

City of Joondalup Draft Weed Management Plan 2022 - 2032



City of Joondalup pest plant and priority listed weed, Caltrop (*Tribulus terrestris*)

Acknowledgements

Please formally acknowledge the City of Joondalup if you choose to use any of the content contained within the Weed Management Plan.

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Acknowledgement of Country

The City of Joondalup acknowledges the Traditional Custodians of this land, the Whadjuk people of the Noongar nation. The City recognises the culture of the Noongar people and the unique contribution they make to the Joondalup region and Australia.

The City pays its respects to Elders past, present, and emerging, as well as all Aboriginal and Torres Strait Islander peoples.

This plan may include words from the Noongar language and the City recognises that Aboriginal languages are oral in nature and the same word can be spelt in multiple ways.

Aboriginal and Torres Strait Islander people are advised that this plan may contain images or names of people who are deceased.

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Acronyms

Acronym / Abbreviation	Definition
APVMA	Australian Pesticides and Veterinary Medicines Authority
BAM Act	<i>Biosecurity and Agriculture Management Act 2007 (State)*</i>
BC Act	<i>Biodiversity Conservation Act 2016 (State)</i>
CALM	Department of Conservation and Land Management
CBP	Commercial Business Precinct
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFWA	Department of Agriculture and Food Western Australia
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DEC	Department of Environment and Conservation
DFES	Department of Fire and Emergency Services
DPaW	Department of Parks and Wildlife
DPIRD	Department of Primary Industries and Regional Development
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
DWER	Department of Water and Environmental Regulation
FCT	Floristic Community Type
ha	Hectare
IARC	International Agency for Research on Cancer
km	kilometre
KPI	Key Performance Indicator
m	meter
n.d.	No date
NEWP	National Established Weed Priorities
NIASA	Nursery Industry Accreditation Scheme Australia
NRM	Natural Resource Management
PAW	Pedestrian Access Way
POSF	Public Open Space Framework
QMS	Quality Management System
SAR	Specified Area Rates
SDS	Safety Data Sheet
TEC	Threatened Ecological Community
WA	Western Australia
WALGA	Western Australian Local Government Association
WAH	Western Australian Herbarium
WAM	Western Australian Museum
WAOL	Western Australian Organism List
WHO	World Health Organization
WoNS	Weeds of National Significance

* A review of the BAM Act is being undertaken in 2022.

1.0 Introduction

1.1 Background

The City is located within the Southwest Australian biodiversity hotspot, one of 36 biodiversity hotspots in the world, with over 2,900 endemic plant species occurring in this region.¹ There are a number of regionally, nationally and internationally significant natural areas located within or adjacent to the City including Yellagonga Regional Park, Marmion Marine Park and Neerabup National Park. There are a total of eight Bush Forever sites within the City that contain vegetation communities and species of high conservation value.

The City is situated along the Swan Coastal Plain, with its southern boundary located approximately 16 kilometres from the Central Business District of Perth. The City covers an area of 96.5 square kilometres which encompasses a diverse range of natural areas including 17 kilometres of coastal foreshore, a chain of wetlands and a variety of natural areas. The City also includes 550ha of parks, 533ha of natural areas, 1,060km of roads and 927km of pathways.

The City is bounded by the City of Wanneroo to the east and north, the City of Stirling to the south, and the Indian Ocean to the west. A map of the City is displayed in Figure 1.

1.2 Weed Management Plan 2022 – 2032

1.2.1 Purpose

The purpose of the *Weed Management Plan 2022 – 2032* is to provide an integrated approach to the management of weeds within the City.

The *Weed Management Plan 2022 - 2032* details actions to prevent, monitor, prioritise and control the introduction and spread of weeds in the City. The Plan describes the potential impacts from weeds, weed control methods, the City's current weed management approach and proposes management strategies to be implemented over the life of the Plan to minimise potential impacts.

Weed management is conducted within the City by staff, contractors and the valuable contributions from community members in Friends Groups. There are currently 19 Friend Groups within the City, whose members voluntarily work to protect, preserve and enhance significant bushland areas in the community. The *Weed Management Plan* is aligned with the voluntary work of Friends Group volunteers.

The *Weed Management Plan 2022 – 2032* builds upon the outcomes of the previous *Weed Management Plan 2016 – 2021*.

1.2.2 Objectives

Over the past decade the City has been implementing an integrated weed management approach and increasing non-chemical weed control methods to address community concerns.

The objectives of the *Weed Management Plan 2022 – 2032* are to:

- i. Implement the integrated weed management program to protect biodiversity and maintain amenity in accordance with regulatory requirements.

¹ Conservation International (2014)

- ii. Reduce the reliance of herbicide use by increasing non-chemical weed control methods, where appropriate.
- iii. Minimise bushfire risk by undertaking weed control to mitigate fire fuel loads.
- iv. Increase communication to the community regarding the City's weed management practices.
- v. Support the community's role in weed management through increased community awareness initiatives.

1.2.3 Scope

The City conducts weed management on City managed or owned land across its 22 suburbs, as required. Weed management is conducted in the City to differing degrees, depending on the primary function and usage type of public open space. In alignment with the City's draft *Public Open Space Framework* all public open spaces owned or managed by the City fall into one of the classifications below:

- Natural Areas
- Urban Areas, consisting of:
 - Sports Park
 - Recreation Park
 - Urban Landscaping.

Weed management of the City's natural areas differs substantially to weed management in parks and urban landscaping areas, due to the difference in weed density and biodiversity values. Section 4.1 of the Plan outlines weed management in natural areas, whilst Section 4.2 of the Plan details weed management in parks and urban landscaping areas.



