City of Cockburn

Weed Management Plan 2017-2022

Document Information:

Document Title: City of Cockburn Weed Management Plan 2017-2022

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Doc Status: Version 2

Document Control

Version History	Description	Date	Authorised by
V.1	Final	25.06.2012	C.Beaton
V.2	1 st Draft	13.12.17	C.Beaton
V.2	2nd Draft	31.01.18	C.Beaton
V.2	Final	28.02.18	C.Beaton

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Executive Summary

Environmental weed invasion has been identified as one of the major threats to biodiversity conservation across Western Australia and on a national scale. Competition from weeds is a major factor affecting biodiversity and ecological communities. In 1999 the State Government developed the Environmental Weed Strategy for Western Australia to give direction in management of environmental weeds and released the Weed Plan for Western Australia in 2001 also known as the *State Weed Plan*. In addition a National Weeds Strategy has also been developed.

In response to this acknowledged threat the City of Cockburn has devised its own environmental weed management plan to help guide management programs and assist in allocation of resources to protect natural areas vested within the City. This plan is the updated version and forms part of the City's Natural Area Management Strategy.

In developing this management plan, standard methodologies for ranking weed species are used to determine weeds that fell into high, medium or low priority categories for control. The level of weed control that can be achieved in each reserve is limited and based on resource allocation. Reserves which are ranked highly in terms of conservation values will receive greater focus in regards to weed control.

VISION: Healthy and resilient landscapes where weed impacts on environmental economic and social values are minimised

GOAL: To achieve coordinated, collaborative and effective weed management throughout the City of Cockburn

The City's weed management plan is based on the following principles:

- Weed management is an integral part of natural resource management
- Prevention, early detection and early intervention provide the most cost effective approach to reducing impacts from weeds
- Effective management requires long term commitment and resources from both public and private land managers
- A coordinated approach between stakeholders will provide the most effective outcomes for weed management
- State, national and local legal frameworks can and should be used to meet weed management objectives

- Effective priority setting and planning process is required to best utilise available weed management resources.

Objectives:

- ❖ To provide a co-ordinated approach for the management of weeds in the City of Cockburn and to ensure effective use of resources both economically and socially for the betterment of natural ecosystems within the City;
- ❖ To develop a list of weed species and rank them according to their level of invasiveness, distribution and environmental impact; and
- ❖ To determine and apply best practice integrated methodology for control of these species.

A list of priority weeds for the City of Cockburn has been developed and monitoring of weed invasion, distribution and control outcomes is achieved through regular mapping of these priority weeds within City of Cockburn reserves.

1 Summary of recommendations

1 Revise and update the priority weed list every 4 years

2 Undertake vegetation condition mapping every 4 years

3 Focus primary weeding efforts in areas of excellent to very good bushland first.

4 Prioritise grass weed control where there is a threat to adjacent areas of high conservation value.

5 Only control weeds if the bushland has the ability to naturally regenerate and out-compete the weeds or in conjunction with revegetation.

6 Prioritise weed control within recently burnt areas, particularly during the first year after fire.

7 Do not attempt revegetation without at least one year, and preferably two years weed control.

8 Undertake weed mapping every 4 years on rotational basis.

9 Control feral pests to reduce the spread of weeds.

10 Undertake a community education campaign to inform residents of the harm caused by weed invasion and how they can contribute to reducing impacts from environmental weeds.

11 Continue to engage with community groups to address environmental weed control issues to achieve natural resource management objectives.

2 Introduction

One of the most significant environmental challenges facing Western Australia is minimising the impact from environmental weeds. In the relatively short history of Western Australia since European settlement, some 1155 exotic plant species have established as weeds in our diverse and generally fragile ecosystems (Dept of Agriculture 2001).

In recognition of existing and potential impacts of weeds, in 2001 the Western Australian Government released *A Weed Plan for Western Australia* to coordinate effective weed management across the state. The *State of the Environment Report: Western Australia 2007* further highlights the significance of weeds by identifying them as a number one priority for management

Environmental weeds are considered one of the most serious threats to biodiversity and natural ecosystems (CALM 1999). They adversely affect the regeneration of indigenous flora and thus survival of its associated fauna. Weeds can affect ecosystem function, services and structure through:

- Displacement of native species
- Prevention of recruitment of native species
- Reduction in species diversity
- Competition for resources
- Alteration of fire regimes
- Alteration of nutrient cycling
- Acceleration of soil erosion rates
- Alteration of soil pH
- Alteration of hydrological cycles
- Acceleration of local, regional and global extinction rates

Weeds can also contribute to reduction in water quality of wetlands, which in turn can lead to midge problems, algal blooms, loss of natural invertebrate communities, displacement of native species and a reduction in aesthetic and recreational values.

At present, environmental weeds are generally not managed to the same extent as agricultural or pastoral weeds (DEC 2012).

In response to this acknowledged threat the City of Cockburn has devised its own environmental Weed Management Plan to help guide management programs and

assist in allocation of resources to protect natural areas vested within the City. This plan is the updated version 2018 and forms part of the City's Natural Area Management Strategy.

2.1 What is a Weed?

There are a number of different definitions of weeds:

Bradley (1988) defines a weed as 'a plant out of place'

Dixon & Keighery, in Scheltema & Harris Ed. (1995), define weeds as 'plants growing where they are not wanted'

The National Weeds Strategy defines a weed as "a plant that has, or has the potential to have, a detrimental effect on economic, social or conservation values" (ARMCANZ, ANZECC and Forestry Ministers, 1997).

According to the Environmental Weed Strategy for Western Australia (1999) environmental weeds are plants that establish themselves in natural ecosystems (marine, aquatic and terrestrial) and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade.

Some native species can also become environmental weeds and require management. It is therefore useful to define weeds, for the purpose of this document, as comprising **all** non-indigenous plants **plus** any indigenous plant that has increased its distribution as a result of disturbance and is threatening the integrity of the local ecosystem.

Weed management in bushland is an important component of the City's overall program of managing its reserves.

