City of Nedlands

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Natural Areas Management Plan 2013—2018

Final Adopted 25 March 2014

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The Friends of Shenton Bushland
The Friends of Allen Park
The Friends of Hollywood Reserve
The Friends of Point Resolution
The Swanbourne Coastal Alliance

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Syrinx Environmental Pl

This Management Plan draws heavily from information compiled in previous management plans developed by Ecoscape Australia, Tranen Revegetation Systems and APACE along with information collected through Natural Area Initial Assessments undertaken by Jean-Paul Orsini and Associates. These documents include:

The Point Resolution Reserve Management Plan (Ecoscape, 1991),
The Allen Park and Environs Management Plan 1996 (Ecoscape, 1996),
The Shenton Bushland Management Plan 1996 (Ecoscape, 1996),
The Hollywood Reserve Management Plan (APACE, 2001),
The Nedlands Foreshore Bushland Reserves Management Plan 2003–2009 (Ecoscape, 2003),
The Allen Park Management Plan 2005 – 2010 (Ecoscape, 2005),
The Shenton Bushland Management Plan 2005 – 2010 (Ecoscape, 2005),
The Hollywood Reserve Management Plan Review and Update (Tranen, 2007); and
The City of Nedlands Natural Area Initial Assessments (Orsini, 2008).

SUMMARY

An outcome identified in the City of Nedlands 2023 Strategic Community Plan 2013-2023 is "Great Natural and Built Environment" and "Natural Environment and Biodiversity Protection" through undertaking natural area management. In 2009 the City resolved to develop a management plan for the City's six natural areas using the Perth Biodiversity Projects "Local Government Guidelines for Bushland Management" (PBP, 2009).

Seven Management Plans have been developed which include this overarching Management Plan and a further six Management Plans for each natural area within the City. These Management Plans have been created by consolidating and reviewing existing Management Plans and information collected through ecological assessments undertaken using the PBP's Natural Area Initial Assessment templates (now referred to as the Local Biodiversity project (LBP)). Five year Management Plans have been developed that provide management actions and strategies for the conservation and restoration of the City's six natural areas.

The key threats to the City's natural areas include environmental weeds, plant diseases, feral animals, fire management, illegal dumping and access, and climate change. The implementation of the City's Natural Area Management Plans will assist the City to:

- Improve public amenity through improvement of bushland condition and access,
- Conserve biodiversity through the protection and enhancement of natural areas,
- Maintain and enhance genetic diversity through the improvement of ecological corridors and habitat,
- Improve the resilience of natural areas in the face of a changing climate,
- Reduce bushfire risk through environmental weed control; and
- Receive grant funding assistance through development and implementation of management actions.

Table 1: Summary of Management Actions to be implemented for the City's six natural areas.

ACTIONS	
PLANNING CONTEXT	
1.	All six natural areas identified in this Management Plan that are managed by the City for conservation are considered "Special Protection Zones" regardless of the "Power to Lease" on Management Orders.
MONITORING AND SURVEYS	
2.	Undertake weed mapping using the Department of Parks and Wildlife (DPAW) Standard Operating Procedure SOP No: 22.1 every five years in spring.
3.	Undertake bushland condition mapping using the Keighery Bushland condition scale every five years in spring.
4.	Continue to compile a comprehensive list of species present, including fungi.
CLIMATE CHANGE	
5.	Implement actions identified in the Climate Change Local Adaptation Action Plan: 2012-2017 for natural areas.
6.	Increase the resilience of natural areas by focussing on threats posed by environmental weeds, feral animals, illegal access and dumping, increased fire frequency, plant diseases and climate change.
7.	Accommodate adjustments to management practices to adapt to a changing climate.
8.	Enhance the resilience of natural areas through the creation and enhancement of ecological corridors by implementing the City's Greenways Policy.
9.	Keep informed about the latest climate change research developments and best practice for natural area adaptation techniques.

PLANT PATHOGENS	
10.	Maintain hygiene protocols for Council operations and contractors within bushland reserves.
11.	Establish hygiene protocols for Friends Group activities.
12.	Ensure that any soil or plant material used for bushland restoration is pathogen free.
13.	Minimise operations involving movement of soil, such as track construction and maintenance and carry out these operations under strict hygiene practices such as pressure cleaning machinery and vehicles.
14.	Ensure that nurseries contracted for revegetation programs are accredited by the Nursery and Garden Industry of Western Australia (NAISA) and are free of Phytophthora.
15.	When restoration work is undertaken begin in the reserves where *Phytophthora* has not been found and then proceed in the other reserves.
16.	Ensure no soil or plant material is transferred between reserves or restoration sites by brushing excess soil off clothing, machinery and equipment, and sterilising with 70% solutions of methylated spirits.
17.	Ensure pruning equipment is sprayed with a 70% solution of methylated spirits (or similar) before, after and between pruning trees and shrubs; and before and after hedging large sections of vegetation.
18.	Ensure that any soil, mulch or plant material used for bushland restoration is certified pathogen-free according to Australian Standard AS4454 for Composts, Soil Conditioners and Mulches.
19.	Apply systemic treatments (when funding is available) to vegetation that has tested positive to *Phytophthora* and surrounding vegetation, to prevent premature decline from pathogens and abiotic factors.
20.	Implement the Western Australian Dieback Signage System within bushland areas know to have *Phytophthora*.
21.	Review the Nedlands Dieback Management Plan in accordance with Council Policy to include plant pathogens and guide the management for City staff, community groups and contractors for areas that are known to have plant pathogens.
FIRE MANAGEMENT	
22.	Fires bans should be instigated and maintained at all times.
23.	Reduce fuel loads through control of weeds such as Perennial Veldt Grass.
24.	Suppress and contain any wildfires within the study area as quickly as possible.
25.	Document fire history with the extent of fires mapped, and dates and causes recorded.
26.	Control access into burnt areas as soon as possible after the fire. Access to any burnt areas should be limited to management vehicles only for the first six to twelve months.
27.	Monitor seed germination and regeneration of vegetation for two years following fire.
28.	Carry out an intensive weed control program after each fire and monitor weed and native species recolonisation to maximise native species establishment.
29.	Do not establish new tracks during fire fighting operations.
30.	Install interpretive signage regarding the dangers of wildfires and the destructive effects of frequent fires on flora and fauna.
31.	Provide a fire contingency fund in the natural area budget for reactive weed management and tree pruning/removal following fires.
32.	Annually update Fire Response Plans with FESA.
33.	Undertake maintenance of fire breaks and access points annually prior to 30th November.
34.	Seek consultancy services to undertake bushfire risk assessments of the City's natural areas using ISO AS/NZ 31000-2009 biennially.
ACCESS	
35.	Regularly prune along all paths to be retained.
36.	Maintain existing path networks and fencing.
37.	Implement the City of Nedlands Natural Area Path Network Policy and Procedures.

38.	Undertake a geotechnical survey at Point Resolution and Birdwood Parade every five years.
39.	Continue to work with the Department of Defence to repair eroded pathways on Melon Hill.
40.	Investigate the installation of fencing along the Rugby Club and dog exercise ovals at Allen Park to reduce informal access.
41.	Undertake maintenance to beach fencing every 18 months.
42.	Investigate the installation of fencing along Cleland Street at Mount Claremont Oval Reserve to reduce illegal access.
CULTURAL HERITAGE, INTERPRETATION AND EDUCATION	
43.	Provide interpretive signage that details environmental, Aboriginal and European heritage for Nedlands natural areas through the WESROC Whadjuk Trails Project.
COMMUNITY INVOLVEMENT	
44.	Continue to support the activities of bushland community groups by implementing the Bushland Friends Group Policy.
45.	Hold an annual event that brings all bushland community groups together rotating annually through different bushland areas.
46.	Provide assistance to help friends groups remain sustainable through advertising and the volunteer referral centre.
REHABILITATION	
47.	Restoration should follow the three basic principles of the Bradley Method.
REVEGETATION	
48.	Develop Rehabilitation Plans for all sites to be intensively managed. These should include as a minimum the boundary of works, a planting list and native plants present that require protection.
49.	Only use plant species and forms of plants for rehabilitation if they would have naturally occurred at the sites.
50.	Prepare seed banks for all reserves for use in revegetation programs.
51.	For internal management purposes establish a monitoring program for indigenous species, with the location and abundance of species in very low abundance recorded.
52.	Document any locally occurring native species that are re-introduced to natural areas.
53.	Include large indigenous trees in annual planting programs.
WEED CONTROL	
54	Use an integrated approach to weed control including herbicides, manual removal, modifying microclimates (in terms of shade, moisture etc) and biological controls (such as Bridal Creeper Leafhopper and the Rust, *Puccinia myrsiphylli.*
55.	Refer to the Department of Parks and Wildlife's (DPAW) Management Notes detailed on Florabase for target weeds species.
FERAL ANIMALS	
56.	Continue to monitor and control feral animals using an integrated feral animal control program.
57.	Continue to use baiting stations for feral rabbit control.
58.	Only undertake fumigation of fox warrens not rabbit warrens.
59.	Avoid using pavers or concrete slabs in natural areas which encourage Coastal Brown Ant infestations.
60.	Continue to control Coastal Brown Ants with maintenance of the Seaward Corridor undertaken biannually.
61.	Continue to work with other local governments and agencies to implement a regional feral animal control program.
62.	Sterilise bamboo stakes that harbor Coastal Brown Ants so they are not inadvertently spread between restoration sites.
63.	Minimise watering of bushland areas (where possible) to discourage Coastal Brown Ant Infestations.
64.	Contribute to the regional program being undertaken for feral bird control by DPAW.

INTRODUCTION

Purpose

This Management Plan outlines guiding information, strategies and management actions necessary to protect, enhance and restore natural areas and biodiversity within the City of Nedlands. Existing management plans have been reviewed and updated with actions provided for natural area management in the following natural areas:

Shenton Bushland,
Allen Park,
Point Resolution Reserve,
Birdwood Parade,
Hollywood Reserve; and
Mount Claremont Oval Reserve.

Some smaller greenways exist within the City which fall under the City's Greenway Corridors Policy. These consist of small fragmented patches of urban bushland around Mount Claremont, Swanbourne, the River Foreshore and along road reserves. Whilst these areas have not been directly addressed in this Management Plan the general management actions provided for rehabilitation, revegetation, feral animal control and weed control can be applied when restoration work is undertaken in these areas.

This Management Plan is intended to provide guidance to those involved in the management of the City's natural areas. This includes the Department of Defence (for Allen Park), Department of Health (for Shenton Bushland), City of Nedlands staff, volunteers and natural area friends groups.

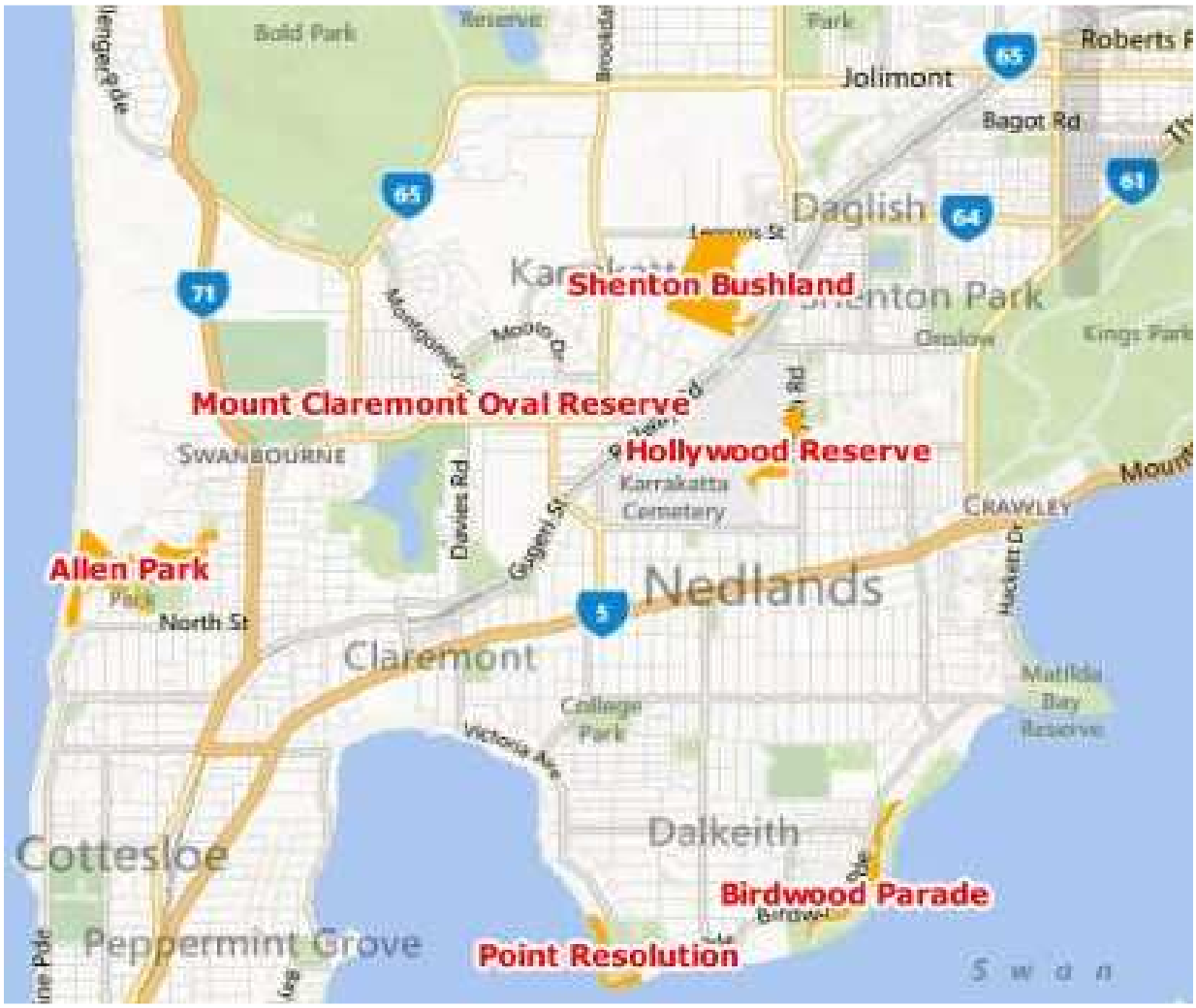
Natural Areas within the City of Nedlands

Natural areas can be areas of native vegetation, vegetated or open wetlands (lakes, swamps) or waterways (rivers, streams, creeks and estuaries - often referred to as channel wetlands), springs, rock outcrops, bare ground (generally sand or mud), caves, coastal dunes or cliffs (LBP - adapted from Environmental Protection Authority, 2003a).

The City has six natural areas all of which are actively managed. They include coastal, riverine and inland natural areas which cover approximately 60Ha. They include:

- Shenton Bushland 26Ha located in Shenton Park (of which 4.8Ha is vested in the Department of Health and 0.4Ha Department of Education),
- Allen Park Bushland 18.9Ha located in Swanbourne (of which 2.9Ha is vested in the Department of Defence),
- Point Resolution Reserve 4Ha located in Dalkeith,
- Birdwood Parade 5.7Ha located in Dalkeith,
- Hollywood Reserve 6.41Ha located in Nedlands; and
- Mount Claremont Oval Reserve 2.21Ha located in Mount Claremont.

Figure 1: Location of Natural Areas within Nedlands (Google Maps 2013)



The City's natural areas provide a variety of environmental, social, recreational and cultural values for the local and wider community.

Threats to Natural Areas

The key threats to the City's natural areas include:

- Environmental weeds,
- Plant pathogens,
- Feral animals,
- Fire,
- Illegal dumping and access; and
- Climate change.

PLANNING CONTEXT

Introduction

To ensure this Management Plan is consistent with other local, regional and national management initiatives, relevant documents, guidelines and policies have been reviewed with brief outlines of these documents provided below.

Vesting

Metropolitan Region Scheme (MRS) and Local Planning Scheme No. 2 (LPS No.2)

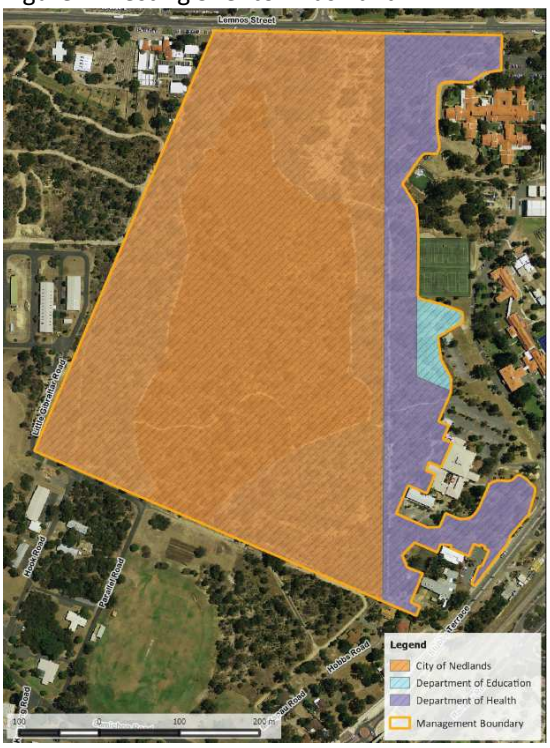
All natural areas except Allen Park and Mount Claremont Oval Reserve are classed as "Parks and Recreation" under the MRS and LPS No.2. Allen Park consists of areas classed as "Parks and Recreation", "Public Purposes" and "Urban" under the MRS and "Parks and Recreation", "Recreation" and "Residential" under the LPS No.2. Mount Claremont Oval Reserve is classed as "Urban" under the MRS and "Recreation" under LPS No. 2.

Shenton Bushland

Shenton Bushland contains A Class Reserve 43161 vested in the City of Nedlands for "Conservation and Recreation". This Reserve was previously vested with the State Government for Health Purposes and covers an area of approximately 21Ha.

Shenton Bushland also contains C Class Reserve 20074 which is vested with the Department of Health for "Health Purposes". Reserve 20074 covers an area of approximately 9Ha of which 4.8Ha consists of bushland. The 4.8Ha of bushland is cooperatively managed between the City of Nedlands, the Friends of Shenton Bushland and the Department of Health. A Memorandum of Understanding (MOU) between the City and the Department of Health outlines the Department of Health's contribution towards natural area management on Reserve 20074 for 2013 – 2017. A small area (0.4Ha) is also owned by the Department of Education on the eastern edge of the bushland.

Figure 2: Vesting Shenton Bushland



Allen Park

The bushland in Allen Park covers an area of 18.9Ha. Allen Park consists of a number of A and C Class reserves, which are primarily vested in the City of Nedlands for "Recreation", "Parks and Recreation" or "Drainage" (refer to Table 2). Under current vesting the City of Nedlands has the "Power to Lease" on Reserves 19283, 7804 and 19349 of which all are A Class reserves.

Lot 1 (which contains Bush Forever Site 315) is Freehold land owned by the City. It is actively managed in conjunction with the Swanbourne Coastal Alliance. Lot 1 has received significant funding through the Department of Planning's Coastwest Program and Australian Governments Coastcare Program over recent years.

The northern 2.9 ha portion (Melon Hill) is owned by the Commonwealth of Australia and vested with the Department of Defence for "Public Purposes". The Department of Defence, the City of Nedlands and the Friends of Allen Park have cooperatively managed this section of Allen Park since 1994. Allen Park (including Melon Hill) has received significant funding through the National Heritage Trust, Lotterywest and Perth Biodiversity Project over the years. The Friends of Allen Park do not distinguish between the different vesting arrangements in terms of on ground works.