Figure 1: Location of the City of Joondalup

1.2.4 Community Consultation

The City conducted community consultation to consider the City's strategic integrated weed management approach and identify opportunities to inform the review of the Weed Management Plan with the Strategic Community Reference Group in May 2021. The Strategic Community Reference Group consisted of community members, experts and Elected Members. Key initiatives and improvements were identified for consideration in the development of the City's new Weed Management Plan, such as increased community education and communications regarding weed management risks and benefits.

The City will also conduct community consultation on the draft Weed Management Plan in 2022-23. Community feedback will be incorporated into the final Weed Management Plan, where relevant, which will be presented to Council for endorsement.

1.3 Public Health and Safety

The City's integrated weed management approach is conducted in accordance with regulatory requirements and with consideration to community wellbeing and public health.

The City's use of any chemical pesticides to control weeds is in accordance with established health and safety standards. The WA Department of Health administers the *Health (Pesticides) Regulations 2011*, which provide for the safe use and application of pesticides, including herbicides, through appropriate registration and licensing of businesses and persons involved in weed control. All City employees and contractors that use herbicides for weed control are required to adhere to these regulations.

The City uses products that are approved by the Australian Pesticides and Veterinary Medicines Authority (APVMA), according to label instructions, and abides by safety requirements listed on Safety Data Sheets (SDS). Risk assessment and management is undertaken to identify and assess pesticide hazards, and where necessary put in place options to eliminate or control risks.

The *Work Health and Safety Act 2020* requires the City to maintain a current register of hazardous chemicals used in the workplace, provide workers with information and training on the risks associated with their use (storage, handling and disposal) and take precautions to eliminate or minimise the risk of injury.

It is also recognised that some weeds affect human and animal health, causing injury, allergies, dermatitis, poisoning, asthma and other respiratory problems. Weeds have additionally been linked to indirectly affecting wellbeing through the reduction of functionality and amenity of natural areas and public open spaces.²

1.4 Weed Management Plan 2016 – 2021

The *Weed Management Plan 2016 – 2021* was endorsed by Council in 2016. Substantial progress has been made in implementing the recommended actions from the Plan with all recommendations that were scheduled for implementation during the life of the Plan having been either completed or commenced. Key achievements from the *Weed Management Plan 2016 - 2021* include:

- Ongoing weed control in natural areas and public open spaces in accordance with the Annual Maintenance Schedules.

² Commonwealth of Australia (2017)

- Flora surveys and vegetation condition assessments conducted in numerous major conservation areas, including weed mapping to enable targeted weed control.
- Regular weed monitoring and mapping of natural areas to inform weed control measures.
- Annual monitoring of percentage cover of weeds in natural areas to assess the City's weed management performance.
- Undertaking soil and leaf tissue analysis and turf renovation works to improve the quality of turf and reduce the likelihood of weeds.
- Implementation of the City's bushfire mitigation program including maintenance of firebreaks and other bushfire mitigation works.
- Conducting alternative weed control and technology trials.
- Implementation of steam and hot water and steam only treatment trials within sections of the:
 - Coastal Dual Use Path
 - Commercial Business Precinct (CBP) - kerbs, footpaths, hardstand (paved) median islands, mulched median islands and general paved areas.
- Best practice landscape design and management including hydrozoning and ecozoning principles undertaken in numerous parks.
- Use of pathogen and weed free mulch to suppress weed growth in garden beds or non-turfed areas.
- Community weed education through the Environmental Education Program and Adopt a Bushland/Coastline Program.
- Participation in the WALGA Local Government Herbicide Use and Integrated Weed Management Working Group.

It is estimated that in 2020-21, the City's weed control trials included 2.2ha of non-chemical techniques as part of its chemical reduction approach which focused on research and trials of both chemical and non-chemical products and technologies.³ Aspirations for future management include measures to continue increasing coverage of non-chemical weed control through the City's chemical reduction approach, as shown in Figure 2.

The City will also aim to continue increasing canopy cover in the City, through the Leafy City Program and the Parks Development Program. The Leafy City Program provides increased leaf canopy cover in residential streets through tree planting to mitigate the heat-island effect and impacts of climate change. The Parks Development Program focuses on the gradual hydrozoning and ecozoning of parks which supports the replacement of invasive weeds with suitable native species, reducing both financial and environmental impacts over time.

³ City of Joondalup, 2021



Figure 2: Steam and hot water weed control commenced within the City's CBP in July 2022

1.5 Weeds in Mooro Noongar Boodjar

The City of Joondalup acknowledge the Traditional Custodians past, present and future of the land and waters we are situated, the Whadjuk people of the Noongar Nation, and recognise Aboriginal peoples have practiced sustainable natural resource management and cared for the flora, fauna and biodiversity of Australia for thousands of years.

The Joondalup area, also known as *Mooro Boodjar* (Country), has always been abundant with natural resources, supporting many Noongar generations who continue to remain connected to *Mooro Boodjar*. In return, Noongar people have cared for, protected and sustainably managed their *Boodjar*, and the local plants and animals, traditional kaardijin (knowledge), stories and ceremonies.

European settlement saw the establishment of market gardens, farms and vineyards, with the subsequent building of roads, settlements and industry; changing the landscape and how it was managed. Traditional Owners recognise that the changes to the landscape brought about by colonisation have significantly changed the connectivity of natural areas, and the local flora, fauna and biodiversity. The clearing of native vegetation, planting of imported species, impacts on wetland and coastal systems, lack of continued cultural burning practices and infestation of pest plants and animals have impacted on *Boodjar*.