Figure 1.Bridal Creeper (*Asparagus asparagoides*) a Weed of National Significance (WONS) found in the City of Cockburn (Photo D. Bright)

2.2 Where do weeds come from?

Most Western Australian weeds originate from South Africa, Europe, Asia and America, brought in by early settlers as ornamental garden plants or for aquaculture, pastoral and agricultural production (DEC 2012).

Some weeds have arrived by accident transported in soil, equipment or animal products. Many of the most successful environmental weeds have come from locations that share a similar climate to WA, that of a Mediterrean climate such as South Africa, parts of Europe and Southern America (Hussey et al 2007).

Plants that do become weeds often have the ability to colonise disturbed areas quickly. Disturbance can be through a range of means such as farming, logging, clearing for housing and development and fire.

Once disturbance occurs weeds are able to utilise effective seed dispersal mechanisms to move into areas and become established (Hussey et al 2007). In comparison to disturbed areas, intact, undisturbed densely vegetated areas are more resilient to weed invasion as weeds are less able to get a foothold and compete for light, moisture and nutrients (DEC 2012).

Some Australian native species have become naturalised outside their normal range of distribution and are considered weeds when they disrupt the structure and diversity of other native plant communities (DEC 2012).

2.3 Weed distribution

It is estimated that of the 1,233 identified weed species in WA, around 55 per cent are classified as environmental weeds, most of which (around 800 identified species) are found in the Swan Coastal Plain bioregion (DEC 2012). The City of Cockburn has many of these species present within its boundaries.

2.4 Types of weeds

To control weeds successfully, it is vital to understand the different types of weeds that exist and how (and when) they grow, reproduce and spread. A thorough understanding of the biology of a target weed will help determine appropriate timing and method for control. Many weed species may require multiple treatments to successfully control.

Weeds can be divided into three broad types: non-woody weeds, woody weeds and aquatic weeds. Non-woody weeds are weeds with a non-woody green stem (i.e. are herbaceous), woody weeds have a woody stem and aquatic weeds are those that grow partly or wholly submerged in water (DEC 2012).

Fig.2 Arum Lily an example of a bulbous weed (Photo: D. Bright)

Weeds, as with other flowering plants, have either an annual, biennial or perennial life cycle. Annual weed species, which means they normally complete their life cycle within a single growing season (from germination to flowering, seed production and death of vegetative parts) and include species such as Fleabane (*Conyza bonariensis*) or fountain grass (*Pennisetum setaceum*) are common in wetland environments. Biennial weeds normally complete their life cycle within two years while perennial weeds, often the most invasive type of weed, normally live for two or more growing seasons (DEC 2012).

3 Vision

The City's weed management plan is part of the City's Natural Area Management Strategy and helps guide efficient and effective use of resources both economic and social.

VISION: Healthy and resilient landscapes where weed impacts on environmental economic and social values are minimised

GOAL: To achieve coordinated, collaborative and effective weed management throughout the City of Cockburn

4 Links to the Strategic Community Plan 2016 – 2026

The City's Weed Management Plan supports the delivery of the City's Natural Area Management Strategy which has been identified under one of the key strategic objectives for economic, social and environmental responsibility.

5 Objectives / Plan

The City's Weed Management *Plan* is based on the following principles:

- Weed control is an essential component of sustainable natural resource management but is much more than simply the elimination of weeds. The underlying objective is always the protection and restoration of naturally diverse ecosystems (Brown et al 2002).
- Prevention, early detection and early intervention are the most cost-effective means of weed management.
- Effective weed control requires a long-term commitment from both public and private land managers.
- Effective weed management requires a coordinated approach with a range of stakeholders.
- State, national and local legal frameworks can and should be used to meet weed management objectives
- Effective priority setting and planning process is required to best utilise available weed management resources

The purpose of the Weed Management Plan is help guide the allocation of resources to control and manage weeds in all conservation reserves within the City of Cockburn which supports broader natural resource management outcomes contained within the City's Natural Area Management Strategy.

5.1 Objective 1

To provide a co-ordinated approach for the management of weeds in the City of Cockburn to ensure effective use of resources both economically and socially for the betterment of natural ecosystems within the City;

5.2 Objective 2

To develop a list of weed species and rank them according to their level of invasiveness, distribution and environmental impact; and

5.3 Objective 3

To determine and apply best practice integrated methodology for control of these species.

6 Setting priorities for control

Environmental weeds and management of them have been identified at three levels:

Local;

State; and

National

The Australian Government has established a list of Weeds of National Significance (WONS), which may include plants of concern in natural areas, waterways or agricultural land. Several weeds found in Western Australia are among recent additions to the Weeds of National Significance (WONS) list, see http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html

Species are selected based on their ranking for invasiveness, potential to spread, and impact on socioeconomic and environmental assets (Commonwealth of Australia 2007).

'Declared Plants', as defined under the Agriculture and Related Resources Act 1976, are high priority weeds that are or may become a problem to agriculture or the environment and are formally 'declared'. When a plant becomes declared, specific control strategies are required. Declared Plants (DP) when found on property, either privately owned or on crown land, must be controlled by landowners or managers. The current list can be viewed on the Department of Agriculture website or see https://www.agric.wa.gov.au/pests-weeds-diseases/weeds/declared-plants

The Local Government Act (1995) and Section 193 of the Biosecurity and Agriculture Management Act (2007) allows a local authority to declare plants as "pest plants". Declaration requires the control of that weed species on all lands within the local authority boundary. When this legislation is applied there is no requirement for consistency between adjacent local authorities, which may result in uncoordinated and less effective control.

In addition to other drivers, climate change may alter the potential range of some weeds. In Australia, the generally warming climate could allow tropical weed species to extend further south, temperate species to retreat to the south, and summer growing species to become more prevalent in the southern regions. This is a prevailing issue that will need consideration into the future.

Additional resources may be required to identify and react to perceived threats. To set priorities for weed control, it is necessary to firstly rank weeds with regard to their impact or potential impact on natural areas.