Table 2: Vesting Allen Park Bushland

Reserve Number(s)	Vesting	Class
Reserve 19283 Part of Boobook Sector, bushland between Sayer Street including Tom Fricker and Mayo cottages.	"Parklands and Recreation". Contains "Power to Lease" for any term not exceeding 21 years subject to Minister for Lands.	Class A
Reserve 19349 Part of South Melon Hill.	Vested for "Recreation" Contains "Power to Lease" subject to consent from Minister for Lands.	Class A
Lot 312 Primary dunes along Marine Parade to Lot 1	Vested for "Recreation"	Class C
Lot 149 (9 Sayer Street) Reserve 19842	Vested for "Parklands and Recreation"	Class C
Reserve 27250 Primary dunes north from Cafe to Campbell Barracks including part of Bush forever Site 315.	Vested for "Recreation"	Class A
Lot 1 Includes part of Bush Forever Site 315	Registered Proprietor – City of Nedlands	Freehold land
Lot 131 89 Wood Street	Registered Proprietor – City of Nedlands	Freehold land
Lot 301 North Melon Hill and Seaward Corridor	Registered proprietor – Commonwealth of Australia	Freehold land
Reserve 7804 Odern Crescent, Flyash Hill, Friends of Allen Park, Tom Collins and Mattie Furphy Cottages and part of South Melon Hill.	Vested for "Parks and Recreation" Contains "Power to Lease" subject to consent from Minister for Lands.	Class A
Lot 1003 Reserve 47253 Boobook Sector and Jones Park	Vested for Drainage	Class C

Figure 3: Land Ownership and Vesting Allen Park Bushland

Hollywood Reserve

Hollywood Reserve is vested in the City of Nedlands as A Class Reserve 32545 for "Gardens and Parks" it covers an area of 6.41Ha.

Birdwood Parade

The Bushland at Birdwood Parade covers an area of approximately 5.7Ha. Birdwood Parade is vested in the City of Nedlands as A Class Reserve 1624 for "Parks and Recreation". Currently, the City of Nedlands has the "Power to Lease" on Reserve 1624. Birdwood Parade falls within the Swan River Trust's Development Control Area (DCA). The Swan River Trust provides advice, considers and makes recommendations on development and land use applications that affect the DCA.

Figure 4: Swan River Trust Development Control Area Birdwood Parade.

Point Resolution

The bushland at Point Resolution covers an area of approximately 4Ha. Point Resolution is vested in the City of Nedlands as A Class Reserve 17391 for "Parks and Recreation". The City of Nedlands has the "Power to Lease" on Reserve 17391. Like Birdwood Parade, Point Resolution also falls within the Swan River Trust's DCA. The Swan River Trust provides advice, considers and makes recommendations on development and land use applications that affect the DCA.

Figure 5: Swan River Trust Development Control Area Point Resolution

Mount Claremont Oval Reserve

The bushland at Mount Claremont Oval Reserve covers an area of approximately 2.21Ha. Mount Claremont Oval Reserve is vested in the City of Nedlands as A Class Reserve 26102 for "Parks and Recreation". The City of Nedlands has the "Power to Lease" on Reserve 26102.

Local Government Context

City of Nedlands 2023 Strategic Community Plan 2013-2023

This Plan represents a plan for the future, setting the direction for how the City will respond to its challenges.

The City of Nedlands Strategic Community Plan refers to a "Great Natural and Built Environment". This relates to:

- Enhanced, engaging community spaces,
- Heritage protection,
- Well planned and managed development; and
- Natural environment and biodiversity protection.

The Strategic Community Plan also identifies four Key Focus Areas (KFA) with the Natural and Built Environment key focus area specifically relating to natural area management. This KFA is explained in the Strategic Community Plan as follows:

"This KFA contributes directly to enhancing, engaging community spaces, heritage protection and environmental protection. Volunteering for environmental enhancement is always encouraged and

supported. The natural and built environment KFA is also essential to recognising and encouraging a city that's easy to get around and is a great place to do business. High quality built environments are healthy and have character and charm, enhance community connections and protect amenity. The built environment also provides many facilities that are essential to community activities such as halls, pavilions, community centres and sporting facilities.

This KFA includes:

- Land use planning,
- Development approvals and compliance,
- Building control,
- Streetscape,
- Underground power,
- Natural area management,
- Sustainability education and capacity building,
- Waste management,
- Water conservation and management,
- Parks, ovals and reserves; and
- Heritage protection.

Asset Management Plan

The City of Nedlands is in the process of developing a Natural Area Asset Management Plan in order to provide and maintain assets to meet the needs of the Community and ensure their long term sustainability. This Plan is part of the City's fulfilment to the Integrated Planning and Reporting Framework, implemented by the State Government's Local Government Reform Program. The development of the Asset Management Plans Strategy demonstrates the City's commitment.

Corporate Business Plan

The Corporate Business Plan was developed and adopted to deliver the 2023 Community Strategic Plan. The Strategic Community plan highlighted the community's focus on improving the knowledge of asset condition and implementing a pro-active asset management program.

Greenways Corridors Policy

The aim of the City's Greenways Corridors policy is to link natural and built environments to provide for greater biodiversity and sustainability. The City of Nedlands' Greenways Corridors Policy was approved in 2001 following a public consultation with residents. The Greenways policy identifies land where action can be taken to enhance local and regional ecological corridors by connecting natural areas and parklands.

All the City of Nedlands' natural areas managed for conservation and restoration are considered local greenways along with small fragmented bushland remnants in Mount Claremont, Swanbourne and the river foreshore. Allen Park, Birdwood Parade, Point Resolution and Shenton Bushland form part of regional greenways along with some of the small fragmented bushland remnants in Mount Claremont, Swanbourne and the river foreshore.

Community Friends Group Policy

The City of Nedlands aims to work collaboratively with residents who are prepared to form a Community Friends Group to assist in natural area management and/or wildlife protection within the City. This policy outlines the process by which Community Friends Groups assist in the care of natural areas and wildlife within the City.

Illegal Removal of Vegetation Policy

This policy outlines how the City of Nedlands will respond to illegally removed vegetation from its parks and reserves. The purpose of this policy is to discourage unauthorised removal of vegetation through the use of signage and prosecution. This policy also encourages community members to report illegal damage to vegetation on public land.

Bushland Path Network Policy

This policy outlines how the City of Nedlands will upgrade the natural area path network within the City to an acceptable standard in accordance with Australian Standards (where possible). The path upgrade process will be in accordance with fire protection strategies, integrate a hierarchy of paths for pedestrians and cyclists and meet its obligations under the Disability Access and Inclusion Plan (where possible) in consultation with Natural Area Community Groups .

State of the Environment (City of Nedlands, 2000)

This document gives an overview of the City's bushland assets. It also establishes a number of indicators against which bushland management within the Municipality is measured.

City of Nedlands Natural Area Management Plans 1980 – 2010

Several natural area Management Plans have been developed for the City of Nedlands to guide restoration and protection of the City's natural, cultural and historical areas. They include:

- Nedlands Foreshore Plan (Ralph Stanton Planners, 1983),
- Birdwood Parade Management Plan (Bunny, 1993),
- Point Resolution Management Plan(Ecoscape, 1991),
- Shenton Bushland Management Plan (Ecoscape, 1996) and reviewed plan 2005 – 2010,
- Allen Park and Environs Management Plan(Ecoscape, 1996) and reviewed plan 2005 -2010,
- Foreshore Bushland Reserves Management Plan (2003 – 2009) – Birdwood Parade and Point Resolution,
- Management of Phytophthora Dieback at Shenton Bushland (Zuvela, 2002),
- Natural Area Initial Assessments Orsini (2008); and
- City of Nedlands Phytophthora Dieback Management Plan 2008.

Nedlands Foreshore Management Plan, February 2010 (currently under review)

This Management Plan outlines the future use and management of the Nedlands Foreshore. It identifies requirements for managing the use of the foreshore area between Broadway, the Esplanade, Birdwood Parade and Iris Avenue (excluding Sunset Hospital).

Municipal Heritage Inventory for the City of Nedlands (O'Brien Planning Consultants, 1999)

The Municipal Heritage Inventory (currently being reviewed) identifies and describes historical places and assigns them management categories on the basis of their significance.

It identifies a number of significant sites within Birdwood Parade Reserve (adjacent to bushland) including the: Dalkeith/Nedlands Foreshore, Nedlands Yacht Club, Tawarri Restaurant, Perth Flying Squadron Yacht Club, the Dalkeith Gunners Memorial, Sunset Hospital and Gallop House.

The entire Point Resolution Reserve is a significant site along with Shenton Bushland and the adjacent Irwin Barracks Magazine and Lemnos Hospital and Pine Trees. At Allen Park the site of significance is the Reserve itself and Tom Collins House and Mattie Furphy House along with the adjacent Swanbourne Surf Life Saving Club. Areas identified as significant sites adjacent to Hollywood Reserve include Karrakatta Cemetery and the Perth War Cemetery.

Western Suburbs Greening Plan (Western Suburbs Regional Organisations of Councils – Ecoscape, 2002)

The Greening Plan sets out a framework to maintain and enhance linkages between open space, parks and recreational areas and bushland areas to enhance the ecological processes and the amenity of the Western Suburbs. The foredunes in Allen Park are identified as part of the 'Coastal Link' Regional Greenway and the remainder of Allen Park as an area for securing part of the greenway network. Shenton Bushland and Hollywood Reserve are part of the regional greenway linking Kings Park to Bold Park. Point Resolution and Birdwood Parade are identified as part of a regional river foreshore link from Kings Park to Fremantle. Mount Claremont Oval Reserve forms part of a greenway linking Bold Park and Lake Claremont.

State Government Context

Aboriginal Heritage Act 1972

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

There are no registered Significant Sites in any of the City's natural areas. However, the entire Swan River is a Significant Site and there are "Other Significant Heritage Places" to the north of Point Resolution, close to Mount Claremont Oval Reserve and possibly four in the surrounding area of Shenton Bushland.

Significant Sites, regardless of whether they are they are registered or not, are protected under the Aboriginal Heritage Act, 1972.

Agriculture and Related Resources Protection Act 1976

This Act makes provisions to declare, manage, prevent and control plants and animals that are known to be a significant environmental threat to agriculture and related resources. The City has three declared plants which are discussed in the environmental weed section of this Management Plan.

Bushfires Act 1954

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

Conservation Reserves for Western Australia – System 6 (Department of Conservation and Environment, 1983)

The System 6 Conservation Reserve System developed by the Department of Conservation and Environment (1983) was the precursor of the Bush Forever Policy. Point Resolution Reserve and the foredunes at Allen Park were included in the System 6 Conservation Reserve System.

Directions 2031 and Beyond and Central Metropolitan Perth sub-regional Strategy

"Directions 2031" is a high level spatial framework and strategic plan that establishes a vision for future growth of the metropolitan Perth and Peel region.

The Central Metropolitan Perth sub-regional strategy recognises the size and complexity of strategic planning for the metropolitan area. A sub-regional strategy provides the opportunity to provide guidance at the local level.

A strategic priority of these documents that directly relates to this Plan is to:

> "*Protect our natural and built environments and scarce resources; respond to social change and optimise the land use and transport conditions that create vibrant, accessible, healthy and adaptable communities."*

This priority recognises the importance of strategic planning integrating the key environmental principles of environmental protections, natural resource management and sustainability.

Heritage of Western Australia Act 1990

Tom Collins and Mattie Furphy House at Allen Park and Gallop House at Birdwood Parade are listed on the State Register of Heritage Places.

The State Register of Heritage Places was established by the Heritage of Western Australia Act 1990 to ensure that places are recognised for their value and importance to the State and to promote their conservation into the future.

The Register is managed by the Heritage Council of Western Australia with the assistance of the State Heritage Office. Entry in the State Register means that any changes or works proposed for the place need to be referred, usually by the responsible local government, to the Heritage Council for advice.

National Trust of Australia (W.A) Act 1964

The Register includes landscapes, buildings and industrial sites which the Trust determines as having heritage significance and being worthy of conservation. Listing by the National Trust W.A is as an authoritative statement of the heritage significance of a particular location and is not legally binding on the landowner.

Places in or adjacent to the City's natural areas that are listed on the Register of the National Trust of W.A. (as at August 2013) include Gallop House and Tom Collins House.

State Planning Policy 2.8

State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region was prepared under the *Planning and Development* Act 2005. This is a strategic policy guiding State and local planning systems. One of the key initiatives of this policy is the listing of properties under the State planning requirements of the 'Bush Forever' Policy.

Western Australian Planning Commission Bush Forever Policy 2000

The Bush Forever Policy replaces the Conservation Reserve System 6 recommendations as a blueprint for conservation of bushland of regional significance in the Perth Metropolitan Region. Bush Forever was prepared by the Department of Environmental Protection, Ministry for Planning, CALM and the Water and Rivers Commission and was endorsed by Cabinet and supported by the Environmental Protection Authority as the principle mechanism to identify and protect regionally significant bushland in the Perth Metropolitan Region.

The City has three Bush Forever Sites which include:

- Shenton Bushland - Site 218,
- Allen Park - Site 315 (north-western most portion – including Lot 1); and
- Point Resolution - Site 221.

Wildlife Conservation Act 1950

This Act provides the legislation relating to conservation and protection of flora and fauna. Seven species considered as "*Specially Protected Fauna*" under the Wildlife Conservation Act known to utilise the City's natural areas include: Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Forest Red-tailed Black-Cockatoos (*Calyptorhynchus banksii naso*) which are listed as Schedule 1 — *Fauna that is rare or is likely to become extinct* and the Rainbow Bee-eater (*Merops ornatus*), Grey Plover (*Pluvialis squatorola*), Common Sandpiper (*Actitis hypoleucos*), Common Greenshank (*Tringa nebalaria*); and Caspian Tern (*Hydropogne caspia*) which are listed as Schedule 3 — *Migratory birds protected under an international agreement*. The Carpet Python (*Morelia spilota imbricata*) is listed as Schedule 4 — *Other specially protected fauna*. However the Carpet Python that was found at Allen Park is unconfirmed as being wild or a captive escapee.

Three plant species are listed as Schedule 1 *Threatened Flora* (Declared Rare Flora) these include *Caladenia huegelii* (Grand Spider Orchid) which occurs in Shenton Bushland and Acacia *denticulosa (*Sandpaper Wattle) and *Eucalyptus crucis* subsp*. Crucis (*Southern Cross Silver Mallee) which have historically been planted in Hollywood Reserve outside of their normal range.

Swan and Canning Rivers Management Act 2006

The Swan and Canning Rivers Management Act 2006 established the area covered by the Swan Canning Riverpark and sets out guidelines for government, industry and the community to work together to protect the Swan and Canning river systems.

Federal Government Context

Australia's Biodiversity Conservation Strategy 2010-2030

This Strategy provides the framework for the conservation of Australia's biodiversity.

Environmental Protection and Biodiversity Conservation Act, 1999 (EPBC Act)

The EPBC Act enables the Australian Government to protect matters of national environmental significance. Three flora species listed under the EPBC Act occur in the City's natural areas these include *Caladenia huegelii* (Grand Spider Orchid) which occurs in Shenton Bushland; and Acacia *denticulosa (*Sandpaper wattle) and *Eucalyptus crucis* subsp*. Crucis (*Southern Cross Silver Mallee) which have historically been planted in Hollywood Reserve outside of their normal range.

Seven bird species that occur in the City's natural areas are listed under the EPBC Act. These include the Carnaby's Cockatoo *(Calyptorhynchus latirostris)* which is listed as *Endangered, the* Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii)* which is listed as *Vulnerable* and the Rainbow Bee-eater *(Merops ornatus)*, Grey Plover (*Pluvialis squatorola*), Common Sandpiper (*Actitis hypoleucos*), Common Greenshank (*Tringa nebalaria*); and Caspian Tern (*Hydropogne caspia*) which are listed as *Migratory* and *Marine* species.

The City of Nedlands has three confirmed Carnaby's Cockatoo roosting sites they include:

- 104 Adelma Rd Dalkeith (GCC36),
- Hollywood Hospital Site Nedlands (R3); and
- Perry Lakes (R15).

There are also three unconfirmed Roost Sites they include:

- Sunset Hospital Site Dalkeith (DEC37),
- Birdwood Parade (DEC37); and
- Corner of Narla Road and Servetus Street (DEC50).

Carnaby's Cockatoos regularly forage in all the City's natural areas. A flock of Red Tailed Black Cockatoos also roost on University of Western Australia owned land near the McGillivray Oval. Red – tailed Black Cockatoos are regularly seen foraging in Shenton Bushland and Hollywood Reserve. Rainbow bee–eaters migrate annually in summer to Perth from parts of northern Australia, Papua New Guinea and some Indonesian Islands. They nest in Perth's sandy soils and have been found in Shenton Bushland, Allen Park, Birdwood Parade and Point Resolution.

Regional Weed Control Strategy (Department of Defence, 2006)

The Department of Defence manages land adjacent to Shenton Bushland and within Allen Park. This strategy identifies the role of individual landholders, including the Department of Defence as needing to:

- Understand that weeds are an important factor in land degradation;
- Allocate sufficient resources to manage weeds to a practical level;
- Detect and report new weed occurrences;
- Understand land use activities and the cause/effect relationships which apply to weed problems;
- Integrate economic and environmental values in the management of weed problems on their land;
- Co-operate with and, where relevant, plan weed management activities jointly with neighbours; and support and promote sustainable production practices to minimise the development of weed problems; and
- Support and promote sustainable operational practices to minimise the development of weed problems.

As a public land manager, the Department of Defence has a role to:

- Participate in local and regional weed management programs,
- Provide the community with information on weed management issues; and
- Participate in the development of codes and policies which will reduce the impact of weeds.

As both a landholder and land manager, the Department of Defence should recognise that effective weed management can only be achieved through a coordinated approach involving all levels of government, industry, community and individual landholders.

International Union for Conservation of Nature (IUCN)

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. The Carnaby's Cockatoo (*Calyptorhynchus latirostris*) is IUCN Red Listed species as 'Endangered'. Carnaby's Cockatoos forage in all of the City's Natural Areas. The native plant *Jacksonia sericea* is also IUCN Red Listed as 'Endangered'. *Jacksonia sericea* occur in Shenton Bushland, Hollywood Reserve and Point Resolution.

PHYSICAL ENVIRONMENT

Climate

The climate of the City of Nedlands is typically Mediterranean, with mild wet winters and long hot dry summers. The rainfall is moderate and highly seasonal with an average rainfall of approximately 850 mm most of which occurs between May and September. The maximum rainfall is usually recorded in the month of June, with an average of around 176 mm received. The mean maximum temperatures range from 31 °C in February to a mild 18°C in July, while mean minimum temperatures range from 16 °C in December to 8°C in July. Evaporation generally exceeds the rainfall for eight months of the year from September through to April. The winds in Nedlands are strongest during the summer months with strong easterly winds in the morning, swinging to strong south–westerly winds in the afternoons. In the winter months the winds are generally much lighter except for strong westerly and north–westerly winds associated with rain–bearing depressions.

Climate Change

Background

The Earth's climate has changed over the last century and it has the potential to adversely affect the environment, communities and the economy. Local, state and federal governments have recognised the need to work together to adapt and reduce their contribution to the impacts of climate change.

The Intergovernmental Panel on Climate Change (IPCC) is regarded as the most reliable source of climate change data within the scientific community. The IPCC report (2007) developed climate change scenarios for the year 2070, and the anticipated changes for Perth are listed below:

- An increase in annual average temperature of 2.7°C, and twice as many days over 35°C per year;
- 20% reduction in annual rainfall,
- An increase of mean sea level of 0.33m (and 0.9m over a 100 year timeframe); and
- Increase in the intensity of extreme weather events such as storms.

Impacts on Biodiversity

According to the Australian Biodiversity Conservation Strategy 2010 - 2030 biodiversity is one of the sectors most vulnerable to climate change due to its ability to increase existing threats and further disrupt ecological processes. Reduction in rainfall, increases in average temperatures, increases in the frequency and severity of extreme events such as fires, floods and droughts and increases in the distribution and abundance of invasive species will impact natural areas and biodiversity by altering vegetation communities and habitats.