The *Weed Management Plan 2022 - 2032* aims to address the adverse impacts brought about in a relatively short span of time by European colonisation and, with the guidance of Traditional Owners, contribute towards bringing back the health of *Boodjar*. This plan also seeks to work in conjunction with the City's strategic environmental framework and draft Reconciliation Action Plan to sustainably manage *Boodjar* in the City. The City's *Environment Plan 2014 - 2019*, *Yellagonga Integrated Catchment Management Plan 2021 - 2026* and Natural Area Management Plans also support the removal of invasive weeds while protecting and promoting natural areas.

1.6 Strategic Context

The purpose of the *Weed Management Plan* aligns with the City of Joondalup Strategic Environmental Framework outlined in Figure 3. Details of the relevant local, State and Federal legislation policies, plans and strategies are outlined in Appendix 3.



Figure 3: City of Joondalup Strategic Environmental Framework

2.0 Impact of Weeds

The City manages large areas of bushland, approximately 533 hectares (ha) of natural areas in over 100 reserves, many of which are recognised as having local, regional or national significance. Weeds are a key management issue for the City's natural areas and threaten the biodiversity values they contain.

The City also contains large areas of assets and infrastructure, parks and urban landscaping areas. Assets maintained by the City include 550ha of parks, 17ha of urban streetscapes, 1,060km of roads, 120ha of grassed medians, 15 artificial wetlands, 927km of pathways and cycleways, numerous play spaces, public garden beds, sporting fields and more. The invasion of weeds in these areas affects the amenity, functionality and aesthetics and impacts upon community use of the sites.

2.1 What are Weeds?

Weeds are plants that grow in areas where they are not naturally occurring and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade.⁴ A weed usually requires some form of action to reduce its effects on the economy, the environment, human health and amenity.⁵ Weeds can establish themselves in terrestrial, aquatic or marine ecosystems.²

There are two types of invasive weeds, exotic plants that have been introduced and native species that have moved into new areas in response to changed land and water use and management practices.^{5, 6}

Weeds account for approximately 15% of all flora in Australia, with this figure increasing by approximately 20 species per year.^{7, 8} The number of weeds in Australia has increased linearly over recent years, compared with the majority of other regions of the world where introductions are still increasing exponentially.⁹ Over 27,000 known weed species have been introduced to Australia and 10% of those are now considered to be established (have existed for a long time). Escaped garden and landscaping plants are the main source of Australia's weeds, accounting for 66% of recognised weed species.¹⁰

Most of the environmental impacts on threatened species and communities in Australia are caused by a small number of target weed species.¹¹ For example, there are 187 invasive weed species introduced to Australia and 16 invasive native plant species introduced to regions outside their native range and have become problematic and are resulting in the greatest impact to Australia's threatened species and communities.¹²

Weeds typically produce large numbers of seeds and spread rapidly, invading natural areas, parks and urban landscaping areas. Weeds can be spread by:

- dispersal of seeds by water, wind, birds, animals, human or vehicle movement
- site activities
- underground root systems

⁴ DPaW (1999)

⁵ NRM Ministerial Council (2007)

⁶ Australian Government (2022)

⁷ Australian Government (2012b)

⁸ Australian Government (2022)

⁹ Australian Government (2022)

¹⁰ Groves, Boden and Lonsdale (2005)

¹¹ Australian Government (2022)

¹² Australian Government (2022)

- mulch, soil and plant stock
- garden rubbish dumping
- fire.⁷

Yearly growth patterns of weeds vary with some species growing in summer and seeding in autumn and others growing in winter and seeding in spring. The life cycle of weeds also varies, with weeds being classified as either:

- **Annual:** Weeds which germinate, grow, set seed and die in one season or year, such as Wild Oat, Veldt Grass, Paterson's Curse and Cape Weed.
- **Biennial:** Weeds which live for up to two years, usually growing and flowering in the first year and setting seed in the second, such as Bridal Creeper.
- **Perennial:** Weeds which live for three years or more, such as Geraldton Carnation Weed or Gazania.¹³

2.2 Why Weed Management is Important

The City is required to undertake weed control and management to:

- meet the regulatory requirements under the *Biosecurity and Agriculture Management Act 2007*
- protect biodiversity
- reduce bushfire risk
- reduce damage to infrastructure
- meet community expectations for the amenity and aesthetics of local areas.

Within the City, there are 285 identified weeds including 15 declared pest plants and five WoNS. These weed species are often widespread and without control can alter public open spaces reducing viability and biodiversity. The City recognises the importance of weed management and outlines the key impacts in the sections below.

Environment

Weeds are one of the major threats to Australia's natural environment and biodiversity and can change the natural diversity and balance of ecological communities. The City is committed to the ongoing management and conservation of the City's natural environment and biodiversity. Integrated weed management, inclusive of utilising a suite of weed control techniques and timely interventions, is essential to the ongoing protection and enhancement of the City's natural environment.

The City manages a diverse range of natural areas including iconic locations such as sections of Yellagonga Regional Park, Craigie Bushland, Warwick Bushland, Hepburn Heights Conservation Area, Shepherds Bush Reserve and a range of coastal foreshore reserves. Key environmental aspects of the natural areas managed by the City include:

- Two Federally listed Threatened Ecological Communities (TEC)
- Eight Bush Forever sites
- 30 conservation significant fauna
- One endangered and six priority flora species.

