea rosea* var. *australis*	Guildford Grass	Introduced				N (B)			R	X	X	X		*Romulea rosea	
IRIDACEAE	*Sparaxis bulbifera*	-	Introduced			H	H (G,H,I)			P			?			
JUNCACEAE	*Luzula meridionalis*	Field Woodrush								R	X		X	X		
JUNCAGINACEAE	*Triglochin calcitrapa*	-								P			?			
JUNCAGINACEAE	*Triglochin isingiana*	-								R	X					
LAMIACEAE	*Hemiandra pungens*	Snakebush								P			?			
LAURACEAE	*Cassytha flava*	Dodder Laurel								R	X					
LAURACEAE	*Cassytha glabella* forma. ?	Tangled Dodder Laurel								P			?			
LAURACEAE	*Cassytha pomiformis*	Dodder Laurel								R		X				
LAURACEAE	*Cassytha racemosa* var. *?racemosa* (no fruit)	Dodder Laurel								R	X		X	X	*Cassytha racemosa*	
LORANTHACEAE	*Nuytsia floribunda*	Christmas Tree, Mudja								R	X					
MALVACEAE	*Malva parviflora*	Marshmellow	Introduced			L	N (B)			R	X					
MALVACEAE	*Thomasia foliosa*	-								P			?			
MYRTACEAE	*Agonis flexuosa*	Peppermint	Introduced				M (D,E,F)			R	X					
MYRTACEAE	*Calothamnus quadrifidus*	One Sided Bottlebrush, Kwowdjard								R	X	X	X	X	*Calothamnus*	

Family	Species Name	Common Name (as per FloraBase)	Conservation Status / Introduced (Weeds)	City of Joondalup		DPaW		DAFWA	Federal	Recorded or Potential	Syrinx, 2014	NAIA, 2004 & 2012	Keighery & Keighery, 1991	Tingay, 1993	Previous Nomenclature (Name Changes)	Notes
				Target Weeds (HHCA)	Pest Plant Local Law (2012)	WAEWA (1999)	Swan Region Weeds DPaW (2013)	Declared Pest Plant	WONS (2013)							
	subsp. *quadrifidus*														*quadrifidus*	
MYRTACEAE	*Calytrix angulata*	Yellow Starflower								P			?			
MYRTACEAE	*Chamelaucium uncinatum*	Geraldton Wax	Introduced				L (B,C,D)			R	X					
MYRTACEAE	*Corymbia calophylla*	Marri								R	X		X		*Eucalyptus calophylla*	
MYRTACEAE	*Eucalyptus decipiens* subsp. *decipiens*	Limestone Marlock, Moit								R	X	X	X	X	*Eucalyptus decipiens*	
MYRTACEAE	*Eucalyptus gomphocephala*	Tuart, Duart								R	X	X	X	X		
MYRTACEAE	*Eucalyptus marginata* subsp. *marginata*	Jarrah, Djara								R	X	X	X	X	*Eucalyptus marginata*	
MYRTACEAE	*Hypocalymma robustum*	Swan River Myrtle								R	X	X	X	X		
MYRTACEAE	*Kunzea glabrescens*	Spearwood								R	X					
MYRTACEAE	*Melaleuca nesophila*	Mindiyed	Introduced	*			FAR			R	X					
MYRTACEAE	*Melaleuca systena*	-								R	X	X	X	X	*Melaleuca acerosa*	
OLACACEAE	*Olax benthamiana*	-								P			?	X		
OLEACEAE	*Olea europaea*	Olive	Introduced	*		Mo	H (H,I)			R	X					
ORCHIDACEAE	*Caladenia arenicola*	-								R	X					
ORCHIDACEAE	*Caladenia flava* subsp. *flava*	Cowslip Orchid								R	X		X		*Caladenia flava*	
ORCHIDACEAE	*Caladenia huegelii*	Grand Spider Orchid	**Threatened, BF**							P			?			Likely to be *Caladenia arenicola*
ORCHIDACEAE	*Caladenia latifolia*	Pink Fairy Orchid								R	X		X			
ORCHIDACEAE	*Caladenia longicauda* subsp. *calcigena*	Common White Spider Orchid								R	X		X			
ORCHIDACEAE	*Diuris* ?sp. Eneabba (A.H. Burbidge 3941)(immat.)	-								R	X					
ORCHIDACEAE	*Diuris longifolia*	Common Donkey Orchid								P			?			Probably *Diuris magnifica*
ORCHIDACEAE	*Diuris magnifica*	-								R	X					
ORCHIDACEAE	*Microtis media* subsp. *media*	Tall Mignionette Orchid								R	X	X	X		*Microtis uniflora*	
ORCHIDACEAE	*Prasophyllum hians*	Yawning Leek Orchid								R	X					
ORCHIDACEAE	*Pterostylis* ?sp. 'short sepals' (W. Jackson BJ269)(senescent)	-								R	X		X		*Pterostylis nana* (this group has been split)	
ORCHIDACEAE	*Pterostylis recurva*	Jug Orchid								P			?			
ORCHIDACEAE	*Pterostylis vittata*	Banded Greenhood Orchid								R	X		X			
ORCHIDACEAE	*Pyrorchis nigricans*	Red Beaks, Elephants Ears								R	X		X	X	*Lyperanthus nigricans, Burnettia nigricans*	
OROBANCHACEAE	*Orobanche minor*	Lesser Broomrape	Introduced			Mo	N (B)			P			?			
OROBANCHACEAE	*Parentucellia latifolia*	Common Bartsia	Introduced			Mo	N (B)			P			?			
OXALIDACEAE	*Oxalis pes-caprae*	Soursob	Introduced			Mi	L (C)			R	X					
OXALIDACEAE	*Oxalis purpurea*	Largeflower Wood Sorrel	Introduced			L	L (C)			R	X					
PAPAVERACEAE	*Fumaria capreolata*	Whiteflower Fumitory	Introduced	*		Mi	L (D)			R	X	X	X			
PHYLANTHACEAE	*Phyllanthus calycinus*	False Boronia								R	X	X	X	X		
PHYLANTHACEAE	*Poranthera microphylla*	Small Porathera								R	X		X			
PITTOSPORACEAE	*Billardiera ?fraseri* (sterile)	Elegant Pronaya								R	X					
POACEAE	*Aira caryophyllea*	Silvery Hairgrass	Introduced			Mo	N (B)			P			?			
POACEAE	*Amphipogon turbinatus*	-								P			?			
POACEAE	*Austrostipa compressa*	-								R	X		X		*Stipa compressa*	