Key actions in the Australian Biodiversity Conservation Strategy 2010 - 2030 were identified as building ecosystem resilience so it can adapt to changes and disturbances resulting from climate change. Maintaining natural areas and creating ecological linkages is the most effective strategy to build resilience in a changing climate as they provide for species migration and protection. Undertaking ongoing natural area management activities will also build ecosystem resilience by reducing existing threats to natural areas such as feral animals and environmental weeds and by increasing the connectivity and protection of fragmented landscapes. Maintaining a comprehensive, adequate and representative reserve system is the best way to secure the habitats of vulnerable species (DEWHA 2009).

Relevant Documents

Carbon Inventory and Management Report Baseline year 2010/2011

This report summarised the findings from a baseline inventory that was completed by the City and recommended actions towards a Carbon Management Plan. This inventory has measured the baseline year for the City of Nedlands' carbon emissions, and aims to develop carbon mitigating actions by the City. The footprint measured was 2504.46 tonnes of carbon dioxide equivalent emissions for the 2010/2011 financial year.

WESROC Regional Climate Change Adaptation Action Plan 2010-2011

Coastal Zone Management developed a Climate Change Risk Assessment and Adaptation Plan for WESROC in 2010. This Plan outlines actions that are to be completed on a local and regional basis. A regional Climate Change Project Group has formed and meets regularly with representatives from each member council to discuss climate change impacts and adaptation measures.

City of Nedlands Climate Change Local Adaptation Action Plan: 2012-2017

This Local Adaptation Plan accompanies the WESROC Regional Climate Change Adaptation Action Plan 2010-2011 developed by Coastal Zone Management. It identifies adaptive actions for the City over a 20 year period across all divisions within the City.

Coastal Zone Management's report (2010) identified key threats to natural areas across WESROC as:

- Threat to infrastructure adjacent to the coast and river from erosion and inundation; and
- Impact of natural resources such as bush land and landscaped gardens, and water and air quality.

The "extreme" risks identified in the Coastal Zone Management report to natural areas and biodiversity were:

- Changes in groundwater levels leading to decline in water quality,
- Shifts in distributions of plant and animal species,
- Increases in ecological disturbances and reduced ecosystem resilience to stress,
- Increased erosion and/or exceedance of seawalls, jetties and other coastal defences;
- Inundation and/or erosion of roads in coastal and estuarine areas,
- Increased frequency, or permanent inundation of, coastal infrastructure and utilities e.g. Water, sewerage, gas, telecommunications, electricity, transportation;
- Increased risk of population extinctions (flora and fauna),
- Increased coastal erosion and inundation,
- Increase in the spatial extent of nutrient rich sediments due to reduced river flows and increased tidal extend (due to sea level rise); and
- Erosion or inundation leading to loss of coastal and estuarine recreational infrastructure.

The following actions for natural areas have been compiled from the Climate Change Local Adaptation Action Plan: 2012-2017 and are listed on the following page:

Table 3: Natural Area Actions from the Climate Change Local Adaptation Action Plan: 2012-2017

ACTIONS	
1.	Work with Natural Area Friends Groups on Climate Change strengthening activities such as monitoring, adaptation work and raising community awareness.
2.	Develop partnerships with agencies to enhance and respond to Climate Change such as the Swan River Trust and Department of Planning.
3.	Continue to implement the WESROC Greening Plan and Greenway Corridors Policy to create ecological corridors and protect natural areas.
4.	Review management plans, policies and strategies to incorporate climate change impacts and adaptation measures.
5.	Protect natural areas through ongoing management programs such as feral animal and environmental weed management programs.
6.	Enhance coastal and estuarine foreshore protection management.
7.	Undertake vulnerability assessments for coastal and estuarine areas.
8.	Under take geotechnical surveys at required locations.
9.	Enhance the resilience of natural areas through the creation and enhancement of ecological corridors and implementing the City's Greenways Policy.
10.	Develop coastal and/or estuarine monitoring programs in conjunction with the state and federal government.

Management Actions 2013 - 2018

ACTIONS	
1.	Implement actions identified in the Climate Change Local Adaptation Action Plan: 2012-2017 for natural areas.
2.	Increase the resilience of natural areas by focussing on threats posed by environmental weeds, feral animals, illegal access and dumping, increased fire frequency, plant diseases and climate change.
3.	Accommodate adjustments to management practices to adapt to a changing climate.
4.	Enhance the resilience of natural areas through the creation and enhancement of ecological corridors by implementing the City's Greenways Policy.
5.	Keep informed about the latest climate change research developments and best practice for natural area adaptation techniques.

Geology, Soils and Geomorphology

Geology

Almost the entire City of Nedlands area, and most of the Natural Areas described in the City of Nedlands Natural Area Management Plans 2013 - 2018, are underlain by Quaternary Tamala Limestone or by the sand derived from it. These two distinctive geological units together make up Spearwood Dunes.

The Tamala Limestone is typically light yellowish brown. It is variably sandy, variably well-lithified, contains trace amounts of shell debris, and is clearly of wind-blown origin. The sand derived from eroding Tamala Limestone outcrops, sometimes referred to informally as 'Spearwood Sand', is pale or olive yellow, and moderately well sorted. It consists of well-rounded to sub-angular, fine- to coarse-grained quartz, with trace feldspar. It is residual in origin.

A younger unit, the Safety Bay Sand, forms discontinuous patches along the Perth coast. It is best developed south of Fremantle, especially in the Rockingham-Warnbro Sound area. In the City of Nedlands area, an irregular tongue extends nearly 3 km inland from the Swanbourne shoreline almost as far as Challenge Stadium. The Safety Bay Sand is not a single massive unit, but is made up of white, fine- to medium-grained, immature, calcareous sands, which typically consist of sub-rounded quartz grains with abundant shell debris.

The Safety Bay Sand forms the Quindalup Dune System, a geomorphological feature discussed in the following section. The most detailed description of the surface geology of the Perth urban area is the map published by the Geological Survey of Western Australia (Gozzard 1986).

Geomorphology

Geomorphology is the study of landforms and the processes that shape them. There is general agreement in Western Australia that particular combinations of landforms and soils are consistently associated with particular vegetation types. It is this generalisation that underlies the concept of the 'vegetation complex' (e.g. Heddle *et al.* 1980) discussed in a later section of this Management Plan.

The City of Nedlands occupies a small part of the Swan Coastal Plain, a geologically modern landscape feature along the western margin of the southern Australian continent. In the Perth area, the Swan Coastal Plain is a series of sand dunes and interdune swamps, aligned approximately north-south, parallel to the present coastline. Three groups of dunes in particular are recognised locally as 'geomorphological systems' or 'landscape systems' (McArthur & Bettenay 1960) – from west to east (with increasing age and maturity), Quindalup, Spearwood and Bassendean Dunes. Churchwood & McArthur (1980) proposed a more-detailed scheme in which they further subdivided the simple landscape systems of McArthur & Bettenay into 'geomorphological units', and their scheme has been adopted in many later studies, for example Perth's Bushplan (1998), Bush Forever (2000) and previous management plans developed for City of Nedlands natural areas (e.g. Ecoscape (1996)).

For the City of Nedlands area, Churchwood & McArthur recognised two distinct geomorphological units in what had previously been known simply as the 'Spearwood Dunes'—Cottesloe in the west; Karrakatta in the central and eastern section. These units are probably better known by their informal names – 'Cottesloe Dunes' and 'Karrakatta Dunes'.

As stated earlier, the Quindalup Dunes are the geomorphological equivalent of the Safety Bay Sand, which is represented in the City of Nedlands area by an irregular tongue of white sand extending about 2.8 km inland from the Defence Department beachfront at Swanbourne. The Mount

Claremont Oval Reserve is excavated from an edge of this tongue, and, although very little of the original landscape remains at this site, high ground near the western boundary is probably a preserved remnant of Quindalup Dunes. Previous management plans developed for Allen Park stated Allen Park included a small section of Quindalup Dunes. This claim, however, is not consistent with earlier mapping, e.g. Heddle *et al.* (1980), Gozzard (1986), or with recent observations (Ian Fordyce, pers. comm.).

Other minor geomorphological features represented in the City of Nedlands are described below. Since they are not strictly part of any of the City's natural areas, they are not considered further in this Management Plan.

1) River floodplain along the Nedlands foreshore below Birdwood Parade. This area has been substantially engineered and the original landscape obscured. However, by analogy with alluvial remnants at Pelican Point and small stretches along the Dalkeith foreshore, it is likely that the original material was a white, well-sorted, medium-grained sand of sub angular quartz and feldspar grains with abundant shell fragments.
2) Interdune marshland. Small marshlands are preserved at Kilgour Park (Aberdare Road adjacent to Queen Elizabeth II Hospital) and Mason Gardens (corner of Melvista Avenue and Vincent Road, Dalkeith). Both areas are now grassy parklands, with highly modified soils and vegetation.

Soils

There has been some confusion about soil nomenclature on the Swan Coastal Plain, because various authors have introduced different terms, or applied existing terms in different ways. The information described in the 2013 – 2018 Management Plans use the simplified, nomenclatural system of Bolland (1998), as summarised on the Department of Agriculture and Food website.

In the City of Nedlands area, natural soils associated with the major geomorphological units are

- Spearwood Dunes: pale to olive yellow sand, occasionally becoming loamy in depressions. Thin and skeletal over limestone outcrops.
- Quindalup Dunes: pale calcareous sand with rare, thin patches of light yellow and light grey loamy sand.

Many soil profiles in the City of Nedlands area, even in some of the Natural Areas discussed in this report, have been altered to some extent. In some cases, the native soil has been removed, buried or replaced entirely.

Regional Classification of Vegetation Complex Heddle et al (1980)

Heddle et al (1980) grouped vegetation types into vegetation complexes on the basis of patterns in soils and landforms in medium to large areas. This regional scale mapping shows the City of Nedlands natural areas are classified as having two different vegetation complexes which include:

- Cottesloe Complex – Central and South; and
- Karrakatta –Central and South Vegetation Complex.

The Commonwealth Government has recognised the need to retain 30% of each vegetation community in order to maintain species diversity within an ecological community. In order to meet this national objective the 30% threshold has been set as the target for Biodiversity Conservation 2001-2005. According to the Local Biodiversity Projects Remnant Vegetation Extent by Vegetation Complexes (2010) currently both the Cottesloe Complex – Central and South and the Karrakatta – Central and South Vegetation Complex fall below the 30% threshold.

Karrakatta – Central and South Vegetation Complex

Shenton Bushland, Hollywood Reserve, Birdwood Parade, Point Resolution and Mount Claremont Oval Reserve are located within the area mapped by Heddle et al. (1980) as the Karrakatta –Central and South Vegetation Complex. This Complex is characteristic of the Karrakatta soil association and occurs as a narrow belt approximately 5 km wide, 2 to 3 km from the coastline. The vegetation in this Complex is predominately open-forest of Tuart-Jarrah-Marri and woodland of Jarrah and Banksia species. Tuart is dominant on the western side of the Complex, particularly on hills and ridges, where limestone is nearer the surface. Jarrah replaces Tuart on deeper sands, and Marri occurs on localised moister sites.

Cottesloe – Central and South Vegetation Complex

Allen Park is located within the area mapped by Heddle et al. (1980) as the Cottesloe – Central and South Vegetation Complex. The vegetation in this Complex is characterised by a mosaic of woodland of Tuart – Jarrah and Marri with closed heath on the limestone outcrops.

Floristic Community Types (FCTs) – Gibson 1994

Floristic Community Types classify native vegetation into groups of plant species that tend to co-occur together in small to medium areas. They are a more recent and detailed form of vegetation classification to that of vegetation complexes. In order to identify the FCTs across the Swan Coastal Plain 509 100 square meter plots were surveyed, however all geographical or geomorphological areas could not be sampled through this process. Following the analysis of the 509 plots four 'super groups' were distinguished which were then further divided into 43 floristic community types.

All the City's natural areas belong to Super Group 4 – Uplands Centred on Spearwood and Quindalup Dunes. Super Group 4 contains 11 FTC's including 24, 25, 26 (a & b), 27, 28, 29 (a & b), 30 (a, b & c). The only reserve within Nedlands where the FCT has been inferred is Shenton Bushland as detailed in Bush Forever 2000. Point Resolution, another Bush Forever Site was not inferred as containing a specific FCT through Bush Forever which is likely a result of it being considered highly degraded in the Bush Forever Site description.

Rare and Priority Flora and Fauna

Threatened and Priority flora and fauna found in the City's natural areas are listed in Table 4 and 5 below.

Table 4: Priority Flora City of Nedlands

Species	Common Name	Conservation Status	Natural Area
Caladenia huegelii	Grand Spider Orchid	Schedule 1 Critically Endangered (*Wildlife Conservation Act*); and Endangered (EPBC);	Shenton Bushland
Acacia denticulosa	Sandpaper Wattle	Schedule 1 Vulnerable (Wildlife Conservation Act 1950), and Vulnerable (EPBC)	Hollywood Reserve
Eucalyptus crucis subsp. *Crucis*	(Southern Cross) Silver Mallee	Schedule 1 Endangered (*Wildlife Conservation Act*); and Vulnerable (EPBC)	Hollywood Reserve
Dodonaea hackettiana	Hackett's Hopbush	Priority 4 DPAW	Hollywood Reserve
Jacksonia sericea	Waldjumi	Priority 4 DPAW. IUCN Red Listed as Endangered.	Shenton Bushland, Hollywood Reserve, Point Resolution

Banksia lullfitzii		Priority 3 DPAW	Hollywood Reserve
Melaleuca coccinea	Goldfields Bottlebrush	Priority 3 DPAW	Hollywood Reserve
Calothamnus rupestris	Mouse Ears	Priority 4 DPAW	Hollywood Reserve
Eucalyptus kruseana subsp. *kruseana*	Bookleaf Mallee	Priority 4 DPAW	Hollywood Reserve
Grevillea olivacea	Olive Grevillea	Priority 4 DPAW	Hollywood Reserve

Table 5: Priority Fauna City of Nedlands

Species	Common Name	Conservation Status	Natural Area
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	Schedule 1 (*Wildlife Conservation Act*), Vulnerable (DPAW and EPBC)	Shenton Bushland and Hollywood Reserve.
Calyptorhynchus latirostris	Carnaby's Cockatoo	Schedule 1 (*Wildlife Conservation Act*), Endangered (DPAW and EPBC). IUCN Red List of Endangered Species	All 6 natural areas
Merops ornatus	Rainbow Bee-eater	Schedule 3 (*Wildlife Conservation Act*), Migratory (Japan-Australia Migratory Bird Agreement (JAMBA))	Allen Park, Shenton Bushland, Point Resolution, Hollywood Reserve and Birdwood Parade.
Morelia spilota imbricata	Carpet Python	IUCN Red List of Threatened Species	Allen Park (unconfirmed)
Synemon gratiosa	Graceful Sunmoth	Priority 4 DPAW	Shenton Bushland

MONITORING AND SURVEYS

Weed Mapping

Background

Weed mapping is required for the effective development of priorities for weed control. Weed mapping assists with:

- Identifying the distribution and abundance of priority weed species in order to develop management actions,
- Measuring the success of weed management programs; and
- Providing records.

Survey Method

Over the years bushland condition and weeds have been mapped using different methods and cover classes therefore it is difficult to make an accurate quantitative assessment to date.

Weed mapping undertaken for the 2013 – 2018 Management Plans was carried out using specifications developed from the Department of Parks and Wildlife (DPAW) Standard Operating Procedure - SOP 22.1 *Techniques for Mapping Weed Distribution and Cover in Bushland and Wetlands*. DPAW developed these procedures in order to address the subjectivity that can be encountered when different people undertake mapping. In order to address this subjectivity DPAW developed the following cover classes.

- Individual plants (mapped as GPS points),
- Less than 5%,
- 6-75%; and
- 76-100%.

Bushland condition mapping undertaken in 2012/13 used the Keighery Scale. The mapping of bushland condition and weeds was undertaken by dividing each natural area into 20 x 20 meter polygons. This method appeared to be the most efficient way of mapping for the large area being surveyed and time and cost involved. The recording of data in 20 x 20 meter polygons also allows a systematic, measurable and repeatable means of collecting data overtime. Where each 20 x 20m polygon represents an individual unit with a GPS coordinate where specific information relating to each polygon was recorded via field notes. When bushland condition and weed mapping is undertaken in future this method will allow a quantitative assessment to be undertaken to compare changes over time.

Figure 6: Specifications for weed mapping (summarised from DPAW SOP 22.1).

1. Data Recording Methods

- Weeds are to be captured using a Global Positioning System (GPS)
- The data file should contain a minimum set of attribute data for each species
- The data should be captured using the datum of GDA94 either in geographic, coordinates (latitude, longitude); or projected in UTM (zones)
- All data needs to be recorded or transferred into electronic format compatible with a computer mapping system or GIS (e.g. ArcGIS or DECGIS)

2. Mapping Procedure

- Maps are to be appropriately annotated (legend, title, site location, date and species mapped) and hard copy maps produced
- Digital data for each species (including tables, shape files and metadata) are to be made available to the City on the completion of the mapping
- Cover classes should represent
    - Individual plants
    - Less than 5%
    - 6-75%
    - 76-100%
- Individual plants should be recorded as **points** (where each point represents an individual plant)in the following situations:
  -weeds occurring as discrete individuals
  -weeds occurring in low density and abundance
  -weeds occurring in isolated or scattered populations
  (this method is not to be used for geophytes, vines or mass seedling areas)
- Weeds should be mapped as **polygons** using cover classes where they are common frequent or abundant in part of the site with no individual outliers
- Weeds should be mapped as both **polygons** and **points** using cover classes where they are common, frequent or abundant in part of the site along with having individual outliers

Bushland Condition Mapping

Bushland condition is a measure of the degree to which vegetation has been degraded. This measure is based on the proportion of weeds and the degree to which structure (i.e. height and density of vegetation layers) have been modified. An understanding of the natural structure is required to determine whether the structure has been changed. Bushland condition is useful in tracking large changes overtime and should continue to be measured each time this Management Plan is reviewed. This allows changes to be regularly monitored and recorded.

Over the years bushland condition has been mapped using different methods and scales.

The Kaesehagen Scale (1995) was used to assess bushland condition in:

- 2004 for the Shenton Bushland Management Plan 2005 – 2010,
- 2004 for the Allen Park Management Plan 2005 - 2010; and
- 2003 for the Foreshore Reserves Management Plan 2003 - 2009

The Keighery Vegetation Condition Scale (1994) was used to assess bushland condition in:

- 2007 for the Hollywood Reserve Management Plan,
- 2009 for the Natural Area Initial Assessments (undertaken using the LBP's templates); and

- 2012 for bushland condition maps produced within this Management Plan.

Figure 7: Keighery (1994) Vegetation Condition Scale

Pristine Pristine or nearly so, no obvious signs of disturbance
Excellent Vegetation structure intact; disturbance affecting individual species; 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; 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; 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 very aggressive weeds; partial clearing; dieback; 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.

In this Management Plan the Keighery Scale was adapted to assess the impact of disturbance on vegetation structure. The condition of each natural area was assessed by dividing each reserve into 20 x 20m polygons. Each 20 x 20m polygon was provided a rating from *Very Good*, *Good, Degraded* to *Completely Degraded*. The main disturbance factors that influenced the condition rating included fire, environmental weeds, selective removal of species (from plant pathogens, frequent fires, grazing and logging for example) and clearing.

At Shenton Bushland the bushland condition assessment was rated strictly on the basis of local native species present. However all other natural areas included some areas where non-indigenous plantings had previously occurred. To avoid assessing entire portions of these natural areas as *Degraded* or *Very Degraded* they were not assessed strictly on the basis of local native species present. Non-indigenous plants in these natural areas were only rated as a disturbance if they were considered invasive to the site.