Weeds can impact the natural environment by:

¹³ CRC for Australian Weed Management (2005a)

- Reducing the viability of native plant species by competing more vigorously for space, water and nutrients.¹⁴ This can result in a decrease in the abundance and health of native species, even to the point of extinction in that area.
- Reducing natural diversity by smothering native plants or preventing them from regenerating after clearing, fire or other disturbance.
- Altering nutrient recycling and soil quality by fixing nitrogen in the soil which can inhibit the germination of native species or releasing nutrients into the soil which may impact negatively on native seedling germination and growth.
- Introducing pests and disease from different areas which native species may not have previously had contact with and may be particularly susceptible to. Weeds can also be more resilient than native plants to certain pests and diseases.
- Creating high fuel loads for fires and increasing the risk of fire in bushland areas.¹⁵
- Negatively impacting on native fauna by replacing or reducing the native plants and altering plant communities that animals use for shelter, food and nesting.¹⁶
- Altering hydrological cycles by clogging water courses, resulting in erosion and alteration to flow and or aquatic habitat, as well as reducing light and oxygen to aquatic flora and fauna.
- Impact on cultural heritage sites and reducing availability of bush tucker and medicine.
- Altering genetics of native flora species over time from hybridisation through cross-pollination.

Infrastructure and amenity

Weeds can have social impacts on communities by degrading parks, verges, median strips, public access ways and natural areas. Weeds impact these areas by lowering the amenity, functionality and aesthetics of sites and make these areas less usable by the community.

Weed control is undertaken along City managed roadsides to help improve road safety, particularly when weeds on roadsides reduce driver visibility or impact the integrity of the road surface and road shoulder. Weeds can also impact upon stormwater drainage and result in unsafe road surfaces such as potholes forming.

Weeds can form barriers that impact cultural activities, including food collection and recreational use. Weeds can quickly overtake waterways, preventing water recreation activities and remove habitat for locally native species.

It is widely recognised that weed management is costly, including the direct costs of weed control, and the indirect costs in reduction to the amenity of an area. There is also the unquantified impacts of weeds on nature conservation, tourism and landscape amenity.¹⁷ The use of alternative weed control methods in public open spaces usually has an increased cost and subsequent financial impacts.

2.3 The Effect of Climate Change on Weeds

The City is already experiencing the effects of climate change such as increased coastal erosion, higher summer temperatures, more severe heatwaves, less rainfall, more extreme weather events and a longer bushfire season.^{18,19} As a result, climate change has significant social, environmental, economic and legal implications. Climate change has the potential to cause damage to, or loss of, biodiversity and natural habitat.

¹⁴ Australian Government (2012a)

¹⁵ FESA (2011)

¹⁶ City of Joondalup (2012a)

¹⁷ Invasive Plants and Animals Committee (2016)

¹⁸ Scott, J.K., et al (2014)

¹⁹ City of Joondalup (2016)

Predicting the exact scale and nature of climate change at a local level is challenging, and the effect on ecosystems is likely to be complex. Climate change is creating favourable environments for weeds as they are generally able to respond rapidly to disturbances enabling weed species to move into new areas or out-compete native species in their existing range.²⁰

Climate change has the potential to increase the presence of weeds by:

- creating opportunities for weeds to establish through increased extreme events and resulting disturbance to natural areas, noting the rate of response of weeds to establish is expected to be faster than native plants.
- providing weeds, likely a new set of weed species, that are more readily able to adapt to future climates with a competitive advantage over native species.
- altering distribution patterns of weed and native species.
- increasing activity from sleeper weeds which may appear benign for many years, but have the potential to suddenly spread rapidly following certain natural events such as flood, fire, drought, climate change, or change in land or water management.²¹

In terms of weed management, reliance on one type of weed control under all scenarios is no longer feasible or efficient. Therefore, weed management within the City must evolve further using integrated management techniques available and introduce alternate viable techniques.

²⁰ Australian Government (2012)

²¹ Australian Government (2013)

3.0 Background on Weed Control

The City undertakes an integrated weed management approach to its weed control in public open spaces including use of a variety of mechanical, suppression, chemical-free and chemical (herbicide) application methods, as well as hand weeding. In determining the appropriate weed control method(s) for a given situation the City takes the following into consideration:

- the target weed
- the season
- timing i.e. before weeds set seed
- resistance of the weed to specific herbicides
- potential residual effects and damage to off-target species
- rotation of the type of herbicide used to reduce herbicide resistance
- selection of the least toxic herbicide for the target species
- site location and any special considerations i.e. near wetlands
- weather conditions i.e. rain and wind
- effectiveness of outcomes, labour intensity required and cost involved.

The City's integrated approach also incorporates risk mitigation measures, surveillance, diagnostics and the most appropriate management response. The purpose of integrated management is to reduce the total impact of invasive non-native plant species in different systems.

Integrated weed control involves using a number of methods to reduce weed infestations to manageable levels or if possible to eradicate infestations. Potential weed control treatment methods available to the City may include:

- Physical weed control – the removal of weeds by physical or mechanical means or the suppression of weed growth, such as mowing, grazing, mulching, geo-fabrics, tilling, burning or by hand.
- Chemical weed control – the use of selective and non-selective herbicides to affect the growth of the weed and cause it to die.
- Steam and hot water weed control – the application of hot water and/or steam (also known as hydrothermal weed control) to a weed plant causing it to die.
- Biological weed control – the introduction of a weeds natural enemy (could be an insect or pest, fungi or disease) to reduce its spread and growth. This approach is not currently undertaken by the City.
- Electric weed control – the use of a high-voltage electrode that allows an electric current to pass through the plant which raises its temperature and causes it to die. This approach is not currently undertaken by the City.