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				Target Weeds (HHCA)	Pest Plant Local Law (2012)	WAEWA (1999)	Swan Region Weeds DPaW (2013)	Declared Pest Plant	WONS (2013)							
POACEAE	*Austrostipa elegantissima*	-								R	X				*Stipa elegantissima*	
POACEAE	*Austrostipa flavescens*	-								R	X		X		*Stipa flavescens*	
POACEAE	*Austrostipa semibarbata*	-								P			?			
POACEAE	*Avena barbata*	Wild Oats	Introduced			Mo	L (D,E)			R	X	X	X			**Avena barbata* and *A. fatua* commonly confused
POACEAE	*Briza maxima*	Blowfly Grass	Introduced			Mo	L (B,C)			R	X	X	X			
POACEAE	*Briza minor*	Shivery Grass	Introduced			Mo	L (B,C)			R	X		X			
POACEAE	*Bromus diandrus*	Great Brome	Introduced	*		H	L (D)			R	X		X			
POACEAE	*Cynodon dactylon*	Couch Grass	Introduced	*		Mo	L (D,E)			R	X					
POACEAE	*Ehrharta calycina*	Perennial Veldt Grass	Introduced	*		H	L (D,E)			R	X	X	X			
POACEAE	*Ehrharta longiflora*	Annual Veldt Grass	Introduced			Mo	L (D)			R	X	X	X			
POACEAE	*Lagurus ovatus*	Hare's Tail Grass	Introduced	*		H	L (D)			R	X					
POACEAE	*Microlaena stipoides* var. *stipoides*	Weeping Grass								R	X		X		*Microlaena stipoides*	
POACEAE	*Pentameris airoides* subsp. *airoides*	False Hairgrass	Introduced			Mo	N (B)			R	X					
POACEAE	*Poa annua*	Winter Grass								P			?			
POACEAE	*Poa drummondiana*	Knotted Poa								R	X		X			
POACEAE	Poaceae sp. (sterile)	-								R	X					
POACEAE	*Rytidosperma caespitosum*	-								R		X	X	X	*Danthonia caespitosa, Austrodanthonia caespitosa*	
POACEAE	*Rytidosperma occidentale*	-								R		X			*Austrodanthonia occidentalis*	
POACEAE	*Vulpia ?muralis* (immat.)	-	Introduced			L	M (D,E,F)			R	X					
POACEAE	*Vulpia fasciculata*	-	Introduced			Mo	M (D,E,F)			R	X					
POACEAE	*Vulpia myuros* forma ?	Rat's Tail Fescue	Introduced			Mo	M (D,E,F)			P			?		**Vulpia myuros*	
POLYGALACEAE	*Comesperma confertum*	-								P			?			
POLYGONACEAE	*Emex australis*	Doublegee	Introduced	*		L	L (C)			R	X					
PORTULACACEAE	*Calandrinia corrigioloides*	Strap Purslane								R	X		X			
PORTULACACEAE	*Calandrinia granulifera*	Pygmy Purslane								R	X					
PORTULACACEAE	*Calandrinia liniflora*	Parakeelya								P			?			
PRIMULACEAE	*Lysimachia arvensis*	Pimpernel	Introduced				N (B)			R	X	X	X		**Anagallis arvensis*, **Anagallis arvensis* var. *caerulea*	
PROTEACEAE	*Banksia attenuata*	Slender Banksia, Piara								R	X	X				Missing from Keighery/Tingay data
PROTEACEAE	*Banksia dallanneyi* var. *dallanneyi*	-								R	X	X	X	X	*Dryandra nivea, Dryandra lindleyana* var. *lindleyana*	
PROTEACEAE	*Banksia menziesii*	Firewood Banksia								R	X	X				Missing from Keighery/Tingay data
PROTEACEAE	*Banksia prionotes*	Acorn Banksia								R	X	X				Missing from Keighery/Tingay data
PROTEACEAE	*Banksia sessilis var.*	Parrotbush, Pudjak								R	X	X	X	X	*Dryandra sessilis*	

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				Target Weeds (HHCA)	Pest Plant Local Law (2012)	WAEWA (1999)	Swan Region Weeds DPaW (2013)	Declared Pest Plant	WONS (2013)							
	cygnorum															
PROTEACEAE	*Conospermum triplinervium*	Tree Smokebush	**BF**							R	X	X	X			
PROTEACEAE	*Grevillea crithmifolia*	-								R	X	X	X	X		
PROTEACEAE	*Grevillea preissii* subsp. *preissii*	-								R	X	X	X	X	*Grevillea thelemanniana, Grevillea preissii*	
PROTEACEAE	*Grevillea ?preissii*	-	**BF**							R	X					
PROTEACEAE	*Grevillea vestita* subsp. *vestita*	-								R	X	X	X	X	*Grevillea vestita*	
PROTEACEAE	*Hakea lissocarpha*	Honey Bush								R	X	X	X	X		
PROTEACEAE	*Hakea prostrata*	Harsh Hakea								R	X	X	X	X		
PROTEACEAE	*Persoonia saccata*	Snottygobble								R		X	X	X		
PROTEACEAE	*Petrophile brevifolia*	-								R	X		X	X		
PROTEACEAE	*Petrophile linearis*	Pixie Mops								R	X	X	X	X		
PROTEACEAE	*Petrophile macrostachya*	-								R	X	X	X	X		
PROTEACEAE	*Petrophile media*	-								R		X				Likely to be *Petrophile brevifolia*
PROTEACEAE	*Stirlingia latifolia*	Blueboy								R	X	X	X	X		
PROTEACEAE	*Synaphea spinulosa* subsp. *spinulosa*	-								R	X	X	X	X	*Synaphea spinulosa*	
RANUNCULACEAE	*Clematis linearifolia*	-								P			?		*Clematis microphylla*	
RESTIONACEAE	*Alexgeorgea arenicola*	-								R		X				Likely to be *Alexgeorgea nitens*
RESTIONACEAE	*Alexgeorgea nitens*	-								R	X	X	X	X		
RESTIONACEAE	*Desmocladus ?fascicularis* (poor material)	-								R	X		X	X	*Loxocarya fascicularis*	
RESTIONACEAE	*Desmocladus asper*	-								R	X				*Loxocarya flexuosa*	
RESTIONACEAE	*Desmocladus flexuosus*	-								R	X	X	X	X	*Loxocarya flexuosa*	
RESTIONACEAE	*Hypolaena exsulca*	-								P			?			
RESTIONACEAE	*Lyginia imberbis*	-								R	X		X		*Lyginia barbata*	
RHAMNACEAE	*Cryptandra mutila*	-								P				X		
RHAMNACEAE	*Cryptandra pungens*	-								P				X		
RHAMNACEAE	*Spyridium globulosum*	Basket Bush								R	X	X				
RHAMNACEAE	*Stenanthemum notiale* subsp. *chamelum*	-								R	X					
RHAMNACEAE	*Stenanthemum tridentatum*	-								P			?		*Spyridium tridentatum*	Wheatbelt. Possibly *Stenanthemum notiale* subsp. *chamelum*
RUBIACEAE	*Galium murale*	Small Goosefoot	Introduced			Mo	N (B)			R	X					
RUBIACEAE	*Opercularia vaginata*	Dog Weed								R	X	X	X	X		
RUTACEAE	*Philotheca spicata*	Pepper and Salt								R	X		X	X	*Eriostemon spicatus*	
SANTALACEAE	*Exocarpos sparteus*	Broom Ballart, Djuk								R	X			X		
SCROPHULARIACEAE	*Dischisma arenarium*	-	Introduced				N (B)			R	X		X			
SCROPHULARIACEAE	*Myoporum insulare*	Blueberry Tree, Boobialla								R	X		X			
SOLANACEAE	*Anthocercis ilicifolia* subsp. *Ilicifolia*	-								P			?	X	*Anthocercis ilicifolia*	