6.1 Integrated weed control

To achieve the best outcomes in weed management an integrated approach is desirable. Integrated weed management is the combination of social, economic and technical approaches that lead to successful outcomes at all scales (CALM 1999).

Integrated weed management involves the planned use of all control options available to achieve long-term weed control without damaging the environment.

Approaches to environmental weed management include:

- Weed led control-plan to prevent introduction, establishment, survival and dispersal of an emerging environmental weed.
- Site led control-focus on identifying areas that require weed control to maintain their ecological values.
- Human resources led control- will identify weeds and particular circumstances best suited to volunteer control and those managed by professionals.
- Threatened species and communities led control-this approach places the protection of threatened species and threatened communities as the highest priority.
- Cause led control-approach focuses on controlling, reducing or eliminating disturbance factors that increase ecosystem vulnerability.

All approaches will consider the national, state and local strategies and priorities.

To achieve the best use of resources and to enable them to be allocated to the overall program in a structured manner, it is imperative to prioritise weed control.

It should be noted that prevention is better than cure and best way of controlling weeds is to prevent weeds from becoming established in the first place and to act quickly following any new weed invasions (DEC 2012).

6.2 Weed control prioritisation

Weeds can be extremely difficult to eradicate once established and require consistent and sustained effort over time to bring them under control (DEC 2012). Where infestations are severe, it may not be possible to completely remove weeds despite best efforts and ongoing efforts must instead focus on containment to limit further spread. To this end it is important to prioritize management responses to weeds to ensure best use of resources for the desired outcome.

Prioritisation takes into consideration:

- Weed ranking - determination of both major weeds and lesser weeds

- The condition of the reserve, its urban or rural context and biological values.
- Fire hazard: the risk of high fuel loads, for example, Veldt Grass in degraded areas or weedy perimeters that are prone to arson.
- Aesthetic values: particularly along urban edges to encourage and engender an attitude of care.
- Revegetation sites: control of weeds prior to planting and reduction of competition during the establishment stage.

In general, high-priority weeds in areas of excellent to very good quality bushland are those to be controlled first. However thought should be given to medium priority weeds that may occur in small populations in a reserve and without too much effort or expense can easily be controlled. Balancing the reserve size, reserve condition, weed flora and the budget is crucial to the process of effectively determining weed control priorities.

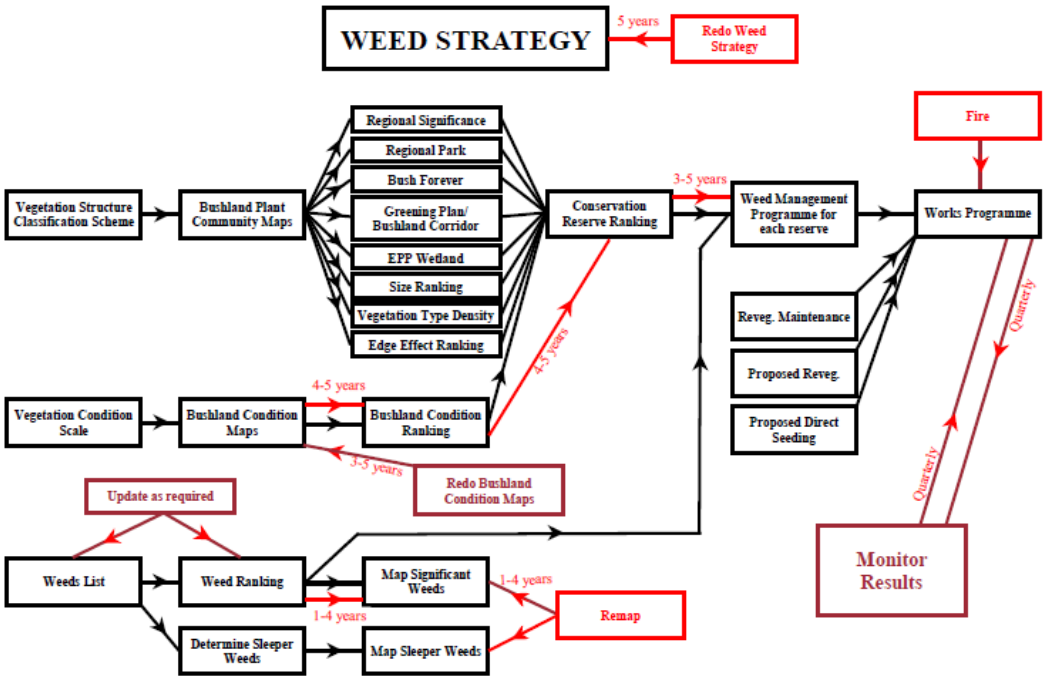

Fig 3 Weed Management Strategy flow chart

6.3 Weed ranking methodology

Weed-ranking methodologies are used to determine level of threat of a weed species.

The Environmental Weed Strategy for WA (EWSWA) (1999) ranks weeds according to:

- Invasiveness: ability to invade bushland in good to excellent condition, or ability to invade waterways. Distribution: wide current or potential distribution including consideration of a known history of widespread distribution elsewhere in the world. Environmental Impacts: ability to change the structure, composition and function of an ecosystem. In particular an ability to form a monoculture in a vegetation community.

The state-based rankings suggested in the EWSWA were deemed too broad for on-ground management by the Department of Biodiversity, Conservation and Attractions.

Subsequently the Department of Biodiversity, Conservation and Attractions (DBCA) (then Department of Environment and Conservation) developed a Weed Prioritisation Process for DEC managed lands in 2008. This process was based on the Environmental Weed Census and Prioritisation, Swan Natural Resource Management Region project developed by Karen Bettink and Greg Keighery (2008). A focus of the process is to consider both: 1) a “species-led”; and 2) an “asset-protection-based” approach to control the threat of environmental weeds within WA (DEC 2013).

One of the key outcomes of this process was to consider ability to control or eradicate populations. Species that were considered no longer viable for control were ranked lower than in previous versions.