There are many aspects that need to be taken into consideration when determining appropriate methods of weed control in public open spaces. The City utilises a range of weed control treatment methods as part of its integrated weed management approach. This approach has included 16 years of researching and trialling alternative weed control options.

The City allows residents to stay informed and receive notification of chemical application treatment locations or alternatively to have their residence excluded from any chemical application treatment. The City's integrated weed management program provides transparency to the community, flexibility to deliver the most safe and effective weed control treatments for the City's diverse range of public open spaces, allows for innovation through trialling emerging weed control methods and where effective will see their incorporation into the program. The City recognises that weed management is constantly evolving and will

review and consider incorporating other emerging weed control methods into its program throughout the life of this plan.

The types of weed control available to the City and their advantages and disadvantages are described in sections 3.1 to 3.5 and detailed in Appendix 6. Further discussion on the use of weed control in particular locations and circumstances is provided in section 4.2.8.

3.1 Physical Weed Control

There are several types of physical weed control methods, including:

- Mechanical or manual – for example hand removal, hand tools, harrows, tractor hoes, brushcutters and mowers
- Smothering – using materials such as wood chips or geofabric to suppress weeds
- Mulching – using NIASA accredited nursery organic matter to suppress weeds (e.g. pathogen-free mulches such as pine wood chips and others)
- Other suppression materials and methods – geofabric materials, organic barriers, revegetation with locally native plantings.

Smothering and the use of mulch are generally not suitable for natural areas as they would also prevent the growth of native seedlings, but can be used in limited situations (e.g. along edges or larger areas void of native vegetation for smothering only). Mechanical methods using large pieces of equipment or machinery would also create too much disturbance to the native vegetation and soil surface and are therefore not suitable.

The physical removal of weeds through hand weeding can be appropriate in some circumstances. Advantages and disadvantages of hand weeding are provided in Table 1.

Table 1: Advantages and Disadvantages of Hand Weeding²²

Advantages:	Disadvantages:
<ul style="list-style-type: none"> • Young plants can be easy to pull out if soil is moist. • Allows for selective removal of weeds. • Can be effective for small infestations. • Avoids the use of herbicides. 	<ul style="list-style-type: none"> • Can be difficult to remove plants if soil is dry or plants are large. • Is time consuming and labour intensive. • Digging can cause soil disturbance and disturb the root systems of native vegetation. • Can result in trampling and destruction of understorey and shrubs (particularly if there are a large number of people conducting hand weeding). • Is not effective for large infestations. • Can make the area more vulnerable to erosion.

Whilst hand weeding has been found to be more time consuming, labour-intensive and less effective than herbicide use, it can form an important part of an integrated weed management approach. Hand weeding using hand tools can be used and may be suitable for many annual species and for relatively small infestations. Hand weeding is particularly useful for the control of herbicide resistant weeds or when herbicides are unable to be used. However, it is mainly used for small infestations or as a follow-up to other methods. The City undertakes a small

²² CRC for Weed Management (2004)

amount of hand weeding. A substantial amount of hand weeding is conducted by Friends Groups volunteers who contribute significantly to weed control in natural areas within the City.

Hand weeding also provides opportunities to the personnel conducting the hand weeding to connect with and make broader observations of the natural area they are working in, which can result in management benefits.

An example of the physical weed control method of hand pulling is shown in Figure 4.