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				Target Weeds (HHCA)	Pest Plant Local Law (2012)	WAEWA (1999)	Swan Region Weeds DPaW (2013)	Declared Pest Plant	WONS (2013)							
SOLANACEAE	*Anthocercis littorea*	Yellow Tailflower								R	X					
SOLANACEAE	*Solanum nigrum*	Black Berry Nightshade	Introduced			Mo	L (B,C)			R	X		X			
STACKHOUSIACEAE	*Tripterococcus brunonis*	Winged Stackhousia								R	X		X			
STYLIDIACEAE	*Levenhookia pusilla*	Midget Stylewort								R	X		X			
STYLIDIACEAE	*Levenhookia stipitata*	-								P			?			
STYLIDIACEAE	*Stylidium androsaceum*									R	X					Possibly same entity *S. calcaratum*
STYLIDIACEAE	*Stylidium calcaratum*	Book Triggerplant								P			?			Possibly same entity as *S. androsaceum*
STYLIDIACEAE	*Stylidium hesperium* ms									R	X		X	X	*Stylidium junceum*	
STYLIDIACEAE	*Stylidium neurophyllum* ms									R	X		X	X	*Stylidium brunonianum*	*S. brunonianum* split into entities
STYLIDIACEAE	*Stylidium repens*	Matted Triggerplant								R	X		X	X		
STYLIDIACEAE	*Stylidium rigidulum*									R	X		X		*Stylidium macrocarpum*	
STYLIDIACEAE	*Stylidium schoenoides*	Cow Kicks								R	X		X	X		
THYMELACEAE	*Pimelea ?sulphurea* (sterile)	Yellow Banjine								R	X					
THYMELACEAE	*Pimelea calcicola*	-	**Priority 3, BF**							P			X	X		Very similar to *P. leucantha*
THYMELACEAE	*Pimelea leucantha*	-								R	X		X			
THYMELACEAE	*Pimelea sulphurea*	Yellow Banjine								R	X		X			
UNKNOWN	Tree sp. (horticultural)	-								R	X					
URTICACEAE	*Parietaria debilis*	Pellitory								P			?			
VIOLACEAE	*Hybanthus calycinus*	Wild Violet								R	X		X			
XANTHORRHOEACEAE	*Xanthorrhoea preissii*	Grass Tree, Balga								R	X	X	X	X		
ZAMIACEAE	*Macrozamia fraseri*	-								R	X	X	X	X	*Macrozamia riedlei*	

Conservation Status: BF = Bush Forever significant species, Priority = DPaW Priority flora species

DPaW WAEWA codes: H = High, Mo = Moderate, Mi = Mild, L= Low

DPaW Swan Region Weeds ranking code: VH = Very High, H = High, M = Medium, L = Low, N = Negligible, FAR = Further Assessment Required. Letters in brackets are codes for management actions that may be considered for each ranking.

DPaW response codes in parentheses refer to management codes (see Table 10, Section 4.3): **A** = No Action, **B** = Monitor Only, **C** = Improve Weed Management, **D** = Protect Priority Sites, **E** = Targeted Control, **F** = Contain Regional Spread, **G** = Reduce Regional Infestation, **H** = Regional Eradication, **I** = State-wide Eradication

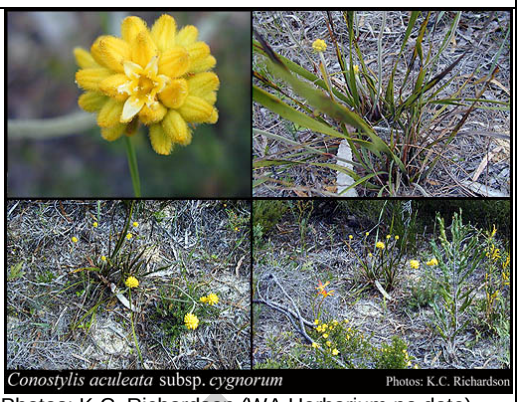
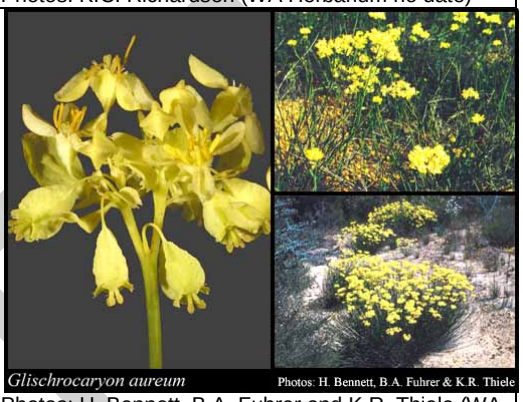
Note: species listed as potential are not included in the final species count for Hepburn Heights Conservation Area due to the Keighery and Keighery (1991) survey being conducted prior to the clearing of bushland at Hepburn Heights and encompassing Pinnaroo Valley Memorial Park and Craigie Open Space and Tingay (1993) refers to flora species recorded in May 1992 prior to bushland clearing.

? = species recorded by Keighery and Keighery (1991) that are unlikely to have been recorded on site previously based on the habitat that they occupy. They are more likely to be present in the Pinnaroo Valley Memorial Park which would probably have been a part of the survey at the time.