DBCA released its updated weed rankings in 2014 for the state. The City of Cockburn Weed Management Plan uses rankings based primarily on the Environmental Weed Strategy for WA and the current Department of Biodiversity, Conservation and Attractions as a basis for determining the priority ranking of weed species.

6.4 Priority weed list

The City has developed its own priority weed list based on the state and national strategic documents and using local knowledge and information. The City of Cockburn Priority Weed List can be found in Appendix 1. Priority ranking of a weed species can change with time as weeds become more established and widespread, adapt to different growing conditions or are brought under control.

These rankings give a current indication of the seriousness of the threat posed by each weed species within the City of Cockburn. In addition the City must be aware of other state or national weed species which may impact on the priority ranking within the City.

Recommendation 1 : Revise and update the priority weed list every 4 years.

6.5 Reserve ranking

The City has limited resources to manage natural areas. It is therefore necessary for reserves to be prioritized according to the criteria outlined below, based on the Natural Area Initial Assessment (WALGA 2009) to ensure that resources are being used effectively in areas where the most benefit can be gained.

Each reserve has been ranked based on the following criteria:

- Vegetation condition
- Reserve size
- Reserve shape
- Perimeter to area ratio
- Connectivity
- Rarity
- Regional and local representation
- Education, community or passive recreation

Social values such as education and community involvement have been considered when assessing each reserve. Generally reserves with higher visibility have a higher community involvement. A greater community involvement means that a reserve is valued by the community and that expectations in relation to funding and management are higher. It can be argued that the greater the community involvement the better the outcomes as funding from alternative sources such as grants are more likely to be forthcoming.

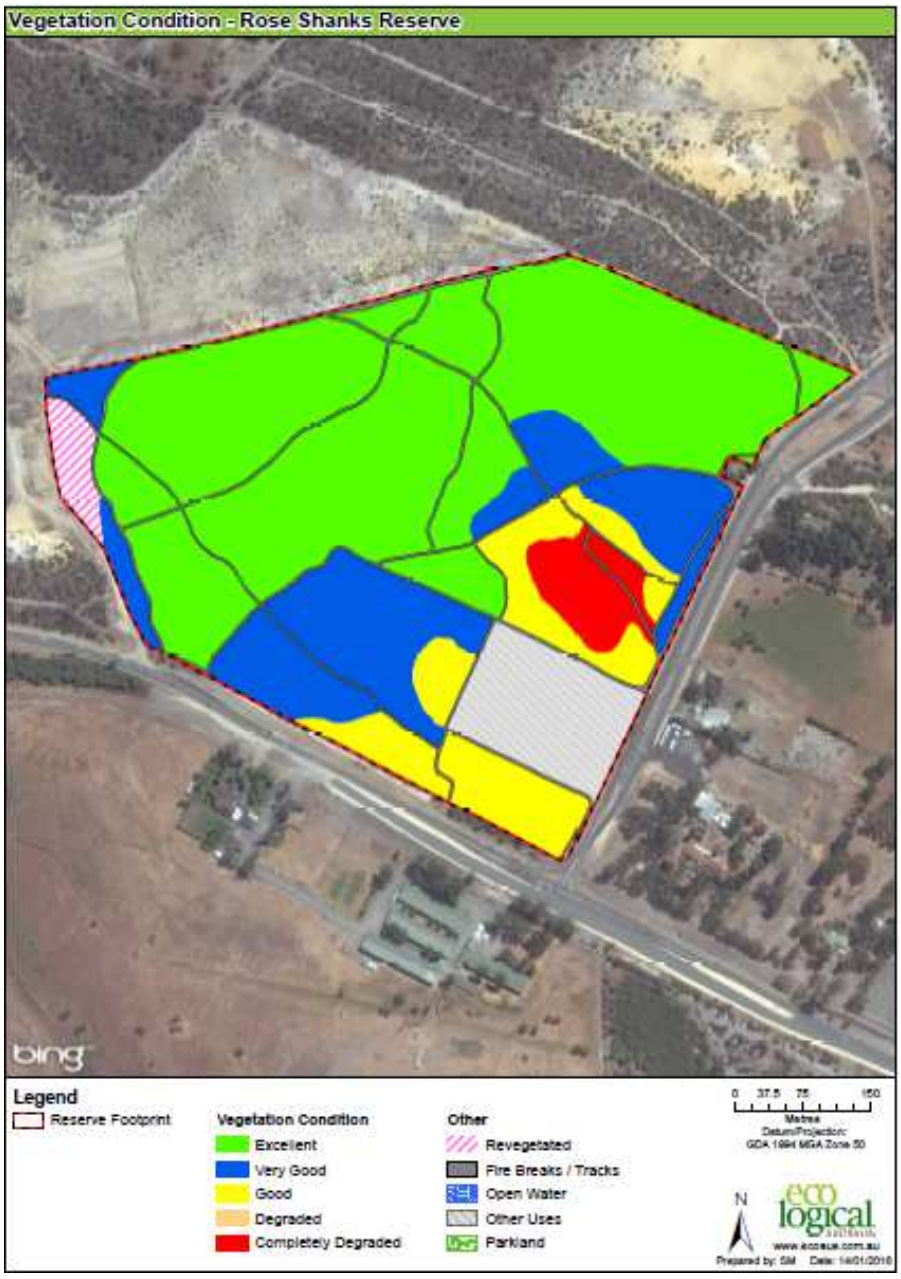

Fig.4 Vegetation Condition map Rose Shanks Reserve 2016 (Source: Ecological 2016)

Mapping vegetation condition of the reserve helps to inform management decisions including where weed control resources should be allocated.

Bushland condition is unlikely to change *significantly* in the short term but the weed control program should be reviewed regularly.

Recommendation 2 : Undertake vegetation condition and weed mapping every 4 years

Recommendation 3 : Focus primary weeding efforts in areas of excellent to very good bushland first.

6.6 Fire Hazard

Fire is an important issue in bushland management. Weeds contribute to increased fire fuel loads in bushland areas and surrounds thus in order to minimize this risk, it is important to control these weeds (Commonwealth Australia 2007). Grass weeds are generally prevalent on disturbed edges. While it is important to prioritize weed control efforts in good condition bushland it is also important to also diminish the fire risk. Unfortunately, if only grass weeds are controlled, it is highly likely that more aggressive and difficult-to-control weeds will invade and thus result in more costly long-term control.