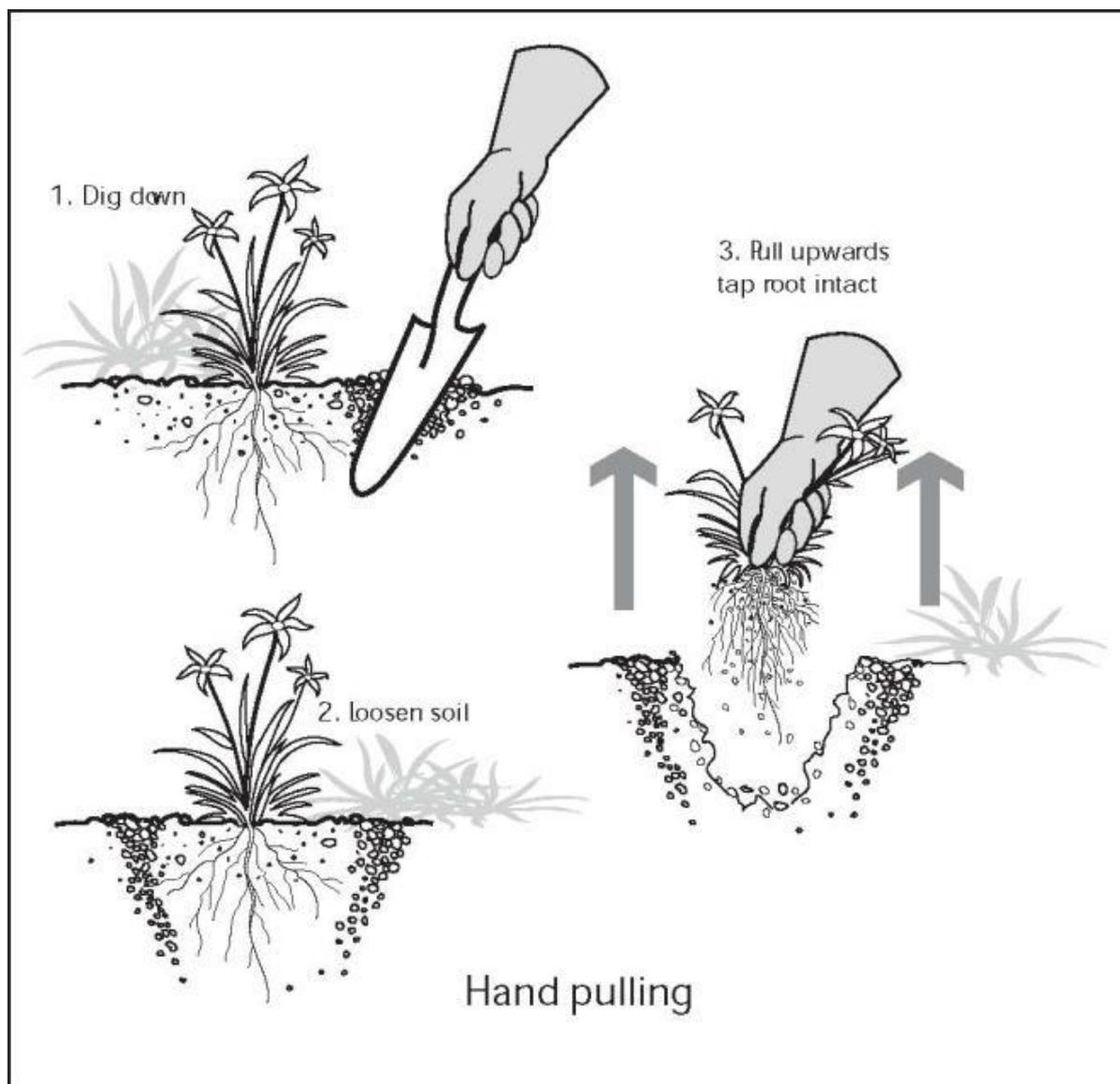


Figure 4: Hand Pulling Method ²³

3.2 Chemical Weed Control

Pesticides are defined as a chemical formulated as a solid, liquid or gas used for managing pests.²⁴ Pesticides can be used for directly or indirectly destroying, stupefying, repelling, inhibiting, or preventing infestation by or attacks of, any pest in relation to a plant, a place or thing; or modifying the physiology of a plant or pest so as to alter its natural development

²³ Department of Planning (n.d.)

²⁴ Department of Health WA (2020)

productivity, quality or productive capacity.²⁵ Pesticides includes herbicides, insecticides, fungicides and algaecides.²⁶

Chemical treatments include pre-emergent, post-emergent and organic herbicides.²⁷ Chemical weed control through the use of herbicides can be an effective and practical method of weed control applicable in a variety of situations.²⁸

Herbicides are defined as 'a chemical substance used to destroy or inhibit the growth of plants, especially weeds'.²⁹ Herbicides can be selective i.e. work on a specific range of plants or can be broad spectrum / non-selective and work on a wide variety of plants. There are also a number of ways in which herbicides can be applied depending on the situation to ensure specific weeds are targeted.³¹

Herbicides are used globally and are an effective component of integrated weed management. Herbicides are generally recognised as being the most effective weed control method having higher success rates than other forms of weed control. They are also generally the most economical means of weed control, requiring less labour, fuel and equipment than other methods.²⁸ In some locations such as natural areas, herbicides offer the most practical, cost-effective and selective method of managing certain weeds.³⁰

However, herbicides are chemicals and have the potential to damage the environment including other plants, fauna and people if applied contrary to manufacturer label instructions. The effect of applying herbicides on the environment varies depending on the target weed, chemical properties, rate, distribution and the soil environment. Herbicides vary in the length of time that they persist in the environment. The greater the solubility in water of a herbicide, the larger the distance that it can move through the soil. As well as impacting targeted plants, herbicides can impact on other aspects of the environment such as insects, bacteria, fungi, algae, non-targeted plants, soil and water. Figure 5 outlines some common processes that may occur following herbicide application.³¹

²⁵ Department of Health WA (2020)

²⁶ Department of Health WA (2020)

²⁷ WALGA (n.d.)

²⁸ Department of Primary Industries (2011)

²⁹ Houghton Mifflin Company (2009)

³⁰ Australian Government (2012b)

³¹ CRC for Australian Weed Management (2005a)

What happens to a herbicide after application?