Appendix 3 – Hepburn Heights Key Flora Species

Priority and Significant Flora at Hepburn Heights

Name	Common Name	Conservation Code	Image
Acacia benthamii		Priority Two (DPaW); Significant Flora of the Perth Metropolitan Region	 Photo: B.R. Maslin (WA Herbarium no date)
Callitris preissii	Rottnest Island Pine	Significant Flora of the Perth Metropolitan Region	 Photos: R. Davis (WA Herbarium no date)
Conospermum triplinervium	Tree Smokebush	Significant Flora of the Perth Metropolitan Region	 Photos: M. Hislop (WA Herbarium no date)

Name	Common Name	Conservation Code	Image
Conostylis aculeata subsp *cygnorum*	Prickly Conostylis	Significant Flora of the Perth Metropolitan Region	 Photos: K.C. Richardson (WA Herbarium no date)
Glischrocaryon ureum	Common Popflower	Significant Flora of the Perth Metropolitan Region	 Photos: H. Bennett, B.A. Fuhrer and K.R. Thiele (WA Herbarium no date)
Grevillea preissii		Significant Flora of the Perth Metropolitan Region	 Photos: E. Wajon (WA Herbarium no date)
Hibbertia cuneiformis	Cutleaf Hibbertia	Significant Flora of the Perth Metropolitan Region	 Photos: C. Hortin, T. Tapper and K.R. Thiele (WA Herbarium no date)

Name	Common Name	Conservation Code	Image
Lechenaultia linarioides	Yellow Leschenaultia	Significant Flora of the Perth Metropolitan Region	 Photos: K.C. Richardson (WA Herbarium no date)
Ricinocarpos glaucus	Wedding Bush	Significant Flora of the Perth Metropolitan Region	 Photos: F.W. Humphries and W.A. Herbarium (WA Herbarium no date)

Note: For further explanations on Conservation Codes, refer to Appendix 4.

Examples of Priority Weed Species at Hepburn Heights

Name	Common Name	Conservation Code	Image
Brassica tournefortii	Mediterranean Turnip	High priority (DPaW Environmental Weed Strategy for WA)	 Photos: K.C. Richardson and J.F. Smith (WA Herbarium no date)
Bromus diandrus	Great Brome	High priority (DPaW Environmental Weed Strategy for WA)	 Photos: L. Fontanini and K.C. Richardson (WA Herbarium no date)
Ehrharta calycina	Perennial Veldt Grass	High priority (DPaW Environmental Weed Strategy for WA)	 Photos: S.M. Armstrong (WA Herbarium no date)
Euphorbia terracina	Geraldton Carnation Weed	High priority (DPaW Environmental Weed Strategy for WA)	 Photos: J.Dodd and K.R. Thiele (WA Herbarium no date)

Name	Common Name	Conservation Code	Image
Lagurus ovatus	Hare's Tail Grass	High priority (DPaW Environmental Weed Strategy for WA)	 Photos: U. Bell, K. Richardson and R. Robson (WA Herbarium no date)
Lupinus cosentinii	Blue Lupin	High priority (DPaW Environmental Weed Strategy for WA); High priority (DPaW Swan Region Weeds Assessment)	 Photos: J. Dodd and J.F. Smith (WA Herbarium no date)
Moraea flaccida	One-leaf Cape Tulip	High priority (DPaW Environmental Weed Strategy for WA)	 Photos: R. Knox and K.C. Richardson (WA Herbarium no date)
Pelargonium capitatum	Rose Pelargonium	High priority (DPaW Environmental Weed Strategy for WA)	

Appendix 4 – Conservation Codes for Western Australian Flora

Australian *Environment Protection and Biodiversity Conservation Act 1999* Threatened Flora Codes

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

WA *Wildlife Conservation Act 1950* Rare Flora Schedules

Category	Code	Description
Schedule 1	S1	Extant species (known to be living in a wild state).
Schedule 2	S2	Species which is presumed extinct.

WA Department of Environment and Conservation and WA Herbarium Flora Conservation Codes

Category	Code	Description
Threatened Flora	T	Declared Rare Flora — Extant (known to be living in a wild state)
Presumed Extinct Flora	X	Declared Rare Flora — Extinct
Priority One	P1	Poorly-known species on threatened lands
Priority Two	P2	Poorly-known species on conservation lands
Priority Three	P3	Poorly-known species on some on conservation lands
Priority Four	P4	Rare, near threatened and other species in need of monitoring.
Priority Five	P5	Conservation dependent species.

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

Appendix 5 – 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 Keighery 1994)

Appendix 6 – Hepburn Heights High Priority Weed Species Management

Latin Name	Common Name	Type of Weed	Status/Notes	Treatment Type	Optimal Treatment Timing (WA Herbarium)
Acacia iteaphylla	Flinders Ranges Wattle	Trees and shrubs	High priority (DPaW)	Cut and paint	December to May
Acacia longifolia subsp. *sophorae*		Trees and shrubs	High priority (DPaW)	Cut and paint	December to May
Brassica tournefortii	Mediterranean Turnip	Herbs	High priority (EWSWA)	Hand weeding	August to September
Bromus diandrus	Great Brome	Grasses	High priority (EWSWA)	Glyphosate, Quizalofop	June to August
Carpobrutus edulis	Hottentot Fig	Herbs		Hand weeding	All year
Centranthus macrosiphon	Spanish Valerian	Herbs	High priority (DPaW)	Metsulfuron	July to September
Cynodon dactylon	Couch	Grasses		Glyphosate, Quizalofop	November to February
Ehrharta calycina	Perennial Veldt Grass	Grasses	High priority (EWSWA)	Quizalofop	June to August
Emex australis	Doublegee	Herbs		Glyphosate	May to August
Euphorbia terracina	Geraldton Carnation Weed	Herbs	High priority (EWSWA)	Triasulfuron, Hand weeding	June to August spray, June to November hand weeding
Ferraria crispa	Black Flag	Herbs		Hand weeding, Glyphosate, Metsulfuron	August to September
Foeniculum vulgare	Fennel	Herbs		Hand weeding, Glyphosate, Metsulfuron	August to December
Freesia alba x leichtlinii	Freesia Hybrid	Herbs	High priority (EWSWA)	Metsulfuron	July to August
Fumaria capreolata	Whiteflower Fumitory	Herbs		Metsulfuron or glyphosate	July to September
Gazania linearis	Gazania	Herbs	High priority (DPaW)	Glyphosate, Hand weeding	June to December spray, All year hand weeding
Gladiolus caryophyllaceus	Wild Gladiolus	Herbs		Hand weeding, hand wipe with Metsulfuron	July to September
Ixia maculata	Yellow Ixia	Herbs	High priority (DPaW)	Metsulfuron	July to September
Lachenalia reflexa	Cape Cowslip	Herbs	High priority (DPaW), High priority (EWSWA)	Metsulfuron	June to August
Lagurus ovatus	Hare's Tail Grass	Grasses	High priority (EWSWA)	Glyphosate	June to August
Lupinus cosentinii	Blue Lupin	Herbs	High priority (EWSWA)	Hand weeding	June to September
Melaleuca nesophila	Mindiyed	Trees and Shrubs		Cut and paint	December to May
Moraea flaccida	One-leaf Cape Tulip	Herbs	High priority (EWSWA)	Metsulfuron	July to August