Fig.5 Fire site in Yangebup Lake subject to weed control post fire (Photo A.Harris).

Growth of annual grasses and weeds with bulbs and corms can be especially vigorous post fire and therefore weed control should be undertaken as soon as germinants start to appear (DEC 2012). Fire also stimulates germination of native seeds which may be difficult to distinguish from weed germinant, as such care must be taken to ensure off target damage is reduced.

Recommendation 4 : Prioritise grass weed control where there is a threat to adjacent areas of high conservation value.

Recommendation 5 : Only control weeds if the bushland has the ability to naturally regenerate and out-compete the weeds or in conjunction with revegetation.

Fire episodes encourage the proliferation of weeds, often at the expense of native plants. However, during the succeeding one- to two-year period, access to the site is likely to be relatively easy with consequent easier targeting of weeds.

Recommendation 6 : Prioritise weed control within recently burnt areas, particularly during the first year after fire.

6.7 Aesthetic Values

The public interface with bushland is generally at the edges. If a bushland looks weed infested and untidy, and therefore appears uncared for, it promotes a negative public attitude. In order to engender a more positive, caring attitude to bushland reserves it is important to manage the edges, particularly for weeds.

Fig.6 Coastal tea tree and grass weeds at Manning Park. (Photo L.Metz)

6.8 Revegetation Sites

Due to the large soil weed seed banks in degraded areas of bushland, the success of any revegetation program through either direct seeding or tubestock installation is directly related to the effectiveness of associated weed control. Without weed control

prior to revegetation taking place, the results are likely to be poor due to competition from weeds.

Fig. 7 Site preparation works prior to revegetation (photo credit L.Metz)

Recommendation 7 : Do not attempt revegetation without at least one year, and preferably two years weed control.

6.9 Weed mapping

Maps that clearly show where weeds occur in bushland are excellent management tools. In conjunction with bushland condition maps, they provide the information needed for strategic weed management. They assist with determining appropriate use of limited resources and provide information on the spread of weeds over time plus the effectiveness of control programs. Not all weeds require mapping – only those that have a serious impact on bushland such as high or medium ranked species. Weed maps are produced at regular intervals based on the priority weed list developed by the City.

Mapping of weed species varies depending on the nature of the weeds being mapped. The mapping techniques used consist of:

• Point Mapping - scattered individuals in a small area or clumps of bulbous weeds

• Density (polygon) Mapping – scattered individuals in a large area mapped at densities of:

1. <5%,
2. 6-30%,
3. 31-60 and
4. >60%.

Fig.8 Weed mapping of Pelargonium capitatum in Baler reserve in 2012. (Source: Eco Logical 2013)

Fig.9 “Other weeds” mapping in Baler Reserve 2016 (Source: Eco Logical 2017)

In addition to the point and density mapping the City produces a combined weed map. This combined map visually demonstrates areas within a reserve that have the greatest density or concentrations of weeds and where efforts may need to be increased. The beauty of this map is that it provides a rapid visual indication of weed concentrations without being species specific. In this way, irrespective of the weed species present, if a high density of weeds have been recorded of several different species in one location within a reserve it is identified within the map.

This will allow a comparison to be made over time of combined weed densities within a reserve and will allow demonstration of weed control efforts to be captured and communicated visually more easily.