Generally accepted practice regarding assessment methodology of bushland condition has therefore been modified within this Management Plan. This is because labelling large areas as *Degraded* or *Very Degraded* even though they contained non-indigenous plants and had good cover and structure of vegetation would not provide a benefit in determining management priorities for these areas.

Flora and Fauna Surveys

Detailed flora and fauna lists have been complied for:

- Shenton Bushland and Allen Park for the 1996 and 2005 Management Plans,
- Birdwood Parade for the 2003 Management Plan,
- Point Resolution between 1953 and 1973 by A. Gardiner and for the 1991 and 2003 Management Plans,
- Hollywood Reserve for the 2001 and 2007 Management Plans; and
- Mount Claremont Oval Reserve had weed lists complied in 2006 for weed mapping and in 2008 for Natural Area Initial Assessments. No formal fauna lists have been developed for this Reserve prior to the development of this Management Plan.

New species recorded since these lists were compiled have been detailed in the relevant Management Plan for these natural areas.

Management Actions 2013 - 2018

ACTIONS	
1.	Undertake weed mapping using the Department of Parks and Wildlife (DPAW) Standard Operating Procedure SOP No: 22.1 every five years in spring.
2.	Undertake bushland condition mapping using the Keighery Bushland condition scale every five years in spring.
3.	Continue to compile a comprehensive list of species present, including fungi.

PLAN FOR MANAGEMENT

Management Boundaries

Objectives

Management boundaries are required for effective communication in terms of locations within the natural areas, and for the elimination of areas where management responsibilities, objectives or practices conflict.

The objectives of bushland boundaries are:

- To facilitate effective communication as to locations within the City,
- To provide clear delineation between parkland and bushland and their associated management practices,
- Facilitate the development of specific management practices appropriate to the different Landforms, vegetation types, levels of degradation and adjacent land uses; and
- To facilitate resource allocation to specific sites.

Background

External and internal bushland boundaries should generally be established for bushland sites. For management purposes it is important to distinguish between external boundaries such as parkland and bushland zones. This has a number of benefits including the reduction of unkempt areas between bushland and lawn. Internal bushland boundaries should be subdivided into Zones and Sites. Zones form the basis of general management and are intended to facilitate the establishment of guidelines for managing areas of similar terrain and degradation, and establishing priorities at a broad scale across reserves. Sites are targeted areas for rehabilitation within zones. They demarcate the extent of areas where specific works such as planting occurs.

Rehabilitation

Objectives

The objectives for bushland rehabilitation are to:

1. Minimise the impact of activities that could result in degradation to vegetation communities through the use of appropriate management strategies,
2. Improve the overall condition of vegetation communities; and
3. Optimise use of resources by prioritising areas for rehabilitation.

Background

Ecological restoration involves restoring the vegetation and habitats through means of reinforcing and reinstating the system's ongoing natural regenerative processes. This involves reducing or eliminating disturbance factors, removal of inhibitors to natural regeneration such as weeds, and the reconstruction of the ecosystem in highly disturbed areas where the potential for natural regeneration has been markedly reduced or lost.

The bushland condition maps can be used as a tool for determining restoration strategies such as:

1. Assisting natural regeneration in better condition bushland is often more cost effective and sustainable than reconstructing poor condition bushland; and
2. Weed control is generally most critical in the better condition bushland and replanting is usually only considered in very degraded condition bushland.

Strategy

Prioritisation

The restoration of the vegetation should aim to maintain the resilience of good condition areas while restoring disturbed areas of the site. The restoration plan should follow three basic principles of bush regeneration, collectively known as the Bradley method. This method involves selective weeding around native species to decrease competition, increase the size and number of native plants and gradually improve the condition of the bushland.

The underlying principles of this method are:

- Work from areas in good condition to areas in poor condition. Start regeneration work in areas with least disturbance to increase its resilience and then gradually work into areas with more weeds,
- Minimise disturbance while working. This is important so that regeneration work does not simply create conditions suitable for weed invasion. Minimise disturbance to soils and trampling of plants,
- Let the rate of natural regeneration determine rate of weed removal. This can be important as over-weeding will leave large bare areas that can be reinvaded by more or different weeds; and
- Assisted natural regeneration following the Bradley method should be undertaken in good condition bushland.

Performance Indicators

Bushland condition mapping can be used to measure the success of ecological restoration, as it can be used to demonstrate increases in areas of good condition, through improvements to the proportion of native species present, the structural integrity of the bushland and a decline in the number and/or level of disturbances present.

Improvement in bushland condition should also be used in determining when a restored site moves from a Reconstruction site to an Assisted Natural Regeneration Site (i.e. when the emphasis changes from replanting and weed control to weed control only).

Reconstruction

Reconstruction is often required in *Degraded* bushland areas as the exclusion of further disturbance will not lead to significant regeneration in these areas. Reconstruction will not generally produce an ecosystem as diverse as one that has regenerated itself. It requires very intensive resources over a long time frame and should not be attempted unless the resources and commitment are available to follow through to completion. Therefore reconstruction should generally be undertaken at focus areas, the boundaries of which are clearly delineated.

Revegetation

Objectives

The objectives for revegetation are to:

1. Reinstate indigenous flora and vegetation communities using local provenance seed, where they have been disturbed and/or depleted; and
2. Ensure that vegetation communities are self-sustaining and are capable of natural regeneration.

Background

Revegetation includes planting seedlings and direct seeding sites where native species have been partially or wholly lost. Revegetation is required at sites that have been sufficiently degraded and where natural regeneration is insufficient to restore the area. When revegetation occurs weeds

should not be inadvertently introduced to the site and only local provenance forms of plants should be used.

Direct Seeding
Direct seeding can be a useful technique in reconstruction areas where the level of weeds is low. However proper research should be undertaken to determine if this option will be successful at selected sites.

Replanting
Seedling planting
Native seedlings should be planted in late autumn and early winter to ensure good establishment from beneficial winter rains and should only be planted after initial winter rainfall has thoroughly moistened the soil. Seedlings which have grown beyond post-emergent stage (around four to nine months, depending on species growth rates) in tube stock (e.g. 75 x 75 x 100 mm or similar) are considered most suitable for planting. Mature stock, although less suitable, do provide an obvious statement to the general public that a regeneration programme is underway and are useful in some places. Native seedlings should include a range of ground strata, middle strata and upper strata species with a view to achieving the floristic and structural composition of the original vegetation community. Large indigenous trees should be included in annual planting programs to achieve a multi-aged population of indigenous trees across Nedlands natural areas.

Adequate ground preparation is important for good plant establishment. A small area approximately 50 cm in diameter should be cleared of weeds as thick layers of mulch can deny weed seeds access to light and thereby restrict their growth. Due to hygiene issues the use of mulch is not recommended within bushland areas and should only be used at focal sites (such as entry points). When mulch is used it should be certified pathogen-free according to Australian Standard AS4454 Composts, Soil Conditioners and Mulches this will ensure that that it is not contaminated with weed seeds or disease. It is not necessary to water plants on planting provided they are well watered before planting and the planting precedes good wetting rains.

Plants should preferably be grown from fertile seeds or cuttings collected within the natural area they are being planted in, or surrounding areas of similar vegetation type. Shenton Bushland and Allen Park (excluding Swanbourne Dunes) have only ever used plants in revegetation activities that were propagated from seed collected within or adjacent to their reserves and this practise should be continued.

Other reserves such as Point Resolution, Birdwood Parade, Mount Claremont Oval Reserve and Hollywood Reserve have all had plants used in revegetation activities propagated from seed collected from the wider Swan Coastal Plain. Due to land clearance on the Swan Coastal Plain local seed is increasingly becoming harder to source and local nurseries have to source their seed from reserves further north and south of the Perth metropolitan area. A seed bank should therefore be developed for all natural areas so that the plants propagated are sourced from the local seed stock contained within these reserves.

All propagated plants should be grown by accredited nurseries, preferably those specialising in contract growing of revegetation species. Generally no fertilisers should be used at the time of planting. Seedlings should not be staked for support (unless rabbits are found within the reserve) as free standing plants become more durable and strong. Care should also be taken to ensure that plants are not evenly spaced or planted in rows. Seedlings should be randomly clumped or spaced to achieve a natural effect.

Seed and Plant Material Collection

When seeds are collected, no more than one third of the available seed should be collected from any individual plant and numerous "parent" plants should be sourced for seed.
This avoids problems of:

1. Inbreeding where too few "parents" are used and the seedlings produced lack vigour; and
2. Genetic pollution due to the introduction of dissimilar genetic material (from a different area) which can result in sterile plants or a form of a species not native to the site becoming rampant.

The seed of some revegetation species are easily obtained from Nedlands' natural areas, however sourcing material for all species may be difficult. There is presently a dearth of information in the public domain with regard to the distances at which genetic variation becomes important for native species. The precautionary principle therefore needs to be adhered to by sourcing material as close to the City's natural areas as possible, keeping good records and noting obvious morphological differences between plants occurring onsite and seedlings planted. The City should investigate the possibility of sourcing seed from nearby and sites such as Bold Park, Kings Park, Campbell and Irwin Barracks or other adjacent Council land.

When this principle cannot be adhered to, obtaining seeds or cuttings from sites far removed from the City's natural areas can sometimes be justified. Species with good dispersal capabilities (e.g. bird or wind dispersed) can be obtained from relatively large distances, while species with poor dispersal capabilities (insect dispersed, winged seeds or vegetative reproducing) must be sourced locally.

Tuart seeds for revegetation in Allen Park have previously been obtained from Ludlow Forest as well as within the Park (Shaw, cited in Ecoscape 2005). This was done because of the difficulty of obtaining local seed. In this instance sourcing tuart seed from afield should not be a concern as '[a]part from the northerly disjunct populations [at Cervantes and Cowalla Road], gene flow, either by pollen or seed dispersal, appears to be sufficient to maintain a relatively homogeneous gene pool throughout the main range of the species' (Coates, Keighery & Broadhurst, cited in Ecoscape 2005).

Species Selection

Ideally the species used in revegetation would consist of the entire suite of plants that naturally occur within the natural area. This is not always possible as not all species can be propagated. There are also situations where certain species are favoured for planting because the can serve a specific management function such as restricting public access.

Documentation and Monitoring

It is important to collect and store data such as what, how and when actions were taken. Rehabilitation Plans should be prepared for all sites that are to be intensively managed. These need not be lengthy documents but should include as a minimum the boundary of works, a planting list, and assets (including relatively rare plants) requiring special consideration.

Documenting rehabilitation work offers an opportunity monitor and evaluate the rehabilitation work and to build on the knowledge base of the city and the wider community.

Environmental Weed Control

Environmental Weeds are plants that establish themselves in natural ecosystems and modify natural processes, resulting in the decline of the ecosystem that they invade. Impacts on ecosystem function by environmental weeds include:

- Resource competition,

- Prevention of native seedling recruitment,
- Alteration to geomorphological processes, such as increased erosion;
- Alteration of hydrological cycles,
- Changes to soil nutrient status,
- Alteration of fire regime, usually through increased fire frequency;
- Displacement of native species (both flora and fauna),
- Reduction of species and genetic diversity,
- Changes to the structure of vegetation communities, often by the removal of the shrub layer or native ground covers; and
- Acceleration of extinction rates.

The fire-weed cycle that is a primary cause of the degradation of bushland and loss of understorey species is particularly prevalent on the deep sands of the coastal plain. The shrubs, herbs and sedges are gradually replaced by weed species, notably grassy weeds as fire frequency increases. Grassy weeds have characteristics which enable them to respond quickly to fires which, in turn supports more frequent fire events, than many of the native perennial understorey shrubs. Some of the contributing factors to the fire-weed cycle are summarised below:

- Weed species are often advantaged by the increase of nutrients available immediately following a fire,
- Weed species, particularly grassy weed species, accumulate biomass rapidly, increasing fuel loads to levels that will sustain fires;
- High growth rates of weed species allows them to outcompete native species,
- Grassy weeds, and many other weed species, are able to set seed within a single year;
- Grassy fuels have a different structure to shrubby fuels. The grasses have a fine, evenly spread structure, compared with the more heterogeneous, discrete structure of native understorey shrubs. This affects fire behaviour and rate of spread, particularly in the initial stages of a fire;
- Native seeder species require time between fires not only to set seed but also to replenish their seed stocks. This may take several years. Frequent fires deplete seed stocks, rapidly eliminating these species from the species assemblage; and
- Native resprouting species (i.e. species that have an underground lignotuber) can also succumb to frequent fires if fire recurs before the new growth has had time to harden.

Disturbances that contribute to the spread of weeds include:

- Clearing,
- Trampling,
- Off-road vehicles,
- Increased fire frequency,
- Rubbish dumping, including soil and garden waste;
- Movement of weed seed; and
- Climate change that has the potential to change weed distribution

<u>Objectives</u>

The objectives for environmental weed management are to:

- Identify and control existing weeds with the highest priority for control,
- Prevent the introduction of additional weed species,
- Undertake early intervention when new weeds become established,
- Prevent further encroachment of weeds into bushland areas,
- Minimise any detrimental effects of the weed control programme on the native biota,
- Integrate the weed control programme in conjunction with bushland restoration programmes; and

- Long term commitment

Weed Control Strategy

Weed control requires prioritisation. There are two forms of weed prioritisation which include site-based management species-based management. Weeds often require a combination of site-based and weed-based management.

Site-based Management

Site-based Management is based on focal points and is developed with consideration of:

- Specific biological values requiring protection (such as Priority or Declared Rare Flora),
- The extent of infestations,
- Level of degradation (the circumstances will determine whether the worst or best sites are the initial point of control),
- Site fragility (such as coastal sand dunes),
- Reducing causes of degradation such as access tracks or weed nodes; and
- Available resources.

Site–based weed control should be focused at sites where either:

- Intensive rehabilitation efforts are being undertaken,
- Where weeds are contributing to an acceptable fuel load near vulnerable property; or
- There is low weed cover and in areas of good condition bushland.

Species-based Management

The prioritisation of weeds for control is critical given that:

- There is a high distribution and abundance of weed species across Nedlands natural areas,
- The effectiveness of controls varies between species,
- The methods and intensity of control vary between weed species,
- The impact of weeds in terms of their ability to displace native plants varies between species and sites; and
- The removal of easily controllable weeds can facilitate the greater proliferation of more difficult to control weeds.

Legislative Responsibilities

Legislative responsibilities in relation to environmental weed management have been identified at local, state and national levels.

Weeds of National Significance (WONS) – Commonwealth of Australia DSEWPAC 2012

Thirty two Weeds of National Significance (WONS) have been identified by Australian governments based on their invasiveness, potential for spread and environmental, social and economic impacts. A list of 20 WONS weeds was endorsed in 1999 and a further 12 were added in 2012.

WONS weeds include plants of concern in natural areas, waterways or agricultural land the species that have been identified as WONS weeds were selected due to their level of invasiveness, potential to spread, and impact on socioeconomic and environmental assets (Commonwealth of Australia 2007). The WONS list includes several weeds found in Western Australia.

The City of Nedlands has the following WONS Weeds shown in Table 6 on the following page.

Table 6: WONS Weeds in the City's Natural Areas

Species	Common Name	Natural Area
Asparagus asparagoides	Bridal Creeper	All 6 natural areas
Lantana camara	Common Lantana	Birdwood Parade
Lyceum ferocissimum	African Boxthorn	Allen Park, Mount Claremont Oval and Point Resolution
Tamarix aphylla	Athel Pine	Allen Park

Agriculture and Related Resources Act 1976 (ARRPA)

The Agriculture and Related Resources Act 1976 identifies Declared Plants. High priority weeds that are or may become a problem to agriculture or the environment and are officially 'declared'. When a plant becomes declared, specific control strategies are required and whether they are found on a public or private property. Declared plants must be controlled by landowners or managers. In addition to declared plants under the ARRPA, there is also provision for a shire council to prescribe any plant, other than a declared plant, as a pest plant within its municipality.

Biosecurity and Agriculture Management Act 2007 (BAM Act) - enacted May 2013.

The purpose of the BAM Act is to:

- prevent new animal and plant pests (vermin and weeds) and diseases from entering Western Australia,
- manage the impact and spread of those pests already present in the State,
- safely manage the use of agricultural and veterinary chemicals; and
- ensure that agricultural products are not contaminated by chemical residues.

The Western Australian Organism List (WAOL) details the status of Organisms have been classified as part of the enactment of the *Biosecurity and Agriculture Management Act 2007* (BAM Act). WAOL groups organisms into four main classifications:

- Declared pests (section 22),
- Permitted (section 11),
- Prohibited (section 12), and
- Permitted Requiring a permit (73, BAM Regulations 2013)

Under the BAM Act, all declared pests are placed in one of three categories, including C1 (exclusion), C2 (eradication) or C3 (management). The City of Nedlands has the following WAOL listed declared weeds that are all classed as C3 (management):

Table 7: WAOL Listed Declared Weeds in the City's Natural Areas

Species	Common Name	Natural Area
Asparagus asparagoides	Bridal Creeper	All 6 natural areas
Lantana camara	Common Lantana	Birdwood Parade
Moraea flaccida	One-leaf Cape Tulip	Shenton Bushland, Hollywood Reserve
Tamarix aphylla	Athel Pine	Allen Park

The Environmental Weed Strategy for Western Australia 1999 (EWSWA)

The Environmental Weed Strategy for Western Australia (EWSWA) provided a basis for determining which weeds were most critical to control. The 3 characteristics used for determining the ratings for

environmental weeds in the EWSWA strategy were invasiveness, distribution and environmental Impacts. The ENSWA strategy is still considered relevant however Appendix 3, the "List of Environmental Weed Species of Actual and Potential Significance in WA" is out dated.

Invasive Plant Prioritisation Process (DPAW)

In 2008 in order to progress the EWSWA strategy and update the weed ratings the Invasive Plant Prioritisation Process for the DEC (now DPAW) was undertaken. A species led prioritisation process was undertaken, that focussed on several NRM regions including the Swan NRM Region. To assess environmental weeds in order to identify the most threatening species those species with high ecological impacts, high to extensive potential distribution and moderate to rapid rates of spread were ranked with a high (H) to very high (VH) management priority. A 30 highest priority weed list was also developed.

City of Nedlands Priority Weeds for Management

The following list has been compiled from:

- The Swan Region Assessment 2008,
- 30 highest priority weeds for the Swan Region 2008,
- State and federal weed lists,
- Local knowledge from friends groups that assisted with the development of a priority list for weeds to be mapped; and
- Their ability to be controlled without causing disturbance to natural areas.

Table 8: Priority Weeds in the City of Nedlands Natural Areas.