Appendix 6 – Hepburn Heights High Priority Weed Species Management

Latin Name	Common Name	Type of Weed	Status/Notes	Treatment Type	Optimal Treatment Timing (WA Herbarium)
Olea europaea	Olive	Trees and Shrubs	High priority (DPaW)	Hand weeding, Glyphosate	October to June
Pelargonium capitatum	Rose Pelargonium	Herbs	High priority (EWSWA)	Glyphosate, Metsulfuron, Hand weeding	June to October
Schinus terebinthifolius	Japanese Pepper	Trees and shrubs		Triclopyr/Picloram, Hand weeding	December to February
Trachyandra divaricata	False Onion Weed	Herbs		Glyphosate, Metsulfuron, Hand weeding	June to August spraying, All year hand weeding
Vicia sativa	Common Vetch	Herbs		Hand weeding, Metsulfuron	July to September

Note: The Hepburn Heights High Priority Weed Species Management table was created using the following criteria:

- Weed species listed as a Weed of National Significance (WONS) under the National Weeds Strategy (1997);
- The weed species is listed as a Declared Plant according to the Department of Agriculture and Food WA (2010);
- The weed species is a High Priority Weed according to the Environmental Weed Strategy for WA (DPaW 1999);
- The weed species is listed as Very High Priority or High Priority weed according to the DPaW Weed Prioritisation Process for the Swan Region (2013);
- The weed species is listed as a pest plant under the City's *Pest Plant Local Law 2012*;
- The City of Joondalup has determined that the weed species poses: a major threat to vegetation and the structure of vegetation communities or is likely to contribute to a high fuel load (e.g. grasses).

Appendix 7 – Hepburn Heights Fauna Species Lists

Hepburn Heights Conservation Area Fauna Species List

Taxa			Recorded or Potential	Conservation Status				Surveys			
Family	**Scientific name**	**Common name**		**Introduced**	**Locally Significant**	**EPBC**	**WC Act**	**HHMP (1993)**	**How and Dell (2000)**	**NAIA (2004 and 2012)**	**Syrinx (2014)**
Amphibians											
Myobatrachidae (ground frogs)	*Limnodynastes dorsalis*	Western Banjo Frog	R					X			X
	Myobatrachus gouldii	Turtle Frog	R						X		X
Reptiles											
Agamidae (dragon lizards)	*Pogona minor*	Western Bearded Dragon	R					X	X		X
Elapidae (front-fanged snakes)	*Brachyurophis semifasciata*	Half-ringed Snake	R						X		
	Pseudonaja affinis	Dugite	R					X			X
	Simoselaps bertholdi	Jan's Bandy-Bandy	R						X		X
Gekkonidae (geckoes)	*Christinus marmoratus*	Marbled Gecko	R					X	X		X
Gekkonidae (geckoes)	*Diplodactylus polyophthalmus*	Speckled Stone Gecko	P		X			X			
Pygopodidae (legless lizards)	*Aprasia repens*	Sandplain Worm Lizard	R					X	X		
	Lialis burtonis	Burton's Legless Lizard	R					X	X		X
Scincidae (skinks)	*Cryptoblepharus buchananii (*formerly *Cryptoblepharus plagiocephalus)*	Fence Skink	R					X	X		X
	*Ctenotus australis (*formerly *Ctenotus*	Limestone Ctenotus	R					X	X		

Taxa			Recorded or Potential	Conservation Status				Surveys			
Family	**Scientific name**	**Common name**		**Introduced**	**Locally Significant**	**EPBC**	**WC Act**	**HHMP (1993)**	**How and Dell (2000)**	**NAIA (2004 and 2012)**	**Syrinx (2014)**
	lesueurii)										
	Ctenotus fallens	West Coast Ctenotus	R					X	X		X
	Cyclodomorphus celatus	Western Slender-bluetongue	R						X		X
	Hemiergis quadrilineata	Two-toed Skink	R					X	X		X
Scincidae (skinks)	*Lerista elegans*	Four-toed Lerista	R					X	X		X
	Lerista praepedita	Western Worm Lerista	R					X	X		X
	Menetia greyii	Common Dwarf Skink	R					X	X		X
	Morethia lineoocellata	Spotted Morethia	P					X			
	Morethia obscura	Shrubland Morethia	R					X	X		X
	Tiliqua occipitalis	Western Bluetongue	P					X			
	Tiliqua rugosa	Bobtail	R					X			X
Typhlopidae (blind snakes)	*Ramphotyphlops australis*	Southern Blind Snake	R						X		
Varanidae (monitors or goannas)	*Varanus gouldii*	Gould's Sand Goanna	R					X			X
Birds											
Accipitridae (kites, hawks and eagles)	*Elanus axillaris*	Black-shouldered Kite	P					X			
	Haliastur sphenurus	Whistling Kite	P					X			
Artamidae (woodswallows)	*Cracticus torquatus*	Grey Butcherbird	R								X
	Gymnorhina tibicen	Australian Magpie	R							X	X
Cacatuidae	*Cacatua roseicapilla*	Galah	R					X			X

Taxa			Recorded or Potential	Conservation Status				Surveys			
Family	**Scientific name**	**Common name**		**Introduced**	**Locally Significant**	**EPBC**	**WC Act**	**HHMP (1993)**	**How and Dell (2000)**	**NAIA (2004 and 2012)**	**Syrinx (2014)**
(cockatoos)											
Cacatuidae (cockatoos)	*Cacatua tenuirostris*	Long-billed Corella	R	X							X
	Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	R			EN	S1				X
Campephagidae (cuckoo-shrikes)	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	R					X			X
	Lalage sueurii	White-winged Triller	P					X			
Columbidae (pigeons and doves)	*Streptopelia chinensis*	Spotted Turtle-Dove	R	X				X			X
	Streptopelia senegalensis	Laughing Turtle-Dove	R	X				X			X
Corvidae (ravens and crows)	*Corvus coronoides*	Australian Raven	R					X		X	X
Cuculidae (cuckoos)	*Cuculus pallidus*	Pallid Cuckoo	P					X			
Dicruridae (flycatchers)	*Rhipidura leucophrys*	Willie Wagtail	R					X			X
Falconidae (falcons)	*Falco berigora*	Brown Falcon	R								X
	Falco cenchroides	Nankeen Kestrel	P					X			
	Falco longipennis	Australian Hobby	R								X
	Falco peregrinus	Peregrine Falcon	P				S4	X			
Halcyonidae (forest kingfishers)	*Dacelo novaeguineae*	Laughing Kookaburra	R	X				X			X
	Todiramphus sanctus	Sacred Kingfisher	P					X			
Hirundinidae (swallows)	*Hirundo neoxena*	Welcome Swallow	R					X			X
	Petrochelidon nigricans	Tree Martin	R					X			X
Maluridae (fairy-wrens)	*Malurus splendens*	Splendid Fairy-wren	P		X			X			