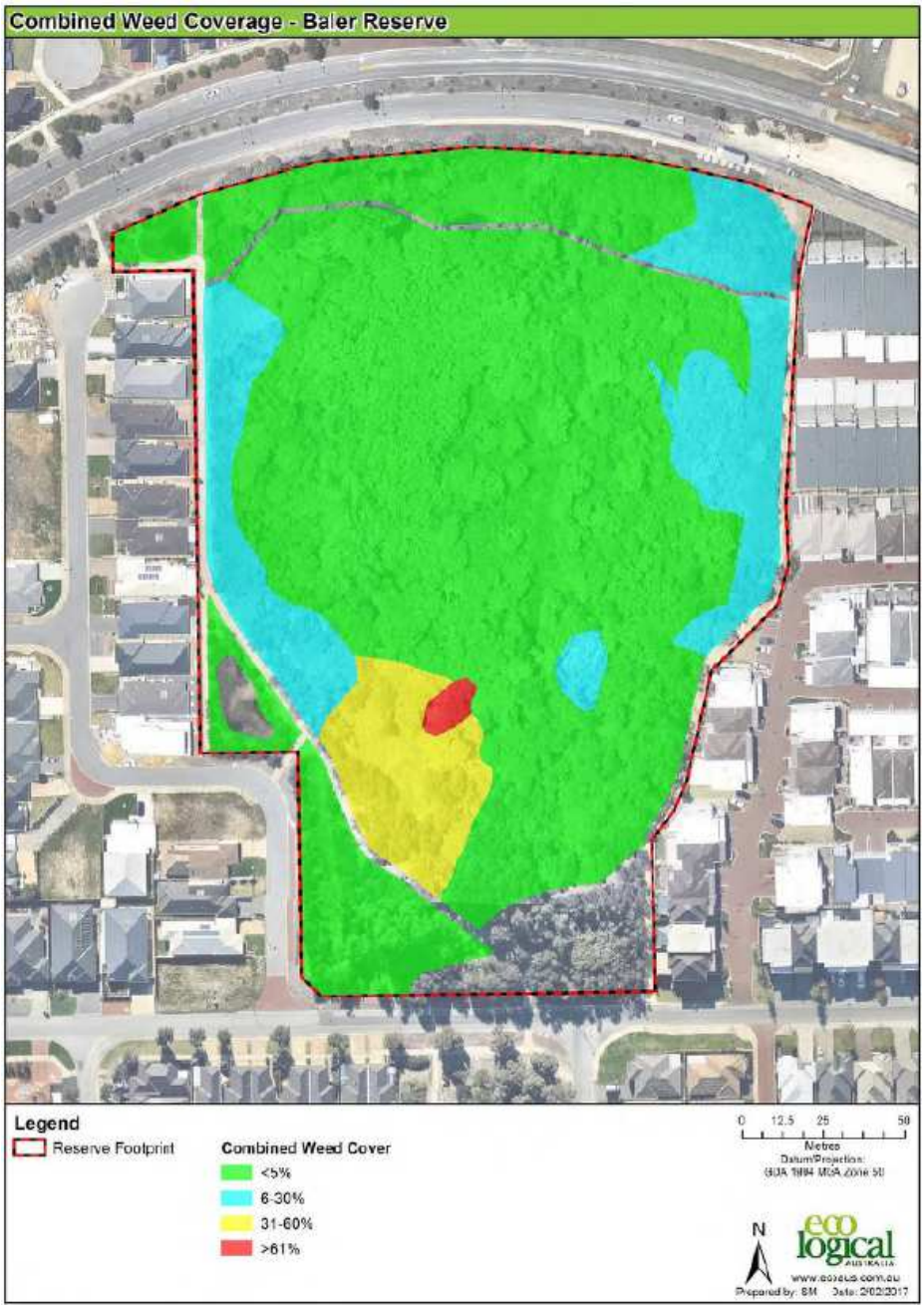

Fig 10 Combined weed map for Baler reserve 2016. (Source: Eco Logical 2017)

Spatial data and maps produced are loaded onto the City's Geographical Information System (GIS) and provide a record of key weeds species and their distribution throughout actively managed conservation reserves. This mapping is undertaken annually with each reserve having a four year rotation.

Recommendation 8 : Undertake weed mapping every 4 years on rotational basis

6.10 Identifying weed species

It is important that before removal of weeds occurs, species are positively identified first. Some native species look very similar to introduced plants. In addition some native plants may become weeds and adequate care to minimize any off target damage to surrounding vegetation is required. *Western Weeds* produced by Hussey et al is still considered one of the key reference texts for identification of Western Australian weeds. Florabase and the WA Herbarium also provide information on identification of weed species and their control. The City has developed its own herbarium to help staff identify common weeds found within the City.

7 Weed control methods

Direct methods such as biological control, manual control, use of herbicides or indirect methods through effective land and water management can be used to control weeds. In several cases a combination of both direct and indirect methods are required for effective control.

The selection of the best and most effective method depends largely on the biology of the weed species, for example, woody weeds may respond differently to bulbous weeds for a particular approach. As such it is vital that correct identification of the weed and its growth form is established prior to treatment (DEC 2012). Controlling degrading influences that increase ecosystem vulnerability to weed invasion is in of itself a very effective method of reducing weed impact (Brown et al 2002).

Weed control methods include:

• manual control

• mechanical control

• suppression

• barriers

• flame and steam weeding

• biological control

• controlled grazing

• chemical control

The City utilises all of these methods to control weeds within the City. An example of biological control is the use of leaf rust on Bridal Creeper. City staff harvest spores and release these into infested areas each spring.

Figure: 11 Aerial control of *Typha orientalis* at Bibra Lake 2012 Photo L.Metz

7.1 Aquatic weeds

Aquatic weeds pose a unique challenge to control especially in wetland environments. Many of these types of plants are well adapted to invading and colonising a space rapidly. Aquatic weeds can enter the environment in a number of ways including dumping from aquariums, disposal of water from ponds and through storm water into wetlands.

As they are located in water the appropriate control methods must be carefully considered to avoid doing harm to the environment. Specific herbicides are available for use in aquatic environments but in many cases mechanical of manual control methods are required.

Fig. 12 Amazon Frogbit (*Limnobium laevigatum*) Photo D.Friesen

Fig.13 Amazon Frogbit outbreak at Yangebup Lake. Photo D.Friesen

7.2 Fauna and weeds

Weeds can provide habitat and foraging value for a variety of fauna species. Removal of such weeds should be staged in conjunction with a complimentary revegetation program so that impacts on fauna are mitigated. This situation has

become particularly evident with the federally listed threatened Carnaby's Black Cockatoo. These birds rely heavily on introduced pine trees for foraging (Valentine 2008). Removal of pine trees in the Gnangara pine plantations has had a deleterious effect on the threatened species and as such staged removal is now being adopted. In the same way the City will consider implications of weed removal on native fauna and undertake measures to mitigate impacts where possible.

Fig.14 Carnaby's Black Cockatoo feeding on pine cone (Photo: Keith Lightbody)

Examples of weeds being used by native fauna include Bandicoots using Kikuyu, *Pennisetum clandestinum*, at Little Rush Lake and water birds using *Typha orientalis*, at Bibra Lake (Denise Crosbie pers.comm).

Weeds may continue to be introduced into a natural area even though control is occurring. Birds and other animals will continue to reintroduce seed of plants with fleshy fruits from surrounding areas, such as Olive, Fig, Japanese Pepper and Bridal creeper. Rabbits also can encourage the spread of weeds through eating seed of non-native plants and dispersing them through their scats.

Recommendation 9 : Control feral pests to reduce the spread of weeds

8 The role of community in weed control

Part of the solution to managing weeds in Western Australia is raising public awareness of the causes and appropriate responses to the problem.

Often people are not aware of the impact that weeds have on the natural environment and primary production or that they may be contributing to the problem through their own actions, for example, dumping weed-infested garden refuse in bushland or by distributing weed seeds by vehicles, animals and produce.

Fig. 15 Large Lantana (WONS) infestation on private land in Banjup (Photo L.Metz)

Community involvement can greatly contribute to the successful management of weeds in natural areas (CALM 2001). A growing number of community members are contributing to awareness and control of weeds through on ground action such as being part of a “Friends of” group or providing resources such as grants which can be otherwise limited.

Fig.16 Community group undertaking removal of Amazon frogbit at Yangebup Lake. (Photo D.Friesen)

The City of Cockburn is developing a weed brochure to help inform community members about significant weeds within the City and to provide information on how to control them. In addition the City works with volunteer and “Friends of” groups to implement weed management strategies.