Species Name	Common Name	DPAW Invasive Plant Prioritisation Rating
Acacia iteaphylla	Flinders Range Wattle	Further Assessment Required (FAR)
Arctotheca calendula	Capeweed	High
Avena fatua	Wild Oat	Very High
Asparagus asparagoides	Bridal Creeper	Very High , 30 highest listed, WONS listed
Babiana angustifolia	Baboon Flower	Very High
Brassica barrelieri subsp. oxyrrhina	Smooth Stem Turnip	High
Brachychiton populneus	Kurrajong	High
Centranthus macrosiphon	Pretty Betsy	Medium/High
Chasmanthe floribunda	African Cornflag	Medium
Cynodon dactylon	Couch	Very High , 30 highest listed
Ehrharta calycina	Perennial Veldt Grass	Very High , 30 highest listed
Euphorbia paralias	Sea Spurge	Medium
Euphorbia terracina	Geraldton Carnation Weed	Very High , 30 highest listed
Ferraria crispa	Black Flag	Very High , 30 highest listed
Ficus carica	Edible Fig	High
Freesia alba x leichtlinii	Freesia	Very High, 30 highest listed
Fumaria capreolata	Climbing Fumitory	Medium/High
Gladiolus angustus	Long Tubed Painted Lady	High
Gladiolus undulatus	Wavy Gladiolus	Very High
Ixia maculata	Yellow Ixia	High
Lachenalia aloides	Soldiers	High
Lachenalia bulbifera	Soldiers	High

Species Name	Common Name	DEC Invasive Plant Prioritisation Rating
Lachenalia reflexa	Soldiers	Very High , 30 highest listed
Lantana camara	Common Lantana	Medium, WONS listed
Leptospermum laevigatum	Coast Teatree	Very High , 30 highest listed
Lupinus angustifolius	Narrowleaf Lupin	Unrated
Lupinus cosentinii	Sandplain Lupin	Unrated
Lycium ferocissimum	African Boxthorn	Very High , WONS listed
Moraea flaccida	One-leaf Cape Tulip	Very High , 30 highest listed, P1
Olea europaea subsp. Europaea	Olive	High
Oxalis pes-caprae	Soursob	High
Pelargonium capitatum	Rose Pelargonium	Medium/High
Pennisetum clandestinum	Kikuyu Grass	High
Pennisetum setaceum	Fountain Grass	Medium
Schinus terebinthifolius	Brazilian Pepper Tree	Very High , 30 highest listed
Sparaxis bulbifera	Sparaxis	Very High , 30 highest listed
Stenotaphrum secundatum	Buffalo Grass	High
Tamarix aphylla	Athel Pine	High , WONS listed
Watsonia meriana var. bulbillifera	Watsonia	High, 30 highest listed

Table 9: Alert Weed in the City of Nedlands

Species Name	Common Name	Notes
Acacia longifolia	Sydney Golden Wattle	Previously removed from Shenton Bushland and Point Resolution
Hyparrhenia hirta	Tambookie Grass	Found on west coast highway north of Allen Park
Retama raetam	White Broom	Found on west coast highway north of Allen Park

A list of priority weeds has also been developed for each natural area which are detailed in the relevant Management Plan for these areas.

Integrated Weed Management

The aim of integrated weed management is to use of a combination of different techniques to maintain weed density and cover at manageable levels. Hand weeding is preferred over herbicide use however it is not suitable for all weeds (such as geophytes or grass weeds occurring across large areas). Hand weeding is also very costly and time consuming which could potentially reduce the effectiveness of the City's natural area management program if it was undertaken in isolation to other weed control methods.

The City uses a combination of manual, chemical and biological control methods in order to control environmental weeds in natural areas. Each priority weed listed in Table 8 will be managed according to the management notes provided on the DPAW's Florabase website see http://florabase.dec.wa.gov.au Appendix 1: Details the management strategy for all priority weeds in the City.

Consideration should also be given to the management of weeds at different sites as some native species are considered weeds at particular reserves as they have been planted outside their natural range and distribution. For example W.A Peppermints are a weed in Hollywood Reserve along with *Acacia saligna* which is invading burnt sites. If these species are left untreated they have the potential to displace native species. However, WA Peppermints are considered native at Allen Park and Point Resolution and control of these species is not recommended in these reserves.

The City of Nedlands has contracts for bushland herbicide spraying. Only spot spraying of specific target weeds is undertaken in the City's natural areas. The contracts outline risk management, specifications for herbicide spraying, insurance and license requirements. Contractors undertaking herbicide spraying are supervised by City staff. All contractors undertaking work in the City's natural areas have relevant Department of Health licenses and undertake spraying in accordance with Department of Health *(Pesticides) Regulations 2011*.

Management Actions 2013 - 2018

ACTIONS	
REHABILITATION	
1.	Restoration should follow the three basic principles of the Bradley Method.
REVEGETATION	
2.	Develop Rehabilitation Plans for all sites to be intensively managed. These should include as a minimum the boundary of works, a planting list and native plants present that require protection.
3.	Only use plant species and forms of plants for rehabilitation if they would have naturally occurred at the sites.
4.	Prepare seed banks for all reserves for use in revegetation programs.
5.	For internal management purposes establish a monitoring program for indigenous species, with the location and abundance of species in very low abundance recorded.
6.	Document any locally occurring native species that are re-introduced to natural areas.
7.	Include large indigenous trees in annual planting programs.
WEED CONTROL	
8.	Use an integrated approach to weed control including herbicides, manual removal, modifying microclimates (in terms of shade, moisture etc) and biological controls (such as Bridal Creeper Leafhopper and the Rust, *Puccinia myrsiphylli.*
9.	Refer to the Department of Parks and Wildlife's (DPAW) Management Notes detailed on Florabase for target weeds species.

PLANT PATHOGEN MANAGEMENT

Objectives

The objectives for plant pathogen management within the City's natural areas are to:

1. Prevent the introduction of plant pathogens and prevent further spread of existing plant pathogens; and
2. Monitor vegetation for the presence of plant pathogens such as *Phytophthora sp*, *Armillaria, Quambalaria* coyrecup (cause of Marri canker) and other plant pathogens.

Background

Plant pathogens consist of organisms such as fungi, bacteria and viruses that cause plant diseases. Plant pathogens naturally occur within soil and plants, and are considered to be an important part of a natural functioning healthy ecosystem. However, some plant pathogens have been introduced to new areas through the movement of soil and vegetation. These pathogens may survive in the soil or within plant tissues for long periods without causing an outbreak of serious disease. Disease outbreaks occur if there are increases in the population of the pathogen, alteration to a more favourable environment, or increases in the vulnerability of the plant (as a result of stress caused by factors such as drought, water logging or mechanical damage to the trunk).

Following significant tree decline and death across Nedlands parks, natural areas and streetscapes in 2010, a broad disease survey was undertaken across eight reserves. The reserves surveyed included Point Resolution Reserve, Birdwood Parade, Shenton Bushland, Mount Claremont Oval Reserve, Allen Park, Hollywood Reserve, Mooro Park and Pine Tree Park. Approximately 100 samples were collected for testing for the presence of *Phytophthora* species along with the examination of a range of abiotic (non living) and biotic (living) factors for their impact upon each tree. The survey focused on the three iconic endemic species of Tuart *(Eucalyptus gomphocephala*), Jarrah *(Eucalyptus marginata*) and Marri *(Corymbia calophylla*). Subsequently, 62 trees were treated with systemic implants to mitigate their decline and improve their health and resilience.

The key results found that six out of eight reserves surveyed tested positive for *Phytophthora* species, including *Phytophthora multivora*, *Phytophthora sp. ohioensis and Phytophthora aff. arenaria.* The two reserves that did not test positive for *Phytophthora* included Shenton Bushland and Pine Tree Park. In addition to isolating *Phytophthora* species other biotic and abiotic symptoms contributing to tree death and decline were identified as resulting from drought, nutrient deficiencies, fungal canker pathogens, stem boring insects and mechanical damage. The results for the City's natural areas are shown in Table 10 below.

Table 10: Results of Plant Pathogen Survey 2010.

Natural Area	*Phytophthora multivora*	*Phytophthora aff. arenaria*	*Phytophthora sp. ohioensis*	*Armillaria luteobubalina*	*Canker Diseases*
Shenton Bushland					**x**
Allen Park	**x**		**x (in carpark area)**	**Possible – not confirmed**	**x**
Hollywood Reserve	**x**			**Possible – not confirmed**	**x**
Birdwood Parade	**x**	**x**		**Possible – not confirmed**	**x**
Point Resolution	**x**	**x**		**x**	
Mount Claremont Oval				**x**	

Pathogens and Diseases

Phytophthora dieback

This disease is caused by the genus of water mould *Phytophthora*, a very well documented genus throughout the world limiting the production of many agricultural and forest crops. It is one of the most devastating pathogens of forests worldwide. The Latin name is derived from the Greek for "plant killer". This group of organisms is incredibly well adapted to a wide range of environmental conditions, spreading rapidly in wet conditions via swimming zoospores, and surviving extended dry periods through thick walled chlamydospores or oospores. Most species within this genus cause disease of the roots, but some can cause severe disease of the lower and upper stems and foliage.

The most well-known of the *Phytophthora* species occurring in Australia is *P. cinnamomi.* This pathogen is a national and Western Australian (W.A.) state listed threat to biodiversity. More than 2000 native plant species are susceptible. The pathogen survives in soil and plant tissue and can readily be moved around the environment in these media. It is generally regarded as not commonly occurring on the calcareous sands of the coastal dunes, preferring soils of lower pH. This is only one of many species of *Phytophthora* that are now known to occur within WA.

Soil movement through human activities is perhaps the biggest factor contributing to the spread of *Phytophthora* species. Infected soil can be moved around on vehicles, bikes, footwear, animals and through construction and maintenance activities. Nurseries and infected stock are suspected of being one of the biggest sources of introduction of *Phytophthora* into new areas. *Phytophthora* may be moved through infected green waste mulch that has not been properly composted. Management of *Phytophthora cinnamomi* has been successful using a combination of hygiene and treatment of the host with chemicals such as phosphite. More recently, the use of a combination of novel systemic implants has shown promise for the suppression of the pathogen and improvement in crown condition.

Phytophthora multivora

This pathogen was recently described and has been widely found throughout the south west of WA. It is associated with a range of *Phytophthora* sensitive indicator species. However, it is the only *Phytophthora* species that has been found in association with declining Tuart along the Swan Coastal Plain. It appears to have a much greater tolerance of the higher pH soils of the Spearwood and Quindalup Dune Systems when compared to *P. cinnamomi*.

Phytophthora aff. *arenaria*

Morphologically this species is very similar to the recently described *P. arenaria*. According to DNA analysis however, it is slightly different and appears to be an undescribed species, new to science. Knowledge of this pathogen is therefore very limited and further research will be required to determine effective management strategies.

Phytophthora sp. *ohioensis*

According to DNA analysis *Phytophthora sp. ohioensis* that was isolated in the surveys undertaken in the City of Nedlands is an exact match with an undescribed species from overseas. Therefore it has been given the tentative name *Phytophthora* sp*. ohioensis*. All that is known about this species is that it was isolated from oak forest soil in Ohio, USA. Knowledge of this pathogen is therefore very limited and further research will be required to determine effective management strategies.

Armillaria luteobubalina (Honey Fungus)

Armillaria, is a mushroom-producing parasitic soil borne fungus that causes collar and root rot of a wide variety of plants. It is native to W.A. and lives off both live and dead hosts. It occurs across many vegetation types and plant families and genera including those found on the Swan Coastal Plain.

Armillaria does not survive in soil but spreads from a woody food source, such as a tree, stump or piece of infected root. As the root systems of many trees are in contact with each other the fungus is able to move to nearby healthy trees. Once it has infected the roots of a tree it reduces the function of plant roots which affects the internal structure of the tree, often resulting in a slow decline in health and eventually death. It can be found in conjunction with *Phytophthora,* and is thought to infect hosts through wounds or lesions induced by *Phytophthora. Armillaria* appears as a golden yellow fruiting body at the base of tree stumps around May to September. Other signs of the presence of *Armillaria* can include large inverted V shaped lesions at the base of trees, or white mycelial webs just beneath the bark. Trees that have been affected by *Armillaria* for some years can fail due to the decay of the large lateral roots or basal stem.

Unlike *Phytophthora*, movement of soil does not affect the spread of the *Armillaria*. However, its spread is thought to be favoured by disturbance, irrigation, and the use of diseased, untreated mulch and movement of plant material. Once established management is extremely difficult and expensive as it requires removing all infected stumps and roots from the site. No commercial fungicides or chemicals are currently known to control or eradicate this pathogen, although there has been some success in improving the crown health of diseased trees through systemic treatments.

Canker Diseases

Canker diseases on native W.A. trees are most commonly caused by fungal pathogens such as *Quambalaria coyrecup* (cause of Marri canker) or *Botryosphaeria.* They are largely air, splash or wind dispersed fungi that can affect a wide range of host species throughout south west WA. Occurrence of these pathogens is dependent on a combination of the availability of a susceptible host, the infective pathogen, and the ideal environmental conditions. Canker pathogens may either invade stem tissues and penetrate the bark layer, usually via a wound, or be present within the plant tissue as latent pathogens. Over-pruning of limbs, causing unnecessary wounding, can produce suitable infection sites for initiation and development of canker disease. Following the onset of suitable conditions, or a trigger stress event (e.g. hailstorm, drought), the canker pathogen may develop and cause small lesions known as 'cankers' beneath the bark of the minor or main stems. As cankers develop over time they may eventually girdle entire stems causing their death, and even cause tree mortality if severe. A good example is the marri canker pathogen, *Quambalaria coyrecup.* This pathogen also affects the red flowering gum and has been responsible for a widespread epidemic throughout south-west WA on Marri, and the destruction of most of the trees that existed along Fraser Avenue in Kings Park prior to replacement with the now existent and resistant Lemon-Scented Gums. Canker pathogens can be responsible for serious limb failures of trees, causing damage to life and property, particularly throughout the urban area. Healthy trees not subjected to stress or wounds are unlikely to be severely affected. There is no large scale control method for canker pathogens, however, a combination of sound arboricultural practices and systemic treatments has recently shown some promising results.

Myrtle rust (*Puccinia psidii sensu lato*)

Myrtle rust is a fungus that causes disease in plants in the family Myrtaceae. Myrtle rust is also known as eucalyptus rust or guava rust. While there are no confirmed reports of myrtle rust in Western Australia, it has been placed on alert by DPAW.

Management Strategies

The plant pathogens *Phytophthora*, *Armillaria* and *Quambalaria coyrecup* have been identified within the study area. Other biotic and abiotic factors including drought stress, nutrient deficiencies, stem boring insects and mechanical damage have also been identified as contributing to the decline in health of vegetation and facilitating pathogen infection and development. Management of these pathogens should primarily focus on the prevention of their introduction into an area as once they

are introduced they are extremely difficult to eradicate. Standard hygiene procedures that minimise the introduction and spread of infected soil or plant material should be implemented and maintained. In addition, maintaining the health of the existing population of flora is important to increase the resistance to any potential infection. For example, reducing pruning of canker-susceptible trees to limbs that are only deemed to be an unacceptable risk to life or property, avoiding over-irrigation in turfed areas, increasing the healthy microbial communities in the soil, or improving the nutrition of trees via systemic or soil treatments. If the pathogens are detected within an area, procedures should be implemented to systemically treat these trees to control the pathogens, ensure infested soil or plant material is not moved within or outside the site, and trees adjacent to infected trees are treated as a preventative to infection as this is always more effective than treated as a curative.

Management Actions 2013 - 2018

ACTIONS	
1.	Maintain hygiene protocols for Council operations and contractors within bushland reserves.
2.	Establish hygiene protocols for Friends Group activities.
3.	Ensure that any soil or plant material used for bushland restoration is pathogen free.
4.	Minimise operations involving movement of soil, such as track construction and maintenance and carry out these operations under strict hygiene practices such as pressure cleaning machinery and vehicles.
5.	Ensure that nurseries contracted for revegetation programs are accredited by the Nursery and Garden Industry of Western Australia (NAISA) and are free of Phytophthora.
6.	When restoration work is undertaken begin in the reserves where *Phytophthora* has not been found and then proceed in the other reserves.
7.	Ensure no soil or plant material is transferred between reserves or restoration sites by brushing excess soil off clothing, machinery and equipment, and sterilising with 70% solutions of methylated spirits.
8.	Ensure pruning equipment is sprayed with a 70% solution of methylated spirits (or similar) before, after and between pruning trees and shrubs; and before and after hedging large sections of vegetation.
9.	Ensure that any soil, mulch or plant material used for bushland restoration is certified pathogen-free according to Australian Standard AS4454 for Composts, Soil Conditioners and Mulches.
10.	Apply systemic treatments (when funding is available) to vegetation that has tested positive to *Phytophthora* and surrounding vegetation, to prevent premature decline from pathogens and abiotic factors.
11.	Implement the Western Australian Dieback Signage System within bushland areas know to have *Phytophthora*.
12.	Review the Nedlands Dieback Management Plan in accordance with Council Policy to include plant pathogens and guide the management for City staff, community groups and contractors for areas that are known to have plant pathogens.

FIRE MANAGEMENT

Objectives

The objectives for fire management are to ensure:

- Protection of human life,
- Protection of public and private property,
- Fulfilment of obligations under fire legislation,
- Reduction of the area, frequency and impact of fires,
- Minimisation of the impacts of fire on air quality; and
- Protection of ecological integrity and biological values.

Background

The City of Nedlands has Fire Control Working Plans for all six natural areas that were developed in conjunction with DFES and relevant community groups. The City undertakes maintenance of firebreaks prior to the 30th November in all the City's natural areas. Fuel load reduction work is also undertaken as required when native or introduced vegetation dies.

Shenton Bushland

- Grace Vaughn House,
- Selby Older Adult Mental Health Service,
- Shenton Dogs Refuge,
- Building on Irwin Barracks,
- Child Care Centre Stubbs Terrace,
- Designated "Conservation Zones"; and
- Remaining 26 Tuart (*Eucalyptus gomphocephala*) on site.

Allen Park

- The Heritage Precinct Houses,
- Residences along Coast Rise, Sayer Street, Dune court, Island View Place, Horizon Court, Breeze Place and Wood Street,
- The Western Power box on Jameson Street,
- The Rugby Clubhouse,
- Rottnest Island Pines (*Callitris preissii*) trees that are fire sensitive; and
- A number of species that are limited including, Broom Ballart (*Exocarpos sparteus*), Hairy Yellow Pea (*Gompholobium tomentosum*), Fanflower (*Scaevola thesioides)*, Coast Beard Heath (*Leucopogon parviflorus*), and Yellow Leschenaultia *(Leschenaultia linarioides)*.

Hollywood Reserve

- Office of the Australian War Graves,
- Metropolitan Cemeteries Board depot; and
- Rottnest Island Pines that are fire sensitive.

Birdwood Parade

- Residence on the Avenue and the Esplanade,
- Gallop House; and
- Rottnest Island Pines that are fire sensitive.

Point Resolution

- Residence at 68 Jutland Parade and 166 Victoria Avenue,
- The three 100 year old Olive Trees that have historical significance,

- Board walk; and
- Rottnest Island Pines that are fire sensitive.

Mount Claremont Oval Reserve
- Lisle Villages.

Responsibilities

Local governments are vested with responsibilities under the Bush Fires Act 1954 in relation to the prevention, control and extinguishment of bushfires. The Department of Fire and Emergency Services (DFES) is responsible for fire extinguishment within DFES Gazetted Fire Districts such as Nedlands.

Bush fire planning principles were developed by the Department of Planning in collaboration with DFES and are contained within *Planning for Bush Fire Protection Guidelines (Edition 2)*. These guidelines encourage local governments to be more proactive in providing a better approach to bush fire management when:

- Managing bush fire risk,
- Managing bush fire hazards,
- Planning land developments; and
- Establishing new communities.

Bush Fire Risk Assessments

In order to provide a better approach to bush fire management and to ensure compliance with relevant legislation and guidelines the City is currently undertaking bush fire risk assessments across all natural areas with the aim of undertaking bush fire risk assessments every two years. These assessments will:

- Assess fuel hazards across all natural areas,
- Undertake Bushfire Attack Level (BAL) assessments for identified values including critical infrastructure and residential areas,
- Determine and map bushfire hazards using DFES Bushfire Threat Analysis; and
- Provide a fire management plan with recommendations to mitigate identified hazards.

The assessments and any associated recommendations will incorporate the following:

- AS 3959 - 2009 Construction of Buildings in Bushfire Prone Areas,
- Planning for Bushfire Protection Guidelines, Edition 2 (Department of Planning),
- AS/NZS ISO 31000:2009 Risk management - Principles and Guidelines; and
- Main Roads WA-Operational Guideline 94- Roadside Vegetation Management and Fire Hazard Control.

Following these assessments any recommendations identified for fuel loading reduction or access for fire fighting vehicles will be implemented in consultation with relevant friends groups.