Taxa			Recorded or Potential	Conservation Status				Surveys			
Family	**Scientific name**	**Common name**		**Introduced**	**Locally Significant**	**EPBC**	**WC Act**	**HHMP (1993)**	**How and Dell (2000)**	**NAIA (2004 and 2012)**	**Syrinx (2014)**
Meliphagidae (honeyeaters)	*Anthochaera carunculata*	Red Wattlebird	R								X
	Lichenostomus virescens	Singing Honeyeater	R								X
	Lichmera indistincta	Brown Honeyeater	R								X
	Manorina flavigula	Yellow-throated Minor	P							#	
	Phylidonyris nigra	White-cheeked Honeyeater	R		X						X
Meropidae (bee-eaters)	*Merops ornatus*	Rainbow Bee-eater	R			IA	S3				X
Pachycephalidae (whistlers)	*Pachycephala rufiventris*	Rufous Whistler	R		X			X			X
	Pachycephala pectoralis	Golden Whistler	P		X			X			
Pardalotidae (pardalotes)	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	R		X						X
	Acanthiza inornata	Western Thornbill	R		X						X
	Gerygone fusca	Western Gerygone	R								X
	Pardalotus striatus	Striated Pardalote	R								X
	Smicrornis brevirostris	Weebill	R		X						X
Petroicidae (Australian robins)	*Petroica multicolor*	Scarlet Robin	P		X			X			
Psittacidae (lorikeets and parrots)	*Barnardius zonarius*	Australian Ringneck	R					X			X
	Polytelis swainsonii	Superb Parrot	R	X							X
	Trichoglossus haematodus	Rainbow Lorikeet	R	X						X	X
Strigidae (hawk-owls)	*Ninox novaeseelandiae*	Southern Boobook	P					X			

Taxa			Recorded or Potential	Conservation Status				Surveys			
Family	**Scientific name**	**Common name**		**Introduced**	**Locally Significant**	**EPBC**	**WC Act**	**HHMP (1993)**	**How and Dell (2000)**	**NAIA (2004 and 2012)**	**Syrinx (2014)**
Zosteropidae (white-eyes)	*Zosterops lateralis*	Silvereye	R							X	X
Mammals											
Canidae (foxes and dogs)	*Vulpes vulpes*	European Red Fox	R	X							X
	Canis lupus	Dog	R	X						X	
Felidae (cats)	*Felis catus*	Feral Cat	R	X							X
Leporidae (rabbits and hares)	*Oryctolagus cuniculus*	Rabbit	R	X						X	
Macropodidae (kangaroos and wallabies)	*Macropus fuliginosus*	Western Grey Kangaroo	R					X			X
Mollosidae (mastiff bats)	*Austronomous australis*	White-striped Bat	R								X
Muridae (rats and mice)	*Mus musculus*	House Mouse	R	X							X
Vespertilionidae (vesper bats)	*Chalinolobus gouldii*	Gould's Wattled Bat	R								X
Invertebrates											
Acrididae	*Goniaea australasiae*	Smoothridge Dead Gumleaf Acrihopper	R								X
Apidae	*Apis mellifera*	European Honey Bee	R	X							X
Armadillidiidae	*Buddelundia* TBC sp. TBC	White-dashed Rolling Armaslater	R								X
Blattidae	*Helea latascavenger*	Beaten Bronze Paleleg Blatroach	R								X
Bothriembryontidae	*Bothriembryon* sp. TBC	Bosnail	R								X

Taxa			Recorded or Potential	Conservation Status				Surveys			
Family	**Scientific name**	**Common name**		**Introduced**	**Locally Significant**	**EPBC**	**WC Act**	**HHMP (1993)**	**How and Dell (2000)**	**NAIA (2004 and 2012)**	**Syrinx (2014)**
Buthidae	*Lychas marmorata*	Marbled Scorpion	R								X
Cicadidae	*Pyropsalta melete*	Silverbelt Orangeband Slowtick Cicabug	R								X
Coreidae	*Mictis profana*	Crusader Bug	R								X
Family TBC	Gen. sp. TBC	Small Blue Centipede	R								X
Formicidae	*Camponotus terebrans*	Brownleg Mattneck Glossblack Ant	R								X
	Iridomyrmex sp.	Meat Ant	R								X
Gryllacrididae	Gen. nov. TBC sp. TBC	Rose-kneed Lemonfoot Gryllacracricket	R								X
	Paragryllacris TBC sp.	Gryllacracricket	R								X
Helicidae	^*Theba pisana*	Variable White Mediterranean Helisnail	R								X
Ixodidae	*Amblyomma triguttatum*	Kangaroo Tick	R								X
Julidae	^*Ommatoiulus moreletii*	Portuguese Dark Thorntail Julidiplopede	R								X
	Ommatoiulus moreletii	Portuguese Millipede	R	X							X
Lycosidae	'Lycosa' australicola	Black-chevroned Lycospider	R								X
	Tasmanicosa leuckartii	Greater Greybrown Ringbelly Lycospider	R								X
Myrmeleontidae	Gen. sp. TBC	Larval Myrmlacewing	R								X

Taxa			Recorded or Potential	Conservation Status				Surveys			
Family	**Scientific name**	**Common name**		**Introduced**	**Locally Significant**	**EPBC**	**WC Act**	**HHMP (1993)**	**How and Dell (2000)**	**NAIA (2004 and 2012)**	**Syrinx (2014)**
Nephilidae	*Nephila edulis* F	Southern Golden Orb Nephspider	R								X
	Nephila sp.	Golden Orb Weaver	R								X
Otostigmidae	*Ethmostigmus* sp. TBC	Blackhead Toffee Otochilopede	R								X
Paradoxosommatidae	*Antichiropus* sp. nov	Compact Rippleback Horntip Paradiplopede	R		X						X
Pentatomidae	*Poecilometis apicalis*	One-spot Trunk Pentabug	R								X
Phasmatidae	*Arphax australis* (imm.)	Green Shorthorn Rustjoint Phastick	R								X
	Gen. sp. TBC	Large Grey Phastick	R								X
Pholcidae	*Pholcus phalangioides*	Domestic Bandknee Longleg Pholspider	R								X
Porcellionidae?	*Porcellio scaber?*	slater/woodlice	R								X
Scarabaeidae	*Colpochila* sp. TBC	Pallid Rehead Ridgebrow Meloscarabeetle	R								X
Scarabaeidae	Gen. sp. TBC	Flathair Shoulderbrush Brown Meloscarabeetle	R								X
	Gen. sp. TBC	Pygmy Brown Meloscarabeetle	R								X
Scolopendrinae	*?*	large centipede	R								X
Sparassidae	*Eodelena lapidicola*	Southern Blackfront Sparaspider	R								X