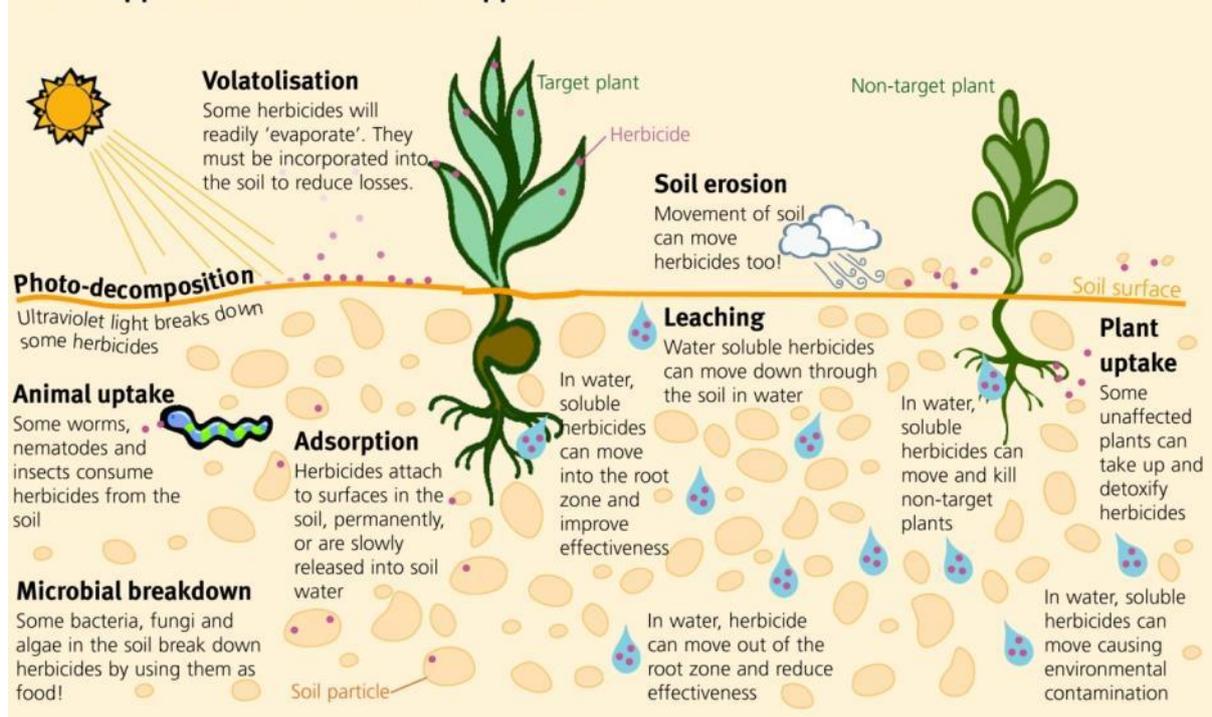


Figure 5: Processes that may occur following Herbicide Application³¹

When herbicides are used correctly they can be very effective and have limited negative impact on the environment and public health.^{31,32} The correct application of herbicides involves knowing the target weed, understanding the site conditions, choosing the correct herbicide, choosing the correct application method, ensuring operators are trained and ensuring all regulations and label instructions are followed.

Certain weeds can become resistant to herbicides with repeated application, meaning that herbicides are no longer effective to control those species. There are currently 25 weed species in Australia with populations that are resistant to at least one herbicide group.³³ Five are present in Western Australia and are also present within the City:

- Mediterranean Turnip (*Brassica tournefortii*)
- Patersons Curse (*Echium plantagineum*)
- Wimmera Ryegrass (*Lolium rigidum*)
- Wild Oat (*Avena fatua*)
- Wild Radish (*Raphanus raphanistrum*).³⁴

An integrated weed management approach will reduce the likelihood of weeds becoming resistant to a particular herbicide and will ensure a more effective response to those weeds that are resistant.

The advantages and disadvantages of chemical weed control are provided in Table 2.

³² WALGA (n.d.)

³³ Department of Agriculture and Food (n.d.)

³⁴ WeedScience.org (2013)

Table 2: Advantages and Disadvantages of Chemical Weed Control

Advantages:	Disadvantages:
<ul style="list-style-type: none">• Is usually the most effective form of weed control.• Is cost effective for large infestations.• Can be selective (depending on choice of herbicide, timing, plant life cycles, operator skills).• Can prevent weeds seeding and spreading.• Is appropriate on small and large weed infestations.• Minimises direct soil disturbance.	<ul style="list-style-type: none">• Weeds can become resistant to particular herbicides.• Some herbicides may be soluble in water and therefore may not be appropriate in wetland or other sensitive areas.• Some herbicides are non-selective and can impact on other plants and animals.• Has potential for negative impacts on the broader environment, such as causing environmental contamination.• Herbicide residue can build up in the soil and affect the growth of native species.• Technical proficiency is required otherwise there may be operator / public hazards.

Glyphosate

Glyphosate is a broad-spectrum and non-selective herbicide effective on annual and perennial plants. Glyphosate currently has the highest global production volume of all herbicides. Glyphosate has been registered by the APVMA for over 45 years and there are around 200 products containing glyphosate registered for use in Australia.

In 2015 reports investigating the health effects of using glyphosate were released by the International Agency for Research on Cancer (IARC), an agency affiliated with the World Health Organization (WHO), the reports classified glyphosate as 'probably carcinogenic to humans', following a hazard-based assessment of publicly available scientific information. The IARC assessment looked at the intrinsic 'hazard' of the chemical glyphosate as a cancer-causing agent only. Other components of the toxicity of glyphosate are not taken into account.

Following the release of this report the APVMA undertook several investigations to determine the risks for people using the formulated chemical product. As Australia's agricultural and veterinary chemical regulator, it is the role of the APVMA to consider all relevant scientific material when determining the likely impacts on human health and worker safety including long and short term exposure to users and residues in food before registering a product. The APVMA considered the full range of risks which include studies of cancer risks and how human exposure can be minimised through instructions for use and safety directions.

The APVMA, in collaboration with the Office of Chemical Safety in the Department of Health, examined the basis for the IARC classification including review of the full monograph related to glyphosate. The APVMA released the findings of its investigations in May 2016 which concluded that products containing glyphosate are safe to use as per the label instructions.

3.3 Steam and Hot Water Weed Control

This method was initially a steam only application and with time has evolved to a combination of steam and hot water. This method of treatment can also be referred to as hydrothermal weed control.