Ecological Impacts of Fire

Fire is a natural component of Swan Coastal Plain ecosystems with the majority of plants having developed adaptations to fire. Many species have the ability to reproduce following fire by either resprouting from underground storage systems or utilising seed stored in the soil or seed material and are able to germinate with assistance from heat or smoke. Long term diversity and composition

of native plants species is therefore dependant on fire. However the timing, frequency and intensity of fire regimes is a complex issue and frequent fires can be very damaging to species composition of flora and the fauna it supports.

Fragmented remnant urban bushland areas such as those found in Nedlands have had a history of frequent fires. This has had a devastating impact on the biodiversity values of these areas. Fire has the ability to modify bushland areas in the following ways:

- Promotion of weed growth especially grass weeds,
- Reduction of the natural regeneration potential of the bushland as recruiting seedlings die before they can set seed,
- Alteration of floristic and fauna species composition,
- Alteration of habitat requirements for fauna,
- Threats to the viability of rare, endangered or geographically restricted species; and
- Threats to the viability of obligate seeder species (which are typically more sensitive to fire than lignotuberous species that can resprout following fire).

This is evident from the lack of a multi aged population of native trees in many of Nedlands natural areas such as Tuart (*Eucalytpus gomphocephala*), Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) which require several years in order to produce seed. Another example is Rottnest Island Pines which require approximately fifteen years between fires to mature and produce adequate seed. They are easily killed by fires which have contributed to their population decline on the Swan Coastal Plain with most of their natural populations now restricted to Rottnest and Garden Islands.

The 2005 – 2010 Shenton Bushland Management Plan and the 2005 – 2010 Allen Park Management Plan prepared by Ecoscape detailed the influence that fire had on species composition and structural diversity using specific examples of species occurring in those reserves. Please refer to these Management Plans for more detail.

According to the Local Biodiversity Guidelines for Bushland Management:

> "*At the landscape scale, fire diversity can promote biodiversity, but some fire regimes together with other threatening processes such as fragmentation and invasion by weeds and other exotic pests, can threaten biodiversity".*

Fires at intervals more frequent than the natural regenerative capacity of the vegetation can promote the spread of exotic weeds by favouring conditions for their growth such as:

- Increased light penetration through burnt-out overstorey,
- Favouring species adapted to increased reproduction following fire such as grass weeds;
- Reduced competition from native perennial species; and
- Increased availability of nutrients.

Fire increases weed growth, particularly annual grass weeds, which greatly increases fire risk in the following interrelated ways:

- Formation of a fine-textured fuel which is highly flammable,
- Production of increased fuel loads in comparison to native plants,
- Formation of a continuous fuel bed, increasing the rate of fire spread as natural vegetation structure is usually more open than dense grass weed infestations; and
- Creation of a very hot fire at ground level.

This leads to a "fire weed cycle" of increased weed growth leading to increased fire risk and thus increased fire intensity and frequency, which in turn leads to increased weed growth. The fire weed cycle can quickly lead to a greatly reduced diversity of native flora and fauna.

Although fire is a natural part of the ecology on the Swan Coastal Plain the current environmental conditions are very different to the natural situation, for the following reasons:

- The remnant urban vegetation remaining is fragmented and often small,
- Climate change has the potential to increase natural fire frequency; and
- The risk of fire ignition due to arson is high in the urban environment.

Considering the damaging effects of frequent fires the City of Nedlands should:

- Establish suppression as the primary form of fire management in all natural areas,
- Restrict unnecessary vehicle access through reserves; and
- Establish a system for documenting fires and their control.

Strategy

Fire management within the City's natural areas consists of the following 3 core element

- Hazard reduction,
- Fire suppression; and
- Post-fire recovery and incident analysis.

Hazard Reduction

The purpose of hazard reduction is to reduce the frequency of ignitions, either accidental or deliberate, and minimise the extent of fires within the bushland. A further aim is to minimise adverse environmental impacts of any fires that do occur. Hazard reduction involves fuel and ignition reduction.

Strategic or controlled burns in urban bushland such as those found in Nedlands are not recommended. Controlled burns have been discontinued in Kings Park because they were considered counterproductive. A comparison of the prescribed block burning program in Kings Park (1954 – 1962) with later fire suppression regimes revealed that the area burnt by wildfire did not vary significantly but that the total area burnt decreased dramatically when prescribed burns were not conducted. Occasional fires will not necessarily lead to the demise of species but regular and frequent fires will lead to the increase of short-lived herbs and some grasses at the expense of other species.

Low Fuel Sites

The most effective manner in which fuel loads can be minimised throughout the bushland is to reduce the abundance of exotic perennial grasses (such as African Veldt Grass). Perennial grasses die back in summer whilst maintaining their root base of which provides fuel loading removal of perennial grasses will reduce fuel loading along with improving the native species composition of species that were out competed by perennial grass weeds.

Low fuel sites can also be created by spreading dead wood through the bushland to reduce high fuel loads in certain areas where vegetation has died or been burnt. This also assists in nutrient recycling and providing and maintaining habitat for fauna. Low fuel areas also include firebreaks, tracks, roads, adjacent park land areas and carparks.

Another way of creating low fuel sites is by revegetating sites with species that have low flammability such as *Carpobrotus virescens* and *Rhagodia baccata*. This should only be considered on the periphery areas adjacent to infrastructure.

Ignition Reduction and Fire Suppression

Whilst fires are infrequent within Nedlands natural areas it is worth noting that 48% of fires over a 50 year period in Kings Park are known to be due to arson and that large fires occur every 10-15

years during extreme conditions (Dixon, cited in Ecoscape 2005 [2]). Fire suppression involves fire-fighting applications once a fire has started and taken hold.

Shenton Bushland and Hollywood Reserve fall under the jurisdiction of the Daglish Fire Station and Allen Park, Mount Claremont Oval and Point Resolution the Claremont Fire Station, with Birdwood Parade split between both jurisdictions.

Daglish Fire Station Contact Details

Street Address	221 Stubbs Terrace DAGLISH WA 6008
Telephone	+61 8 9381 1222

Claremont Fire Station Contact Details

Street Address	8 Congdon Street CLAREMONT WA 6010
Telephone	+61 8 9382 2222

Post-fire Recovery and Incident Analysis

Bushland areas are in a highly sensitive condition following fire. The soil is left bare and sensitive to erosion processes, such as from vehicle and pedestrian movements, heavy rain and wind. Following fires an initial assessment of the area should be undertaken to address informal access. Access control measures should be implemented as soon as possible and should be limited to management purposes for the first six to twelve months.

The site should be monitored for seed germination and resprouting vegetation and weed occurrences for a year following fire. Although regeneration should be adequate where access and weed control measures are implemented, additional direct seeding and tubestock replanting may need to be considered if regeneration is low. Following fire, weed species have an opportunity to increase in density and abundance. Weed control measures will need to be implemented if a fire occurs. The post-fire environment is susceptible to further damage, and weed control works should be undertaken at a time that will give the bushland the greatest chance of successful regeneration. Weed control should therefore be revised after each fire and the need for additional funds to maximise cost effective control of weeds such as Perennial Veldt Grass should be examined at this time.

Fire fighting operations have the potential to cause mechanical damage through trampling of vegetation, water erosion and small scale clearing. This cannot be entirely avoided though should be minimised where possible. Trained bush regenerators should carry out reparation of mechanical damage. Post-fire incident analysis is an important facet of fire management which enables fire fighters and fire control authorities to review procedures, strategies and tactics and revise them in light of experience. All fires that occur within the park should be recorded. Information that should be compiled includes the date, season, time, cause of ignition, intensity and extent of the fire, fire control methods used and damage caused by the fire. This information can be used for long-term fire management planning.

Fire Control Plan

Fire Control Working Plan is a generic term for documents that specify resource available for, and the manner in which fires are to be controlled for a site. This document, should be reviewed annually and identify vulnerable property and environment assets, contact details of key

stakeholders, risk management strategies, hazards, access, fire suppression strategies and fire suppression tactics. The City of Nedlands has developed Fire Pre-Plans in conjunction with FESA for the large bushland reserves of Point Resolution, Allen Park, Shenton Bushland and Hollywood Reserve. The Bush Fire assessments and associated management plan currently being developed will also form part of the fire control plan and should be reviewed biennially.

Fire History

In the last five years areas of less than one hectare have been burnt at Point Resolution, Shenton Bushland, Swanbourne Dunes and Hollywood Reserve. The details are listed below.

Shenton Bushland fire history since 1997:

- Middle area of "The Barrens" 2010,
- Eastern side of "The Barrens" 2009 – an area used by school children,
- South - eastern area during Royal show time 2008. Many fires were lit along Stubbs Terrace the same day; and
- 10.3Ha in 1997.

Point Resolution fire history since 2007:

- The southern foreshore restoration area was burnt in 2010.

Hollywood Reserve fire history since 2007:

- Approx. 1 Ha January 2011 near the Metropolitan Cemeteries Board depot.

Allen Park fire history since 2007

- Western edge of Bush Forever Site – Swanbourne Dunes 2010.

Fire history maps have been detailed in the relevant Management Plan for these areas.

Management Actions 2013 – 2018

ACTIONS	
1.	Fires bans should be instigated and maintained at all times.
2.	Reduce fuel loads through control of weeds such as Perennial Veldt Grass.
3.	Suppress and contain any wildfires within the study area as quickly as possible.
4.	Document fire history with the extent of fires mapped, and dates and causes recorded.
5.	Control access into burnt areas as soon as possible after the fire. Access to any burnt areas should be limited to management vehicles only for the first six to twelve months.
6.	Monitor seed germination and regeneration of vegetation for two years following fire.
7.	Carry out an intensive weed control program after each fire and monitor weed and native species recolonisation to maximise native species establishment.
8.	Do not establish new tracks during fire fighting operations.
9.	Install interpretive signage regarding the dangers of wildfires and the destructive effects of frequent fires on flora and fauna.
10.	Provide a fire contingency fund in the natural area budget for reactive weed management and tree pruning/removal following fires.
11.	Annually update Fire Response Plans with FESA.
12.	Undertake maintenance of fire breaks and access points annually prior to 30th November.
13.	Investigate the installation of fencing along Cleland Street at Mount Claremont Oval Reserve to reduce illegal access.

ACCESS

Objectives

The objectives for maintaining, rationalising or upgrading access within the City's natural areas is to:

- Provide safe access for the public's use of natural areas; and
- Provide access for Council works programs and fire fighting.

These objectives need to be implemented with consideration to construction and maintenance costs minimising perimeter to area ratios for bushland and whether they facilitate public entry into unsafe areas (such as cliffs).

Background

Access is presently managed through paths, signs and fences. The original paths through the majority of the City's natural areas were constructed of crushed limestone of which have deteriorated over time. Maps of path networks and fences have been detailed in the relevant Management Plan for these areas.

In order to address this, the City developed the "Natural Area Path Network Policy". This policy outlines how the City of Nedlands will upgrade the natural area path network to an acceptable standard in accordance with Australian Standards (where possible). The most appropriate path material has been identified as red asphalt due to it durability over time. The City's Corporate Business Plan and natural area path network forward works program outlines the funding requirements and program to upgrade all the City's natural area paths over a ten year period.

Path Network

There is already an established path network in all natural areas of which is considered adequate these are shown in the map sections for each natural area in the relevant natural area. The path networks consist of different materials including crushed limestone, sand, concrete and bitumen. The paths in Allen Park have had informal names used by the Friends of Allen Park over the years. Recently, through the Whadjuk trails project, their names have been formalised with Aboriginal names.

Signage

Signage aims to reduce issues with informal access and dumping in the City's natural areas and consists of 'Cliff Risk', 'Let it Grow', 'No Dumping' and 'Bushland Restoration' signage. The 'Cliff Risk' signage has been installed to restrict access onto cliffs and limestone outcrop areas at Point Resolution. Geotechnical surveys are required to be undertaken every five years to assess the stability of cliff areas. With the last geotechnical survey being undertaken in 2008. 'Let it Grow', 'Bushland Restoration' and 'No Dumping' signage has also been installed in many natural areas to encourage people to stay on pathways and not cause disturbance to the bushland

Fences

Shenton Bushland

There are two fences on City owned land at Shenton Bushland one is an internal ring lock fence on the eastern edge and the other is a low limestone wall along the Lemnos Street boundary to prevent vehicle access. Boundary fences along Irwin Army Barracks and the Dog Refuge Home are the responsibility of agencies other than the City of Nedlands.

Allen Park
The four types of fences at Allen Park include bollards, chainmesh, ring lock and fibre cement. Most of these fences are the responsibility of the City of Nedlands. The fibre cement fences along the boundary of Defence housing is the responsibility of the residences.

Birdwood Parade
There is currently fencing along the path near the Gunners' Memorial and at the base of the limestone outcrops, which is to be retained to restrict access to the limestone outcrops for safety reasons.

Point Resolution
There is ring lock fencing on one steep pathway at Point Resolution that assists pedestrians to keep to paths. There is some temporary fencing that has been installed to protect restoration sites until they become established on the western foreshore and embankment.

Mount Claremont Oval Reserve
There is currently fencing along the southern part of the Reserve on the edge of the oval which is to be retained to restrict access to the Reserve from the playing fields. However there is no fencing on the Cleland Street boundary to the bushland.

Strategy

Path Network and Fences

Shenton Bushland
The fences and walls around Shenton Bushland are appropriate, as is the path network. Therefore the appropriate strategy is to maintain this infrastructure rather than the construction, erection or removal of components. The paths are eroding and therefore require upgrading. They are scheduled to be upgraded in 2022/27 in accordance with natural area path network forward works program and current funding.

Allen Park
Fencing within Allen Park is generally appropriate. There is a 2m high wire boundary fence between the parts of Allen Park managed by the City of Nedlands and the Department of Defence. This fence should remain as it discourages the public from walking down the fragile dune slopes.

The City should investigate the installation of fencing along the Rugby Club playing fields (adjacent to the Odern Crescent sector) and the dog exercise area (adjacent to Flyash Hill) to reduce illegal access and trampling through these areas.

Funding was received by the Department of Planning's Coastwest program to upgrade beach fencing to protect Swanbourne Dunes in 2010. This fencing requires maintenance every 18 months which involves lifting the fencing and removing sand build up off pathways. This will stop the fencing from becoming buried by sand dunes over time and increase its effectiveness to keep pedestrians on pathways.

The number and location of tracks within Allen Park is appropriate. Paths that have become eroded, unstable or overgrown expose the City of Nedlands and Department of Defence to risks with regards to public liability. The City of Nedlands has developed a forward works program to upgrade all stabilised limestone paths within the park. Interim stabilisation work has been undertaken in 2011, 2012 and 2013 with full upgrades of all pathways to be completed by 2014/15.

There are sections of the pathways on Melon Hill which are becoming increasingly eroded. Where these sections are located on land owned by the Department of Defence, the City of Nedlands will

engage the Department of Defence to examine the status of these paths and undertake ongoing maintenance as required.

There is a small amount of pedestrian traffic through the northern portion of the Coastal Foredune and Coastal Swale Sectors. Access through this area is already restricted by existing fencing. The City has previously undertaken dense planting and brushing of this pathway. However the plants and brush were illegally removed. Therefore, it has been accepted that limiting access through this area is not currently achievable.

Hollywood Reserve

The fences and path network at Hollywood Reserve are considered appropriate and rehabilitation has been completed on most informal tracks over recent years. Some of the paths were upgraded in 2011 with the remainder of paths to be upgraded in 2021/22 based on current funding.

Birdwood Parade

The fencing is considered appropriate at Birdwood Parade. The bushland already has a well established path network and rehabilitation has been completed on most informal tracks over recent years. The formal paths should be retained, and any informal tracks continue to be rehabilitated. Interim stabilisation work (consisting of the installation of limestone retaining, spillways and curbing) was undertaken in 2012 with full path upgrades scheduled for completion in 2017/18 based on current funding.

Point Resolution

The fencing is considered appropriate at Point Resolution. The bushland has a well established path network and rehabilitation has been completed on most informal tracks over recent years. The formal tracks should be retained, and any informal tracks continue to be rehabilitated. Formalising access points onto the southern beach is has recently been undertaken. There are four access points along the southern beach area with the remaining foreshore and embankment restored with funding received through the Swan River Trusts Riverbank program.

Two tracks in the south western part of the Reserve are used by fisherman, for access at high tide when access is not possible form the end of the path on the southern beach. The rehabilitation of these areas is not achievable and these two tracks should be left as informal access tracks. Path upgrades are scheduled for completion in 2015/16 at Point Resolution based on current funding.

Mount Claremont Oval Reserve

The number and location of paths within Mount Claremont Oval Reserve is appropriate. There is currently no fencing along the boundary on Cleland Street. The City should investigate the installation of fencing to guide and control access through the bushland from Cleland Street. Interim stabilisation work (consisting of the installation of limestone retaining, spillways and curbing) was undertaken in 2012 with full path upgrades scheduled for 2019/20 based on current funding.

Management Actions 2013 - 2018

ACTIONS	
1.	Regularly prune along all paths to be retained.
2.	Maintain existing path networks and fencing.
3.	Implement the City of Nedlands Natural Area Path Network Policy and Procedures.
4.	Undertake a geotechnical survey at Point Resolution and Birdwood Parade every five years.
5.	Continue to work with the Department of Defence to repair eroded pathways on Melon Hill.
6.	Investigate the installation of fencing along the Rugby Club and dog exercise ovals at Allen Park to reduce informal access.
7.	Undertake maintenance to beach fencing every 18 months.
8.	Investigate the installation of fencing along Cleland Street at Mount Claremont Oval Reserve to reduce illegal access.

CULTURAL HERITAGE, INTERPRETATION & EDUCATION

Objectives

The objectives for cultural heritage, interpretation and education are to:

- Identify, encourage respect for, and preserve Aboriginal and European cultural heritage;
- Increase public knowledge of the environmental, local and regional significance of natural areas;
- Develop opportunities for recreation with minimal impact on the environment;
- Increase the level and quality of information available to the community on the flora, and fauna of the City's natural areas;
- Inform the local community on current and proposed management objectives and encourage public participation in the management of natural areas; and
- Engender a spirit of
- Council, all natural area friends groups in the Western Suburbs, Lotterywest, Department of Sport and Recreation, Swan River Trust and the South West Aboriginal Land and Sea Council (SWALSC).

Aboriginal Heritage

The Whadjuk tribe were one of over fourteen tribal groups that made up the Noongar people. The land occupied by the Mooro group of the Whadjuk tribe originally covered much of what is now the western and northern suburbs of Perth. Their area extended from the ocean in the west to the Swan River in the east and from Moore River in the north to the Swan Estuary to the South.

The leader of the Mooro group was a man called Yellagonga. Yellagonga apparently died in 1835 by drowning in the Swan River (Williams, cited in Ecoscape 2005[1]). It was estimated that in 1837 the population of the Mooro group was only 28 people which may reflect the collapse of Aboriginal society as a result of European occupation and influences. Other authorities have provided a higher population figure. N. Ogle in 1939 estimated that approximately 750 aboriginal people inhabited the present day metropolitan area (Seddon, cited in Ecoscape 2005[1]).

Wetlands in the Western Suburbs such as Perry Lakes, Lake Claremont (Butlers Swamp), Shenton Park Lake (Dysons Swamp) and Mabel Talbot Park (Jolimont Swamp) were important sources of food for Aboriginal people. These food resources included turtles, mud fish and gilgies (O'Connor, cited in Ecoscape 2005 [2]). Kings Park was an important ceremonial and dreaming area for Aboriginal males. According to Williams (cited in Ecoscape 2003) Aboriginal people called Point Resolution Mandyooranup or Mandyuranup which means place of Banksia, however it was not a preferred food gathering site due to its steep banks.

Despite their obvious food value, the exploitation of open shore marine molluscs does not appear to have been favoured by Aboriginal groups occupying the Swan Coastal Plain around Perth (Ecoscape 2005[1]). It is believed that wetlands to the east would have provided more opportunities to hunt and gather food than the coastal area in places such as Allen Park.