Taxa			Recorded or Potential	Conservation Status				Surveys			
Family	**Scientific name**	**Common name**		**Introduced**	**Locally Significant**	**EPBC**	**WC Act**	**HHMP (1993)**	**How and Dell (2000)**	**NAIA (2004 and 2012)**	**Syrinx (2014)**
Tenebrionidae	*Helea perforatus*	Hairy Fullrim Piedish Tenebeetle	R								X
Tettigoniidae	*Caedicia* sp. TBC	Greenleaf Tettihopper	R								X
	Metaballus sp. TBC (imm.)	Tettihopper	R								X
	Requena verticalis	Swan Pallid Wingless Tettihopper	R								X
Theridiidae	*Latrodectus hasselti*	Redback Therispider	R								X
Urodacidae	*Urodacus novaehollandiae*	2-brown Sand Uroscorpion	R								X

Note: there was no specific fauna survey undertaken as part of the Hepburn Heights Management Plan (1993). The Plan's fauna list was based on a fauna list compiled from research in 1988 in an unspecified area, therefore species listed as potential are not included in the final fauna species count.

The following abbreviations are used:

EN = endangered
IA = migratory bird protected under international agreement under *EPBC Act*
S1 = listed under Schedule 1 of the *Wildlife Conservation Act 1950*
S3 = listed under Schedule 3 of the *Wildlife Conservation Act 1950*
S4 = listed under Schedule 4 of the *Wildlife Conservation Act 1950*
= a yellow-throated miner was recorded during the 2004 NAIA survey, however as this species is considered locally extinct it is possible this may have been a misidentification or the incorrect common name.

HHMP (1993) – species noted to likely occur in the region based on an unpublished survey in 1988 in the area.

How and Dell (2000) – Ground vertebrate fauna survey conducted by How and Dell in Hepburn Heights in 2000.

NAIA (2004 and 2012) - Natural Area Initial Field Assessment, Hepburn Conservation Reserve 2004 and 2012.

Syrinx (2014) –Species recorded by Bamford Consulting Ecologists in 2013 for Syrinx Hepburn Heights flora, fauna and fungi survey.

Appendix 8 – Hepburn Heights Key Fauna Species

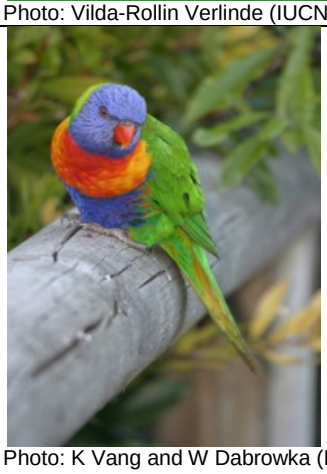
Threatened and Priority Fauna at Hepburn Heights

Name	Common Name	Conservation Code	Image
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	Schedule 1 (*Wildlife Conservation Act*), Endangered (IUCN, DPaW and EPBC)	 Photo: Raana Scott
Merops ornatus	Rainbow Bee-eater	Schedule 3 (*Wildlife Conservation Act*), Migratory (EPBC)	

Note: For further explanations on Conservation Codes, refer to **Appendix 7**.

Key Introduced Fauna at Hepburn Heights

Name	Common Name	Image
Apis mellifera	European Honey Bee	 Photo: Encyclopedia of Life (no date)
Dacelo novaeguineae	Laughing Kookaburra	 Photo: K Vang and W Dabrowka (Birdlife Australia no date)
Mus musculus	House Mouse	 Photo: Roar Solheim (IUCN 2012)

Name	Common Name	Image
Ommatoiulus moreleti	Portuguese Millipede	 Photo: Robert Mesibov (Australian Government no date)
Oryctolagus cuniculus	Rabbit	 Photo: Vilda-Rollin Verlinde (IUCN 2012)
Trichoglossus haematodus	Rainbow Lorikeet	 Photo: K Vang and W Dabrowka (Birdlife Australia no date)
Vulpes vulpes	European Red Fox	 Photo: Centre for Fortean Zoology Australia (2010)

Appendix 9 – Conservation Codes for Western Australian Fauna

Australian *Environment Protection and Biodiversity Conservation Act 1999* Threatened Fauna Codes

Category	Code	Description
Extinct	EX	Species not definitely located in the wild during the past 50 years.
Extinct in the wild	EW	Species known to survive only in captivity.
Critically Endangered	CR	Species facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	EN	Species facing a very high risk of extinction in the wild in the near future.
Vulnerable	VU	Species facing a very high risk of extinction in the wild in the medium-term future.
Near Threatened	NT	Species that risk becoming Vulnerable in the wild.
Conservation Dependent	CO	Species whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent species would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	DD	Species suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	LC	Species that are not threatened.
Migratory	M	Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: • The Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state; • The agreement between the Government of Australian and the Government of the People's Republic of China for the Protection of Migratory Birds and their environment (CAMBA); or • The agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

WA *Wildlife Conservation Act 1950* Threatened Fauna Schedules

Category	Code	Description
Schedule 1	S1	Fauna which is rare or likely to become extinct.
Schedule 2	S2	Fauna which is presumed extinct.
Schedule 3	S3	Migratory birds protected under an international agreement
Schedule 4	S4	Fauna that is otherwise in need of special protection

WA Department of Environment and Conservation Priority Fauna Codes

Category	Code
Priority 1	Poorly known species on threatened lands.
Priority 2	Poorly known species on conservation lands.
Priority 3	Poorly known species some on conservation lands.
Priority 4	Rare, near threatened and other species 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.