Community groups do require training or supervision when undertaking methods of weed control to ensure safe work practices are adhered to and no off target damage is incurred. Largely herbicide use by community volunteers should be limited and professional expertise in addition to community involvement is often required.

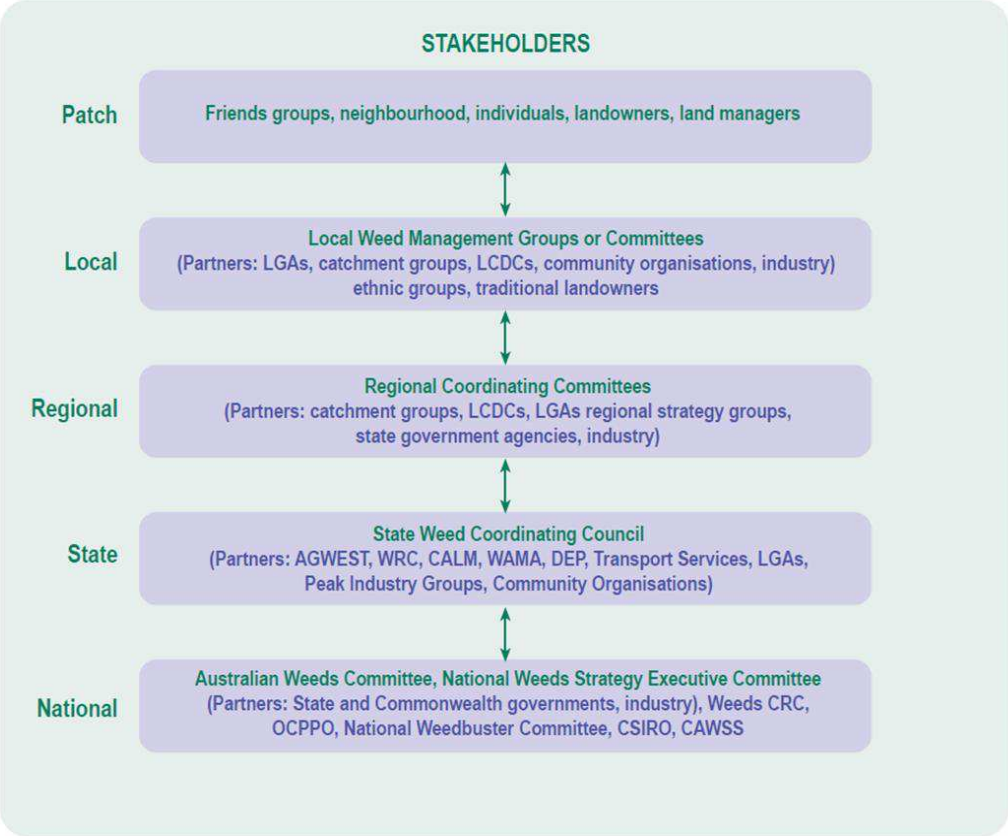

Fig.17 Stakeholder flowchart (Source: Dept Agriculture 2001)

Recommendation 10 : Undertake a community education campaign to inform residents of the harm caused by weed invasion and how they can contribute to reducing impacts from environmental weeds.

Recommendation 11 : Continue to engage with community groups to address environmental weed control issues to achieve natural resource management objectives.

9 Resourcing the Plan

The City's Weed Management Plan is funded through the implementation of the Natural Area Management Strategy and has funding allocated within annual budgets for both vegetation condition and weed mapping. Each reserve has a portion of operational expenditure available for weed control. Recently fire and

emergency services have also provided limited funding for weed control as part of broader fire fuel mitigation works and as a post burn treatment regime.

Funding has also been secured through a number of external grants funding often linked with revegetation projects. Some grant funding options include the Western Australian Government's State Natural Resource Management grants and Coastwest.

10 Measuring Achievement

Monitoring of the success of weed control is achieved through regular weed mapping within the City's reserves (e.g. every 4 years). Where weeds are shown to have increased their distribution assessment and revision of current control methods will occur.

Where new populations or individuals of weeds ranked as high or medium priority have been recorded steps will be taken to ensure outbreaks are eliminated as soon as possible.

Monitoring quadrats are established within specific locations where outbreaks of particularly invasive species have occurred to ensure that these populations are controlled effectively. In addition visual observations undertaken opportunistically can also inform management responses.

As part of the vegetation mapping that occurs,the loss of condition within a bushland will be closely linked to weed invasion and as such threatening process which may reduce the integrity and condition of vegetation within reserves will be assessed and mitigated where possible.

Photo monitoring of reserves also occurs on a regular basis (annually).

Key performance indicators have been identified to help determine the success of the City's Weed Management Plan:

KPI 1- 100% of actively managed reserves to contain no WONS or declared weed species

KPI 2 - 80% of actively managed reserves to have no greater than 30% weed cover of listed high priority weeds species

KPI 3 - 100% of reserves have no more than 50% weed cover

11 Reporting

Information on progress against the City's Weed Management Plan objectives and targets is provided in the City's annual report and State of Sustainability Report.

12 Glossary

Boot Stage: Growth stage when a grass inflorescence is enclosed by the sheath of the uppermost leaf.

Declared Plant (DP) means a plant 'declared' by the Agriculture Protection Board under the Agriculture and Related Resources Protection Act 1976. If a plant is declared, all landholders are obliged to control that plant on their properties. Declarations specify a category, or categories, for each plant according to the control strategies or objectives that the Agriculture Protection Board believes are appropriate in a particular place. E.g. Salvinia, *Salvinia molesta* and Water Hyacinth, *Eichhornia crassipes* are both declared plants, category P2, which requires the landowner to complete eradicate infestations. One Leaf Cape Tulip (*Moraea flaccida*) is declared category P1, which requires the landholder to prevent infestation spreading beyond existing boundaries of infestation.