However Aboriginal utilisation of area around Swanbourne for camping, hunting and gathering continued at least until the early 1950s and some Aboriginal children attended Swanbourne Primary School (Harris, 2013). According to the National Trust it is feasible that Allen Park provided a route between Lake Claremont and the flat limestone reefs off Swanbourne Beach and southwards (cited in Ecoscape 2005[1]).

Aboriginal Significant Sites in Nedlands natural areas

According to the Department of Indigenous Affairs Significant Site database (accessed August 2013) the following sites are found within the vicinity of Shenton Bushland, Mount Claremont Oval Reserve and the river foreshore:

Registered Significant Sites in the vicinity include:

- SO2548 – Swan River (mythological significance),
- SO2155 – Lake Claremont (skeletal material, burial, camp, hunting place, water source); and
- ID20178 – Bold Park – (mythological significance, historical, plant resource, camp, hunting place, lookout point).

There are a further nine sites listed as "Other Heritage Places" within the vicinity of Shenton Bushland, Mount Claremont Oval Reserve and the river foreshore. Other Heritage Places are either sites that have been assessed as not being an Aboriginal Site under the Act; are awaiting assessment; or there is insufficient information to make a decision as to whether the Act applies. These sites include:

- SO2156 is on the north side of Lemnos Street and believed to have once been a camp which is now partly covered by buildings,
- SO2431 was a scarred (modified) tree near Underwood Avenue of which now is destroyed,
- SO2157 is in the vicinity of Lake Jualbup and was believed to be a fringe camp and water source camp water source,
- SO1417 is located near Mengler Avenue and contains artifacts and scatter;
- SO1415 is located on Lisle Street near Mount Claremont Oval Reserve where artefacts/scatter have been located,
- SO0677 is located at Bishop Road Reserve and contains artifacts and scatter; and
- 3 sites (19934, 19936 and 19935) located in the vicinity of Underwood Avenue Bushland which consist of two camps, a meeting place and Jarrah trees.

For the preparation of the Allen Park Management Plan 2005 – 2010 Ecoscape researched collections in the City of Nedlands Library (Local Studies Collection), the Battye (State) Library and the Department of Indigenous Affairs Library collection. However no additional information was obtained for Allen Park.

The Mooro group of the Whadjuk tribe moved in response to seasonal availability of certain staple food items. They would have most certainly crossed all natural areas within the City to collect food, medicinal plants and hunt. Whilst no registered sites have been found to date in the City's natural areas there remains a possibility that evidence of Aboriginal activities could still be found and there may be significant sites within these areas that have not been registered.

European Heritage

Shenton Bushland

There are no historic buildings within Shenton bushland however the Prisoner of War (POW) Holding Compound at Karrakatta was located within the bushland. It was the first POW facility built in Western Australia to accommodate POWs. It was primarily used as a transit or holding depot for the movement of prisoners and was the main holding facility near Perth with up to 160 POWs and Australian Army personnel onsite. The facility was in constant use between 1942 and 1946 for the administration of POWs within the Perth metropolitan area. (Polis, cited in Ecoscape 2005[2]) There are photos in the City of Nedlands local studies collection of Italian POW's filling in the "hot pool" on the Dalkeith/Nedlands Foreshore. It is possible then that the POW's assisted with the reclamation work undertaken along the and perhaps they helped with the reclamation work along the Dalkeith/Nedlands Foreshore (Harris, 2013).

After 1946 the compound was pulled down the site was left to revegetate naturally. The only evidence of it today is the remains of gravel that was brought in from the Perth Hills to build the compound and a small patch of Blue Leschenaultia which was transported with the gravel. Whilst there are no physical remains of the compound its location can be determined from aerial photos from the 1940s (Polis, cited in Ecoscape 2005[2]).

Allen Park

The existence of Allen Park is owed to Mr John (Jack) Allen, the second longest serving Councillor in the City of Nedland's history. Mr Allen was born in England, and having heard about Western Australia from army comrades, he decided to migrate and bought a home at 1 Reeve Street, Swanbourne in 1919. He initiated numerous tree planting programmes within the area as stated by his son:

> *"He also initiated a tree planting programme by means of an Arbor Day. As I recollect, on the Arbor Day local citizens including school children planted trees, some of which still remain - Peppermint, Rottnest Native Fir and Gums."*

From his first years on the board, Mr Allen provided a strong driving force for the purchase of what is now Allen Park. He was particularly fascinated by the uniqueness of the vegetation of Melon Hill as is evidenced the recollection that:

> "*I remember my father stating that the reason he went to a lot of trouble travelling far and wide with the expenditure of much time, getting people to sell their blocks which now make up the park, was the hill - commonly known as Melon Hill. The attractive bush covered hill caused him to make the effort when he moved to Swanbourne in 1919".*

In 1924/25 the Claremont Road Board bought 15 acres of the Langoulant Estate for a new sports ground. Langoulant was the first permanent resident who established a farm in the area in 1869 called 'Pleasant Valley', consisting of 40 acres of land (Williams, cited in Ecoscape 2005[1]). John Allen visited absent owners of some blocks, inducing them to sell. He helped dig the park's first well, which went down 12 feet. He also assisted in laying its first reticulation system.

In 1931 the Claremont Road Board secured parliamentary approval to alter 'Throssel Park Reserve' 7804 to 'Allen Park'. The boundaries of this Reserve were changed to allow the local authority to dispose of certain portions of it for residential purposes as they saw fit. In this way over 60 lots were sold, a portion of the original Reserve and money received was then spent further developing the area (Williams, cited in Ecoscape 2005[1]).

The author Joseph Furphy, who wrote under the pseudonym 'Tom Collins' also has substantial links with the Allen Park area. His house in Servetus Street was one of the earliest dwellings in the area. It is now located in the Allen Park Heritage Precinct and called "Tom Collins House". Joseph Furphy also designed and constructed a home for his son at the corner of Clement Street and Pine Close, overlooking Allen Park. This house has also been relocated next to Tom Collins House in the Heritage precinct and is call "Mattie Furphy House". Joseph Furphy was an avid observer of local natural history and the area now known as Allen Park is mentioned several times in his correspondence.

Until 1991, Melon Hill was part of the Coastal Defence System as a site for a concrete pillbox, now removed, dating from the Second World War. A cairn now stands on Melon Hill with this inscription on the plaque:

SWANBOURNE BATTERY (1936-1964)

This cairn commemorates the efforts of army coastal artillery and the vital role coastal batteries played in defending Australia's coastline from naval attacks. This site marks the location of a battery observation post built and operated on Melon Hill from 1938-1963. The post was used to support army coastal defences. Located 500 metres to the north, within the present day Campbell Barracks Swanbourne battery, was developed and operated by 6 Heavy Battery, Royal Australian Artillery, and formed the northern part of Perth's coastal defence system throughout World War II. The battery consisted of two six inch BL wire MK.VII guns as depicted on mounting central pivot MK.II and had a maximum range of 12 800 metres. The battery was never used in action and the facility was scrapped along with most of Perth's coastal defences in1963 (RK Glyde).

Allen Park Heritage Precinct

The Allen Park and Environs Management Plan (Ecoscape, 1996) designated a general area in the northeast corner of Allen Park as a Heritage Precinct. This recommendation was endorsed in the Swanbourne Local Area Plan which stated that *'[T]he Heritage Precinct in Allen Park is the only precinct in the metropolitan area dedicated to early urban life that has the potential to develop into a living cultural centre unique in Western Australia'* and was subsequently implemented.

Tom Collins House and Mattie Furphy House (built by Joseph Furphy for his son) which are now located to the Heritage Precinct are listed on the city's Municipal Heritage Inventory.

Conservation, Interpretation and Business Plans were developed for the Allen Park Heritage Precinct and between 2000 and 2007, the Heritage Precinct (Allen Park) Management Committee provided advice to the City of Nedlands Council on managing the precinct. The management committee no longer exists however the area surrounding the cottages is maintained through the City's Parks and Health and Compliance Departments.

<u>Hollywood Reserve</u>

Little of the European history of Hollywood Reserve is known however it was used as a farm for many years in which dairy cattle grazed on the Reserve. During World War II the soldiers staying in the nearby Hollywood Hospital were told to go and cut down large trees as part of their rehabilitation therapy. Some of the felled trees still can still be seen today.

<u>Birdwood Parade and Point Resolution</u>

Both Point Resolution and Birdwood Reserve have had a long history of, quarrying, modification and tree planting. In 1890, John Forrest (Western Australian Premier) resolved to form a foreshore reserve from Beatrice Road in Freshwater Bay to Birdwood Parade (including Point Resolution) however this was not possible as part of the intended reserve had already been sold.

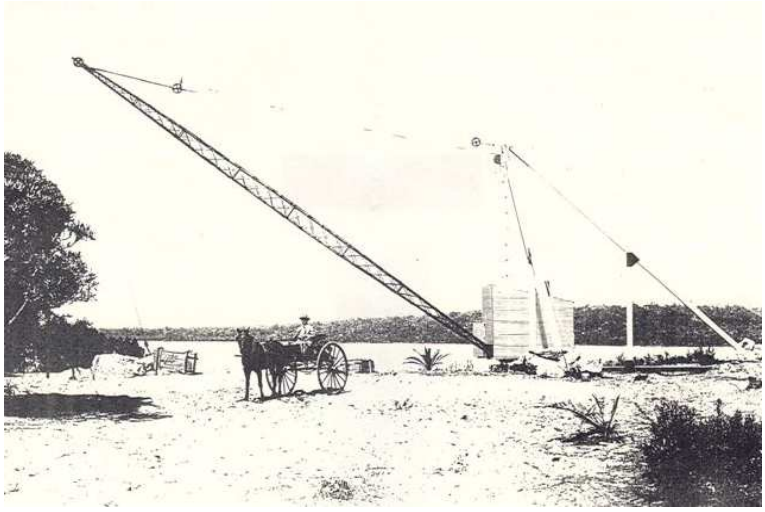
<u>Point Resolution</u>

Some early maps of the Swan River label Point Resolution as Point Brown who was the first Colonial Secretary. However by 1896 the Admiralty Hydrographic Charts refer to it as Point Resolution. This name appears to predate these charts and the origin of the name may have been derived from Captain Cook's ship *Resolution*, although the compiler of the Admiralty Hydrographic Charts, Commander L.S. Lawson, also sailed on a Royal Navy vessel called *Resolution*, (Peet, cited in Ecoscape 2003).

Point Resolution experienced an extensive period of quarrying. During the 1850s convict labour was used to hoist the stone to the top of the scarp where it was trimmed before being used in government buildings, possibly including the Perth Gaol and the Perth Boys' School. It was also used to construct the Perth – Fremantle Road which is now Stirling Highway (Harris, 2013).

By 1894 Alexander Mathieson was using a hand powered crane to bring the rock to the top of the scarp. Some of this rock was dressed on the high ground *'…which to this day [1968]is so full of stone chips 50 yards back from the edge of the cliff as to render it very difficult to dig'*. In 1904 Mr Lakey began using a horse and jigger to bring the rock to the top of the scarp for the construction of Sunset Hospital and in 1908, Messrs Briggs and Rowland used barges to cart stone from a jetty at Point Resolution for the surfacing of Broadway. (Peet, cited in Ecoscape 2003).

Figure 8: Hand powered crane at Point Resolution circa 1890 (Courtesy The West Australian)



The surfacing at Broadway was needed for the development of a new tram line (Harris, 2013). After 1908 when the new tram line took people to the Nedlands Baths, the term "Naughty Nedlands" was coined, people would hire yachts and stay at the beach overnight (Harris, 2013). The Hot Pool was formed in the 1920s from a burst pipe taking hot water to Sunset Hospital. Quarrying possibly ceased in about 1910 (Williams, cited in Ecoscape 2003) but the ruins of the two original convict stone cottages (one of which is shown in Figure 9) that were associated with the original quarrying still stood about 3 foot high in 1894, where a cluster of 'aloes' were growing (Hope, cited in Ecoscape 2003).

Figure 9: Convict Depot at Point Resolution circa 1890 (Courtesy The West Australian)

By about 1920 attempts were made to beautify the area (Peet, cited in Ecoscape 2003). Between World War I and II, White Beach (between Point Resolution and Bishop Road Reserve) was a popular venue for picnics and parties, to the extent that change sheds were erected (Williams, cited in Ecoscape 2003). A barbeque appears to have been built at the south end of White Beach (where the cliffs start) sometime in the 1920s, possibly by fishermen. This is shown in Figure 10.

Figure 10: Remains of Barbeque at Point Resolution

The stones for the barbeque probably came from the cottage or shed near the quarry. A fishermen's cottage also existed just west of the present building line in Jutland Parade as late as 1948 (Anderson, cited in Ecoscape 2003).

The evidence of the history of Point Resolution has now largely been obscured:

- The final remnants of the convict cottages may have been used to construct the barbecue in the 1920s. There are clues, such as old photographs (although the cliff faces may have subsequently altered by quarrying) and references to nearby 'aloes' (which may have been Agave), near where the convict cottages may have stood, however the exact location is unknown;
- The change sheds were demolished by the Nedlands Council in 1964 (Anderson, cited in Ecoscape 2003),
- The jetty at the tip of the point had deteriorated to one post by 1995 and is no longer present,
- A rock drilled with holes for securing barges carting stone has collapsed into the Swan River (Nedlands News, undated); and
- The very large stones used to anchor the hand-powered cranes at the quarry were bulldozed off the top of the scarp in the 1960s Hope, (1968) and Peet (1995) as cited in Ecoscape 2003 noted several features, the exact history of which could not be determined.

There was a partially cemented stone structure just above the high water mark that may have been associated with the jetty and at the eastern end of the Reserve parallel rows of stones (possibly the remains of a landing ramp) were visible at low tide.

Birdwood Parade Reserve

At 21A Birdwood Parade, in the center of the bushland, Gallop House stands prominently as a rare example of a landmark colonial residence overlooking Melville Water.

Figure 11: Gallop House, as it stands today

The stone building was constructed in the 1870s by James Gallop and is now registered with the State Register of Heritage Places and National Heritage Trust. It is significant through its association with the families instrumental in the development of Dalkeith and its strong association with farming in the early European settlement of the Swan River (Australian Heritage Commission, cited in Ecoscape 2003).

There were also several other buildings associated with farming within Birdwood Parade, little evidence of which remains. Their locations are shown in the Birdwood Parade section of this Management Plan. The main agricultural activity around Gallop House was table grape production (Morning Herald, cited in Ecoscape 2003) but other foods grown included apples, guavas, lemons, oranges, nectarines, pears, pomegranates, quinces and peaches, bananas, melons, date palms. Even cotton bushes were planted (Morning Herald, 1905 & West Australian Daily, cited in Ecoscape 2003). In the City's Local Studies collection there are advertisements for "Gallops Cayenne Pepper" that won prizes at the Perth Royal Show (Harris, 2013).

The 20 acres of land on which the Gallop House gardens lay was level with the river and subject to seasonal flooding. To make the ground suitable it was raised by approximately a foot with sand obtained from the adjacent hillside. In order to obtain this 'red' sand a great mass of rock was cut from the hill. This rock was used to construct the Old Men's Home (Sunset Hospital) (West

Australian Daily, cited in Ecoscape 2003). The 'Pinnacles' at the northern end of Birdwood Parade had earlier been quarried by the Armstrongs for Dalkeith Cottage and by the Gallops for its replacement Gallop House (Williams, cited in Ecoscape 2003). Sand around the 'Pinnacles' was mined by Snashells in the 1920's and 1930's. The Nedlands foreshore was then further extended by the reclamation of 17 acres of land west of the Nedlands jetty in the 1940s (West Australian, cited in Ecoscape 2003).

Management Actions 2013 - 2018

ACTIONS	
1.	Provide interpretive signage that details environmental, Aboriginal and European heritage for Nedlands natural areas through the WESROC Whadjuk Trails Project.

COMMUNITY INVOLVEMENT

Objectives

The objectives for community involvement are:

- To demonstrate sound environmental practices to the community,
- To empower the community to provide and preserve the environment for future generations; and
- To document the management of the bushland.

Background

There are five bushland community groups within the City of Nedlands they include:

- The Friends of Shenton Bushland (FOSB),
- The Friends of Allen Park Bushland Group (FOAPBG),
- The Friends of Hollywood Reserve (FOHR),
- The Friends of Point Resolution (FOPR); and
- The Swanbourne Coastal Alliance (SCA).

More detailed information relating to the history of the groups and contact details is provided in the relevant Management Plan for these areas.

City of Nedlands Community Friends Group Policy

The City of Nedlands aims to work collaboratively with residents who are prepared to form a Community Friends Group to assist in natural area management and/or wildlife protection within the City. This policy outlines the process by which Community Friends Groups assist in the care of natural areas and wildlife within the City.

2023 City of Nedlands Community Strategic Plan 2013 - 2023

The objective for community involvement is drawn from the "Great Natural and Built Environment" outcome detailed in the Community Strategic Plan. This outcome relates to:

- Enhanced, engaging community spaces,
- Heritage protection,
- Well planned and managed development; and
- Natural environment and biodiversity protection.

The Strategic Community Plan also identifies four Key Focus Areas with the Natural and Built Environment key focus area specifically relating to natural area management. This key focus area is explained in the Strategic Community Plan as follows:

> "*This KFA contributes directly to enhancing, engaging community spaces, heritage protection and environmental protection. Volunteering for environmental enhancement is always encouraged and supported. The natural and built environment KFA is also essential to recognising and encouraging a city that's easy to get around and is a great place to do business. High quality built environments are healthy and have character and charm, enhance community connections and protect amenity. The built environment also provides many facilities that are essential to community activities such as halls, pavilions, community centres and sporting facilities.*"

Strategy

Generally community-based groups should be encouraged to provide assistance with focused projects, such as specific sites or weeds within a reserve, while the City bears the burden of broader responsibilities (such as control of extensive weeds through spraying programs). Community projects need to be sufficiently focused such that visible results are obtainable for community education purposes. A sense of on-going ownership is also important and the development of specific rehabilitation sites can facilitate this, with the community group participating in follow-up weeding after planting the same site.

A recent challenge for community groups is retaining and recruiting new members. Some groups such as the FOAP, FOSB and FOHR have been in existence for approximately 20 years. In the 1990's these groups had large numbers of volunteers attending work sessions. However, the majority of these groups now only have a small core group of members in attendance and some founding members are currently less able to contribute to on ground activities as they were in the past.

The City has the opportunity to provide support to help these groups remain sustainable through assistance with recruitment of new volunteers through advertising, social media and the volunteer referral centre.

Management Actions 2013 - 2018

ACTIONS	
1.	Continue to support the activities of bushland community groups by implementing the Bushland Friends Group Policy.
2.	Hold an annual event that brings all bushland community groups together rotating annually through different bushland areas.
3.	Provide assistance to help friends groups remain sustainable through advertising and the volunteer referral centre.

FERAL ANIMALS

Objectives

The objective is to suppress feral animal numbers to:

- Minimise predation pressure on native animals by foxes and cats,
- Minimise habitat loss from pressure by feral bees and Coastal Brown Ants; and
- Minimise grazing pressure on native plants and seedlings by rabbits.

Background

Feral animals are introduced animals that live in the wild and have negative impacts on native fauna either by predation or habitat displacement. The City of Nedlands has six main feral animals that are known to cause an impact on natural areas. They include rabbits, foxes, cats, coastal brown ants, European honey bees and feral birds (such as Rainbow lorikeets and Long-billed Corellas).

A regional feral animal control program is being implemented by WESROC Councils in order to coordinate a cross boundary approach to increase the effectiveness of feral animal control in the region.

Rabbits

Rabbits cause significant degradation to restoration sites and established vegetation. They can be particularly damaging to coastal environments where their populations tend to thrive. Rabbits are found in four natural areas including Allen Park, Hollywood Reserve, Birdwood Parade and Point Resolution. These natural areas all have access to reticulated lawn where they feed and to bushland with sandy soils and shrubs where they establish burrows.