Appendix 10 – Hepburn Heights Fungi Species List

Latin Name	Common Name	Functional Group	Syrinx (2014)
Agaricus sp.	Common mushroom	Saprotroph	Y
Clitocybe sp.	Funnel Head Fungus	Saprotroph	Y
Gymnopilus allantopus	Golden Wood Fungus	Saprotroph	Y
Harknessia uromycoides	Tuart Nut Pustules	Saprotroph	Y
Laccaria lateritia	Brick Red Laccaria	Mycorrhizal	Y
Peziza sp.	Cup Fungus	Saprotroph	Y
Pisolithus sp.	Dog Poo Fungus	Ectomycorrhizal	Y
Plicaria sp.	Flat Black Cup Fungus	Mycorrhizal	Y
Psathyrella sp.	Psathyrella	Saprotroph	Y
Pycnoporus coccineus	Scarlet Bracket Fungus	Saprotroph	Y
Scleroderma sp.	Earthballs	Ectomycorrhizal	Y
Tremella mesenterica group	Orange Jelly Fungus	Saprotroph	Y
Unknown 1	Whitish Skin Fungus	Unknown	Y
Unknown 2	Little brown mushroom	Unknown	Y

Appendix 11 – Hepburn Heights Fungi Species

Examples of Fungi Species at Hepburn Heights

Name	Common Name	Image
Gymnopilus allantopus	Golden Wood Fungus	 Photo: N.L. Bougher (Bougher 2009)
Laccaria lateritia	Brick Red Laccaria	 Photo: Syrinx (2014)
Pycnoporus coccineus	Scarlet Bracket Fungus	 Photo: N.L. Bougher (Bougher 2009)

Name	Common Name	Image
Scleroderma sp.	Earthballs	 Photo: Syrinx (2014)
Tremella mesenterica group	Orange Jelly Fungus	 Photo: Syrinx (2014)

Appendix 12 – Hepburn Heights Surrounding Land Use

Pinnaroo Valley Memorial Park

The Pinnaroo Valley Memorial Park is a cemetery that received its first burial in 1978 and is located to the north of Hepburn Heights, as shown in Figure 28. The site is approximately 119 hectares and is part of the same Bush Forever site (303) as Hepburn Heights. The Pinnaroo Valley Memorial Park is listed on the State Heritage Register and included in the District Planning Scheme No. 2 Schedule 5 as a place having significance for the purpose of the protection of the landscape or environment. Pinnaroo Valley Memorial Park is fairly well known for the number of kangaroos that use the site as habitat. The risk of fire at Pinnaroo Valley Memorial Park is minimised by the installation of irrigation on 15 hectares of grassed areas, which could be used in the event of a fire.[71] There is a 2m high fence separating Pinnaroo Valley Memorial Park from Hepburn Heights.

Padbury Catholic Primary School

Padbury Catholic Primary School is a primary school that opened in 1985 and is located at 39 O'Leary Road, Padbury, as shown in Figure 28. Padbury Catholic Primary School is adjacent to Hepburn Heights and is situated on privately owned land. The school currently has approximately 500 students from Kindergarton to Year 6 and is equipped with buildings, a playground, tennis, netball and basketball courts and a playing field.[72] Hepburn Heights is separated from the school by a fence. Liaison with Padbury Catholic Primary School by the City could assist in increasing awareness of the bushland ecological values.

Water Supply and Telecommunications Facility

A Water Supply and Telecommunications Facility is located to the north of Hepburn Heights and is owned by the Water Corporation, as shown in Figure 28 and Figure 29. The facility houses a water tank reservoir and a water chemical dosing plant that are connected to the mains supply via distribution main lines running north and south from the facility through Hepburn Heights. There are also three telecommunciations towers located on site, as shown in Figure 21. A security fence protects the site from unauthorised access and separates the site from Hepburn Heights.

Figure 29: Water Supply and Telecommunications Facility

[71] G French (Metropolitan Cemetaries Board) 2014, pers.comm., 11 February
[72] Padbury Catholic Primary School (2010)

Brazier Park

Brazier Park is located on the corner of Brazier Rise and Cleave Court and is adjacent to the north-west corner of Hepburn Heights, as shown in Figure 28. The park contains a playground, grassed area with some vegetation and a sump. There is a path on the western edge of the park that connects to an entrance to Hepburn Heights.

Lilburne Park

Lilburne Park is located to the south of Hepburn Heights and is a natural area of approximately 5 ha, as shown in Figure 28. Lilburne Park forms the southern section of the ecological corridor that extends to Woodvale Nature Reserve. Lilburne Park is one of the City's five Major Conservation Areas and is included in the District Planning Scheme No. 2 Schedule 5 as a place having significance for the purpose of the protection of the environment. Lilburne Park is separated from Hepburn Heights by Hepburn Avenue, a major arterial road.

Duncraig Fire Station

Duncraig Fire Station is situated within Lilburne Park (as shown in Figure 28 and Figure 30), to the south of Hepburn Heights and coordinate emergency services for a range of natural disasters and emergency incidents, such as fire.

Figure 30: Duncraig Fire Station

Hepburn Heights Shops and Medical Centre

The Hepburn Heights Shops and Medical Centre can be accessed by car from Walter Padbury Boulevard and Blackwattle Parade. There are multiple speciality shops in two buildings on site. A United petrol station is located on the corner of Walter Padbury Boulevard and Hepburn Avenue, adjacent to the Hepburn Heights Shops and Medical Centre.

ATTACHMENT 2

Draft Hepburn Heights Conservation Area Management Plan Community Consultation and Communication Plan

Purpose of the Consultation

- To obtain feedback from key stakeholders regarding the City of Joondalup *Draft Hepburn Heights Conservation Area Management Plan*.

Who will be consulted?

- Key stakeholders including:
    - City of Joondalup Local Members of Parliament;
    - Friends of Hepburn and Pinnaroo Bushland;
    - Department of Parks and Wildlife;
    - Department of Planning (Bush Forever);
    - Department of Fire and Emergency Services;
    - Pinnaroo Valley Memorial Park;
    - Padbury Catholic Primary School; and
    - Water Corporation.
- City of Joondalup community will also be consulted.

How will they be consulted?

Key stakeholders will receive:

- A personally addressed letter explaining the purpose and objectives of the *Draft Hepburn Heights Conservation Area Management Plan* with a link to Plan and feedback form on the City's website.

Hard copies of the *Draft Hepburn Heights Conservation Area Management Plan* will be supplied on request.

The wider City of Joondalup community will receive:

- Information via a Media Release and information on the City's website; and
- The option to complete an online Feedback Form.

Anonymity

It will be a requirement for respondents to include their name and address in order for the Feedback Form to be accepted as a valid response. This will be stated on the Feedback Form.

Date of Commencement and Duration of Consultation

- Following endorsement by Council, targeted consultation will commence on 23 February 2015 for 21 days until 16 March 2015.
- The mail-out to key stakeholders will commence 23 February 2015.
- Length of advertising period will be 21 days commencing 23 February 2015.

Summary of Documents Required for the Consultation

- Hard copies of *Draft Hepburn Heights Conservation Area Management Plan*;
- Covering letters to key stakeholders;
- Electronic copy of the *Draft Hepburn Heights Conservation Area Management Plan*;
- Electronic copy of Feedback Form;
- Hard copy Feedback Form; and
- Reply-paid envelopes.