Ecosystem services: the processes by which the environment produces resources that provide benefits to humans, for example, flood and disease control, clean air, waste recycling, plant pollination

Edge Effect: When an edge is created to any natural ecosystem, and the area outside the boundary is a disturbed or unnatural system, the natural ecosystem is seriously affected for some distance in from the edge. In the case of a forest where the adjacent land has been cut, creating an open land/forest boundary, sunlight and wind penetrate to a much greater extent, drying out the interior of the forest close to the edge and encouraging rampant growth of opportunistic weedy species at the edge.

Endemic: Native to and restricted to a particular geographical region e.g. Mindiyed, *Melaleuca nesophila*, is endemic to the south coast of WA near Bremer Bay.

Indigenous: Originating and living or occurring naturally in an area or environment, not exotic; not imported. E.g. Broad-leaved Paperbark, *Melaleuca quinquenervia*, is indigenous to eastern Australia.

Naturalized: plants that spread and persist outside of their normal range of distribution

Pest Plant: (PP) means a plant declared to be a pest plant, in relation to a district, prescribed by local laws made by a local government in that district. Caltrop, *Tribulus terrestris*, is a prescribed Pest Plant in the City of Cockburn.

Seed set: the formation of mature fruits with viable seeds. To produce seeds after flowering.

Sleeper Weeds: 'Sleeper weeds' are plants that are just waiting to go feral. They possibly have not yet invaded the environment but have the potential to do so. Plants that have had a limited distribution for years may suddenly become environmental weeds. This can be caused by: changing climatic conditions; presence of a pollinator; presence of a vector (spreader); changes in horticultural or agricultural practices. E.g. Bridal Creeper – became invasive on the Swan Coastal Plain recently after having been cultivated in the Wheatbelt for years, and Freesia – recently recognised as a serious weed after years of apparently limited distribution.

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15 Appendices

Appendix 1: Priority Weed List V5 updated January 2018

High Priority		
Scientific Name	Common Name	WONS/ DP
Acacia longifolia	Sydney Golden Wattle	
Anredera cordifolia	Madeira vine	WONS
Asparagus asparagoides	Bridal Creeper	WONS
Cirsium vulgare	Spear Thistle	
Chrysanthemoides monilifera	Boneseed	WONS/DP
Cortaderia selloana	Pampas Grass	
Cynodon dactylon	Couch grass	
Echium plantagineum	Paterson's Curse	DP
Ehrharta calycina	Perenial Veldt Grass	
Emex australis	Doublegee	
Eragrostis curvula	African Lovegrass	
Euphorbia terracina	Geraldton Carnation	
Ferraria crispa	Black Flag	
Freesia hybrid	Freesia	
Fumaria bastardii		
Fumaria capreolata	Climbing Fumitory	
Fumaria muralis	Wall Fumitory	
Gomphocarpus fruticosus	Narrow Leaf Cotton Bush	DP
Hyparrhenia hirta	Tambookie Grass	
Juncus acutus	Spiny Rush	
Lachenalia reflexa	Yellow Soldiers	
Leptospermum laevigatum	Coastal Tea Tree	
Lycium ferocissimum	African boxthorn	WONS
Moraea flaccida	One-Leaf Cape Tulip	DP
Opuntia stricta or other sp.	Prickly Pear	WONS/DP
Pelargonium capitatum	Rose Pelargonium	
Pennisetum setaceum	Fountain Grass	
Retama raetam	White Broom	
Rubus anglocandicans	Blackberry	WONS/DP
Solanum linnaeanum	Apple of Sodom	DP
Tribulus terrestris	Caltrop	
Typha orientalis#	Typha, Bulrush	
Zantedeschia aethiopica	Arum Lily	DP
Medium Priority		

Arundo donax	False Bamboo	
Asphodelus fistulosus	Onion Weed	
Brassica tournefortii	Mediterranean Turnip	
Carpobrotus edulis	Pigface	
Cenchrus echinatus	Burr Grass	
Chasmanthe floribunda	African Cornflag	
Cyperus spp	Nutgrass/ Dense Flat Sedge	
Ehrharta longflora	Annual Veldt Grass	
Ehrharta villosa	Pyp Grass	
Euphorbia paralias	Sea Spurge	
Ficus carica	Edible Fig	
Foeniculum vulgare	Fennel	
Ipomoea cairica	Coast Morning Glory	
Holalanthus novo-guineensis	Bleeding Heart Tree	
Lupinus cosentinii	Sandplain Lupin	
Pennisetum clandestinum	Kikuyu	
Melaleuca nesophila	Mindiyed	
Nicotiana glauca	Tree Tobacco	
Olea europea	Olive	
Oxalis pes-caprae	Soursob	
Phytolacca octandra	Inkweed	
Raphanus raphanistrum	Wild Radish	
Ricinus communis	Castor Oil	
Schinus terebinthifolia	Japanese/Brazilian Pepper	
Symphyotrichum subulatum	Bushy Starwort	
Tagasaste		
Tetragonia decumbens	Sea Spinach	
Thinopyrum distichum	Sea Wheat	
Trachyandra divaricata	Dune Onion Weed	
Watsonia bulbilifera	Watsonia	
Low Priority		
Agave americana	Agave or Century plant	
Stenotraphum secundatum	Buffalo	
Conyza bonariensis	Flaxleaf Fleabane	
Dittrichia graveolens	Stinkwort	
Gazania linearis	Gazania	
Gladiolus caryophyllaceus	Pink Gladiolus	
Malva parviflora	Marshmallow	
Melaleuca quinquenervia	Broad-leaved paperbark	
Salix spp.	Willow	WONS/DP
Aquatic Weeds		
Bacopa monnieri	Bacopa	
Eichhornia crassipes	Water hyacinth	DP

Hydrocotyle bonariensis	Large Leaf Pennywort	
Limnobium laevigatum	Amazon Frogbit	

Note:# *Typha orientalis* has undergone a re-classification and as such is now considered to have a mixed naturalised status (native in part of range and naturalised elsewhere). However due to its invasiveness it is still considered to be ranked high as a priority for control.

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