Foxes

Foxes are not uncommon in the Perth Metropolitan area they threaten natural areas by predating on native animals, especially birds. They have been sighted in the majority of Nedlands natural areas, as well as bushlands and wetlands of the wider Western Suburbs, area with dens having been found in Allen Park, Point Resolution, Birdwood Parade and Shenton Bushland.

Coastal Brown Ants

Coastal Brown Ants (*Pheidole megacephala),* originally from southern Africa, are very aggressive and have the ability to displace native ant populations. They are usually only recorded in urban areas and coastal dune ecosystems disturbed by human impacts and associated deficient indigenous ant fauna (Vanderwoude, Lorry de Bruyn & House, cited in Ecoscape 2005[1]).

The 2005 – 2010 Allen Park Management Plan noted the following details regarding Coastal Brown Ant populations:

"Allen Park is only the second bushland site in Western Australia where Coastal Brown Ants (*Pheidole megacephala*) have been confirmed (Callan, 2004)." This is significant given that this species is highly competitive and displace native ant populations."

Some further surveys for Coastal Brown Ants were undertaken at Bold Park in 2010, however no populations were found. This was considered interesting as the site at Bold Park that was surveyed was on the opposite side of the Road to the first of only two known populations of Coast Brown Ants (at Darren Park in Nedlands). No access to water at Bold Park is a possible factor contributing to this finding (Harris, 2013).

Cats

Feral cats have the potential to occur across all natural areas. The Cat Act 2011 (which came into effect in November 2013) requires the identification, registration and sterilisation of domestic cats. The purpose of the legislation is to provide better management of the unwanted impacts of cats on the community and the environment, as well as encourage responsible cat ownership.

The legislation gives Local governments the power to administer and enforce the legislation. Once cats are six months of age they need to be microchipped, sterilised and registered with the City. Cats are required to wear a collar and registration tag to ensure that cats can be easily identified and returned to their owner.

European Bees

European honey bees are found in all reserves mostly utilising hollows in large trees and stumps of Balga (grass trees). European Bees compete with native insects and vertebrates for pollen and nectar along with establishing hives in tree hollows which reduces the nesting opportunities for native birds and possums.

Introduced Birds

There are six known introduced or feral birds recorded across Nedlands natural areas. These include:

- Rock Dove (*Columba livia),*
- Spotted Dove (*Streptopelia chinensis),*
- Laughing Dove (*Streptopelia senegalensis),*
- Rainbow Lorikeet (*Trichoglossus haematodus),*
- Laughing Kookaburra (*Dacelo novaeguineae), and*
- Long-billed Corella (*Cacatua tenuirostris*).

Feral birds compete with native birds for foraging material and nesting hollows. Some also carry diseases which have the potential to infect native bird populations such as the Rainbow Lorikeet that carry Beak and Feather disease.

Invertebrates

One introduced non-resident moth (the Cabbage White Butterfly (*Pieris rapae*)) has been recorded in Shenton Bushland.

Strategy

Shooting feral animals is not considered appropriate for use in urban areas due to public safety issues. When contractors are engaged to undertake feral animal control the City ensures they have the appropriate licenses and no feral animal control is undertaken where there is potential risk to pets, wildlife or the public. Feral animal control is an ongoing issue.

The City uses an integrated feral animal control program which includes:

- Baiting rabbits (using baiting stations),
- Baiting coastal brown ants,
- Virus release,
- Fumigation (only for foxes); and
- Hive destruction.

Currently the City does not control feral birds, cats or the Cabbage Butterfly. However, with the implementation of the new cat legislation the City will provide enforcement as necessary.

Rabbits

Baiting

Feral rabbits are controlled using Pindone in bait stations (small enclosures for bait). The aim of this is to reduce potential risks to non-target species, although trail baiting has been found to be more effective and cost efficient in reducing rabbit numbers. Baiting is undertaken during summer when natural feed is scarcer which increases the success of the program. Baits are laid overnight to reduce potential off target damage to omnivorous skinks. Appropriate warning signage is installed at entry points and on the bait stations in accordance with label instructions.

Warren Fumigation and Destruction

Warren fumigation and destruction is not used in the City of Nedlands. The City has known populations of Goulds Sand Monitors in five natural areas with four of these areas containing feral rabbits. As monitor lizards are known to use the burrows of rabbits and even predate on juvenile rabbits) it is not suggested to use warren fumigation or destruction as a control method due to the risk of off target damage to monitor lizard populations.

Fencing

Rabbit-proof fencing can provide a viable option for excluding rabbits from areas of high conservation value once they have been eliminated from the site. Twigg and Lowe 2003 (cited in Ecoscape 2005[1]) suggest that fencing can provide a better long-term and cost-effective solution to many rabbit problems in urban areas than baiting, despite the initial cost outlay for rabbit-proofing boundary fences.

Where such fencing is erected consideration also needs to be given to the possible effects on native animal species. There are no large native animals present that would be affected but some reptiles such as Bobtails would be impeded by tightly knit fencing wire. However holes large enough for Bobtails to move through would not be large enough for rabbits.

Fencing is not a viable option for the City of Nedlands. This is due to the difficulty involved with removing all known rabbit populations from the areas they inhabit, followed by the initial cost outlay to install fencing and ongoing maintenance that would be required.

Tree guards

In the absence of fencing tree guards are effective in protecting seedlings in revegetation areas. However once the tree guards are removed the juvenile plants can then be open to predation by rabbits and therefore this method should not be used in isolation.

A number of biological controls have been introduced into Australia to control rabbits. These include: Rabbit Calicivirus Disease (RCD), Myxoma Virus (myxomatosis) and Rabbit Haemorrhagic Disease Virus (RHD).

Whilst useful in controlling overall rabbit numbers, their impact varies across Australia and none of these diseases will result in the complete elimination of rabbits. Therefore it is important to undertake an integrated approach to feral rabbit control.

Foxes

There are two options available to the City for fox control. One is the opportunistic fumigation of fox warrens when they are encountered. Unlike rabbit warrens it is unlikely that rabbits and monitor lizards would utilize the same warrens. It is also very easy to identify an active fox warren thereby eliminating concerns of off target damage. The second option is the use of soft jaw or cage traps

undertaken by a licensed pest contractor with appropriate signage installed on site. This should be undertaken in September or November when there is an influx of juvenile foxes around.
1080 is the only poison available that could be considered to control foxes however it cannot be used in urban areas. Shooting foxes is also not appropriate for use in urban areas due to public safety issues. Another option is the construction of exclusion fences however, this is not appropriate for small urban bushland areas that are regularly used by pedestrians.

Coastal Brown Ants

Habitat Modification

Water availability is the main limiting factor for Coastal Brown Ants (Heterick, Casella & Majer, cited in Ecoscape 2005[1]). Therefore any reticulation within bushland where Coastal Brown Ants are known to occur needs to be minimised in order to avoid encouraging further establishment. Concrete path materials also encourage Coastal Brown Ant infestations as they nest between pavers and under the edges of concrete paths.

Baiting

A study on the use of Amdro at a suburban residential site in Perth found that over a number of years the number of ant species increased from seven to 25 (as native ants recolonised the site) and Coastal Brown Ant activity was reduced to almost zero (Heterick, Casella & Majer, cited in Ecoscape 2005[1]).

The use of Amdro baits has also been used successfully to control Coastal Brown Ants in Allen Park with ongoing treatments required to continue the success of removing Coastal Brown Ants and increasing the ability for native ants to recolonise.

Coastal Brown Ants have been noted as thriving on the bamboo stakes used in restoration activities. If the bamboo stakes are moved between sites then this activity could potentially increase their distributions. The City could look at implementing hygiene practises to ensure no coastal brown ants are inadvertently spread through natural area restoration activities. This could take the form of dipping the stakes in an insecticide once they are collected from site.

European Bees

Annually in spring bee hives are GPS mapped and a contractor engaged to remove hives across all Nedlands reserves.

Feral Birds

Currently the City does not undertake any control in relation to feral birds. Shooting feral birds is not appropriate for use in urban areas due to public safety concerns.

A regional feral bird control program targeting Long-billed Corellas and Rainbow Lorikeets has been undertaken by the Department of Parks and Wildlife (DPAW) for the last five years. The funding for this program expired in 2013. DPAW (at the time of writing this Management Plan) were in the process of approaching local governments to provide financial contribution to the continuation of the control program. The City should consider financially contributing to this program as the target roosts sites are at the University of Western Australia's research station in Underwood Avenue (for Rainbow Lorikeets) and Claremont Show Grounds (for Long-billed Corellas). These roost sites most likely harbour birds that frequent Nedlands natural areas. One further strategy to assist with feral bird control is to remove dead palm fronds from beneath date palm trees as these have been identified as significant nesting sites used by Rainbow Lorikeets in the metropolitan area.

Management Actions 2013 - 2018

ACTIONS	
1.	Continue to monitor and control feral animals using an integrated feral animal control program.
2.	Continue to use baiting stations for feral rabbit control.
3.	Only undertake fumigation of fox warrens not rabbit warrens.
4.	Avoid using pavers or concrete slabs in natural areas which encourage Coastal Brown Ant infestations.
5.	Continue to control Coastal Brown Ants with maintenance of the Seaward Corridor undertaken biannually.
6.	Continue to work with other local governments and agencies to implement a regional feral animal control program.
7.	Sterilise bamboo stakes that harbor Coastal Brown Ants so they are not inadvertently spread between restoration sites.
8.	Minimise watering of bushland areas (where possible) to discourage Coastal Brown Ant Infestations.
9.	Contribute to the regional program being undertaken for feral bird control by DPAW.

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Appendix 1 Priority Weed Management Notes (Compiled from Florabase website)

Scientific Name	Common Name	Management Strategy	Timing (optimal)
Acacia iteaphylla	Flinders Range Wattle	Hand pull seedlings. Fell mature plants.	March - July
Arctotheca calendula	Cape Weed	Chip out small infestations, ensuring root is severed well below ground level to prevent re-sprouting from the crown. For large infestations apply Lontrel 6 ml/10 L (300 ml/ha) in early growth stages. Glyphosate at 0.2% will provide some selective control if the plants are young or at the budding stage, otherwise spot spraying glyphosate at 10 ml/L will control at all growth stages. A combination of chemical and physical control with follow up treatment provides optimal control.	June - Nov
Avena fatua	Wild Oat	Spray at 3-5 leaf stage with Fusilade Forte at 16 ml/10 L + wetting agent. Repeat treatment over following 2 years. Prevent seed production and seedbank inputs each year. In small infestations hand removal may be feasible.	August - November
Asparagus asparagoides	Bridal Creeper	Dig out juvenile seedlings in degraded areas. Spray 0.2 g metsulfuron methyl + Pulse in 15 L water (or 2.5 - 5g /ha + Pulse). Best results achieved when flowering. Biological control agents available such as the Leafhopper and the rust.	July - August
Babiana angustifolia		Spot spray metsulfuron methyl 0.2 g/15 L + Pulse or 2.5 - 5g/ha + Pulse. Apply just on flowering at corm exhaustion.	Aug - Sept
Brassica barrelieri subsp. oxyrrhina	Smooth Stem Turnip	Hand pull plants.	July - September
Brachychiton populneus	Kurrajong	Hand pull seedlings. For mature plants try stem injection with 50-100% glyphosate or apply 250 ml Access in 15 L of diesel to basal 50 cm of trunk (basal bark) or cut and paint with 50% glyphosate.	Sept - April
Centranthus macrosiphon	Pretty Betsy	Hand remove small populations. Spray metsulfuron methyl at 0.1 g/15 L (2 g/ha) + wetting agent.	August - September
Chasmanthe floribunda	African Cornflag	Dig out isolated plants. Spot spray glyphosate 1% + Pulse before flowering.	June - July
Cynodon dactylon	Couch	Spray Fusilade Forte at 8 ml/L + wetting agent when plants are small, or 1% glyphosate in late spring/summer and autumn when rhizomes are actively growing. In sensitive areas try painting runners or crowns with 50% glyphosate. Follow-up always required.	Nov - Feb
Ehrharta calycina	Perennial Veldt Grass	For small infestations, cut out plants ensuring crown removal. Do not slash. Alternatively spray with Fusilade Forte 13 ml/L or 3.3-6.6 L/ha + wetting agent on actively growing and unstressed plants. Use higher rate in dense undergrowth or on older less vigorous plants. Follow-up in subsequent years. Use unplanned fires to spray regrowth and seedlings within 4-6 weeks of germination.	June – Sept (herbicide). Nov – Feb (manual)
Euphorbia paralias	Sea Spurge	Hand pull plants.	Sept – Jan
Euphorbia terracina	Geraldton Carnation Weed	Hand pull plants.	June Nov
Ferraria crispa	Black Flag	Hand remove very small populations in degraded sites. Sift soil to find all corms. Spray 2,2 DPA 10 g/L + Pulse when flowering. In degraded sites try glyphosate 1% + metsulfuron methyl 0.2 g/15 L + Pulse.	August - September

Scientific Name	Common Name	Management Strategy	Timing (optimal)
Ficus carica	Common Fig	Hand remove seedlings. Stem inject with 50% glyphosate and foliar spray regrowth with 10% glyphosate. For stems less than 30 cm diameter apply 250 ml Access in 15 L of diesel to basal 50 cm of trunk (basal bark).	November - March
'Freesia alba x leichtlinii	Freesia	Spot spray metsulfuron methyl 0.2 g/15 L + Pulse or 2.5-5 g/ha + Pulse. Apply just on flowering at corm exhaustion.	July – August
Fumaria capreolata	Whiteflower Fumitory	Hand remove seedlings in good bushland areas/restoration sites if resources available.	July – Sept
Gladiolus angustus	Long Tubed Painted Lady	Spot spray metsulfuron methyl 0.2 g/15 L + glyphosate 1% + Pulse in degraded sites. Any options for good bushland areas?	July – August
Gladiolus undulatus	Wavy Gladiolus	Spot spray metsulfuron methyl 0.2 g/15 L + Pulse or 2.5-5 g/ha + Pulse. Herbicide application should be just on corm exhaustion. Physical removal can result in spread of cormels. Once the parent corm is killed cormels in the soil tend to lose dormancy and germinate.	July
Ixia maculata	Yellow Ixia	Spot spray metsulfuron methyl 0.2 g/15 L + Pulse or 2.5-5 g/ha + Pulse. Apply just on flowering at corm exhaustion.	July - September
Lachenalia aloides	Soldiers	Spot spray metsulfuron methyl 0.2 g/15 L + Pulse or 2.5-5 g/ha + Pulse. Apply just on flowering at corm exhaustion.	July – September
Lachenalia bulbifera	Soldiers	Spot spray metsulfuron methyl 0.2 g/15 L + Pulse or 2.5-5 g/ha + Pulse. Apply just on flowering at corm exhaustion. Physical removal can result in spread of bulbils.	August - September
Lachenalia reflexa	Soldiers	Spot spray metsulfuron methyl 0.2 g/15 L + Pulse (2.5g-5 g/ha).	June - August
Lantana camara	Common Lantana	Apply 250 ml Access in 15 L of diesel to base 50 cm of stems (basal bark) or foliar spray with 1.5% glyphosate.	March - May
Leptospermum laevigatum	Coast Teatree	Hand pull seedlings. Fell mature plants. Resprouting has been recorded in some areas. Where resprouting has been observed, apply 250 ml Access in 15 L of diesel to bottom 50 cm of trunk (basal bark).	July - October
Lupinus angustifolius	Narrowleaf Lupin	Hand remove scattered plants. Spray dense infestations with metsulfuron methyl 0.1 g/15 L (2-3 g/ha) + wetting agent or spot spray Lontrel 6 ml/10 L (300 ml/ha) + wetting agent to late flowering, this will prevent seed set.	July - September
Lupinus cosentinii	Sandplain Lupin	Hand remove scattered plants prior to flowering. Spray dense infestations with metsulfuron methyl 0.1g/15 L (2-3 g/ha) + wetting agent. Larger areas can be treated with more selective herbicides such as 200 g/ha Lontrel or 50 g/ha Logran (based on 500 L of water/ha). For spot spraying use 4 g Lontrel or 1 g Logran in 10 L of water + wetting agent. Glyphosate is relatively ineffective.	July - September
Lycium ferocissimum	African Boxthorn	Hand pull or dig out small seedlings ensuring removal of all roots. For mature plants cut and paint with 50% glyphosate and follow up treatment on regrowth or apply 250 ml Access in 15 L of diesel to basal 50 cm of stem (basal bark).	March – May and Sept- Nov
Moraea flaccida	One-leaf Cape Tulip	Spot spray metsulfuron methyl 0.2 g/15 L or chlorsulfuron 0.2 g/15 L + Pulse or 2.5-5 g/ha + Pulse or 2,2 DPA 55 g/10 L + Pulse. Apply just on flowering at corm exhaustion.	July - August
Olea europaea	Olive	Hand pull or dig out seedlings and small plants ensuring removal of all roots. For mature plants cut to base and paint 50% glyphosate or apply 250 ml Access in 15 L of diesel to base 50 cm of trunk (basal bark). Monitor sites for seedling recruitment.	March – May and October - December

Scientific Name	Common Name	Management Strategy	Timing (optimal)
Oxalis pes-caprae	Soursob	Spot spray metsulfuron methyl 0.2 g/15 L + Pulse, or 1% glyphosate. Apply at bulb exhaustion, generally just on flowering. Exercise care if manually removing as physical removal can result in spread of bulbils.	June – July
Pelargonium capitatum	Rose Pelargonium	Hand pull isolated plants taking care to remove the entire stem as it can reshoot from below ground level. Spot spray metsulfuron methyl 5 g/ha + Pulse. Easily controlled after fire.	June – October
Pennisetum clandestinum	Kikuyu Grass	Difficult to manually control as all rhizomes must be removed. Spray with 1% glyphosate or Fusilade Forte at 16mL/L + wetting agent. 2-3 sprays over a single growing season are often required. Use unplanned fire events to effectively control any regrowth.	November - January
Pennisetum setaceum	Fountain Grass	Dig out small infestations, slash in winter and/or spray with 1% glyphosate + penetrant in spring to autumn. Follow up seedling control and treatment until regrowth ceases. Use unplanned fire events to effectively control any regrowth.	March – April and November - December
Schinus terebinthifolius	Brazilian Pepper	Hand pull seedlings ensuring removal of all root material. Stem inject older plants using 50% glyphosate or basal bark with 250 ml Access in 15 L of diesel to bottom 50 cm of trunk during summer. Avoid root disturbance until trees are confirmed dead.	December - March
Sparaxis bulbifera	Sparaxis	Spot spray metsulfuron methyl 0.2 g/15 L + Pulse or 2.5-5 g/ha + Pulse. Apply just on flowering at corm exhaustion.	September
Stenotaphrum secundatum	Buffalo Grass	Spray with 1% glyphosate 2-3 times over a single growing season, or spray 13 ml/L Fusilade Forte + wetting agent. Do not spray after heavy frost. Solarisation over warmer months can be useful for small, isolated infestations.	November - May
Tamarix aphylla	Athel Pine	Inject 100% glyphosate into root crown. In pasture or degraded areas, manually removal all plant parts and follow up control any regrowth. In sensitive environments, cut stem to ground level, immediately paint with Access 17ml/L in diesel (using glyphosate with cut stump is ineffective). Where there is limited risk of off-target damage or impacts on waterways try foliar spray with triclopyr 600g/L at 1.7 to 10ml/L in water.	All year.
Watsonia meriana var. bulbillifera	Watsonia	Wipe individual leaves with glyphosate 10% or spray dense infestations 2,2-DPA 10 g/L + Pulse. Apply just as flower spikes emerge at corm exhaustion. 2,2-DPA at 5 g/L+ Pulse is also quite effective and is appropriate to use when particularly concerned about off-target damage, for example following fire when Watsonia is growing among germinating native seedlings and resprouting native shrubs.	September