Steam and hot water weed control involves applying hot water under pressure through a heated chamber to the weed. The combination of heat and water pressure breaks down the cellular structure, causing discolouration and plant death within hours or over a few days.³⁵ Steam and hot water weed control has been suggested as a safer alternative to herbicide use.³⁶ However research and trials into steam and hot water weed control have generally found it to be less effective than chemical weed control, more expensive, uses large amounts of energy, is non-selective and is not practical in natural areas.³⁷

Steam and hot water weed control generally kills the upper most portion of the weed and is therefore most suitable for annuals or young perennials. Perennial weeds with deeper roots will generally resprout as the steam and hot water treatment does not affect the deeper root systems.^{35,38,39} As a result more repeat treatments are required when using thermal weed control. Steam and hot water weed control has been found to be more expensive as the cost of the application is more expensive and it takes longer so the labour costs are higher and more treatments are required.³⁹

Whilst steam and hot water weed control is a non-chemical form of weed control, it also uses large amounts of energy to create the steam and therefore has environmental impacts in relation to greenhouse emissions. It can pose a safety risk to the operator through burns or scalds from the use of the hot steam.

Steam and hot water weed control is not a viable option for the treatment of weeds in natural areas⁴⁰ because:

- it is non-selective and will therefore also kill non-target species including adjacent native species.
- the very high temperatures kill beneficial soil microbes including fungi and bacteria and the soil can become inoculated allowing bad pathogens to replace good microbes.
- once treated, an area is left with rotting organic matter and moisture, which can promote seed germination in the soil increasing the number of weeds immediately following treatment.
- the equipment also tends to be large and bulky and is generally unsuitable for accessing natural areas.

Steam and hot water weed control has generally been investigated for use in urban environments, such as on footpaths or kerbs, where concerns about herbicide use are greater and off target impacts are less likely. However steam and hot water weed control in urban environments is still less effective,⁴¹ more expensive and generally does not work as a stand-alone approach in the longer term. The City and a number of other local governments have trialled the use of steam and hot water weed control in urban areas with the aim of reducing herbicide use, with the result that many have limited or ceased the use of steam and hot water weed control due to the cost and effectiveness in the long term.⁴² However, some local

³⁵ Department of Primary Industries (2011)

³⁶ Collins (1999)

³⁷ Hudek et al (2021)

³⁸ Banks and Sandral (2007)

³⁹ Banks and Associates (2009)

⁴⁰ Natural Areas Consulting (2013)

⁴¹ Hudek et al (2021)

⁴² City of Nedlands (2013)

governments, including the City, in the Perth metropolitan area are utilising steam and hot water weed control as part of their integrated weed management approach, particularly for sensitive facilities and suitable hardstand treatment areas.⁴³

The advantages and disadvantages of steam and/or hot water weed control are provided in Table 3.

Table 3: Advantages and Disadvantages of Steam and Hot Water Weed Control

Advantages:	Disadvantages:
<ul style="list-style-type: none">• Does not involve the use of chemicals and may be appropriate in areas of chemical sensitivity.• Can be effective on annuals and some young perennials.	<ul style="list-style-type: none">• Is not suitable in natural areas.• Is more expensive, less effective and requires more repeat treatments.• Is non-selective and can harm adjacent plants.• The high temperatures can kill soil microbes and good bacteria.• May have some results in the short term but not in the long term.• Is carbon and energy intensive.• Equipment is large and bulky and is not suitable for accessing natural areas.

⁴³ WALGA (2022)

3.4 Biological Weed Control

Biological control involves using a weed's naturally occurring enemies (usually insects or disease), to help reduce the impact of the weed and achieve sustainable weed control. These natural enemies of weeds are often referred to as biological control agents⁴⁴.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) states that 'A biological control agent is generally only used when the cost of conventional control methods such as herbicides, mechanical control or fire is so great, both in dollar terms and impact on the environment, that there is little option than to pursue the biological control avenue'.⁴⁵

To develop a new biological control agent requires a substantial investment, adherence to a strict approval process, extensive host specificity testing to ensure it does not pose a threat to non-target species and a risk analysis. It should be noted that not all weeds have biological control agents that would be considered safe for introduction in Australia. Biological control agents have the potential to become pests themselves.⁴⁵

Biological control is unlikely to eradicate a weed species, but it can reduce a weed population and slow down its invasive potential. Successful programs may take more than 10 years to be effective, and results may vary from area to area. Biological control may be practical and effective for inaccessible areas such as timbered, rocky and steep locations, areas of low-priority for control, or where chemical control may be too expensive or not effective.⁴⁶

Biological weed control is not a part of the City's weed management approach because it is better undertaken at a regional level rather than a local level, takes too long to have an impact, is often not effective and can be expensive.

3.5 Electric Weed Control

The use of electrical energy to kill weeds was designed to destroy persistent weeds following conventional chemical treatment. When a high-voltage electrode touches a weed, an electric current passes through the plant and is returned to the transformer via the soil by a ground contact device. Due to the electrical resistance of the plant, the electrical energy is converted to heat. Plant death is caused primarily by the increase in temperature and vaporisation of the water and other volatile liquids it contains, leading to a build up of pressure within the plant cells, and subsequent rupture of the cell membranes.⁴⁷ In plants with an extensive root system, the electric current travels deep into the root system before being dissipated into the soil.⁴⁸ Root damage is known to be more severe in dry conditions in comparison to wet conditions.⁴⁹ As a result, plants dry down and remain fixed to the ground without the need to move soil or open soil surfaces.⁵⁰

Electric weed control technology is currently not certified for use in Australia, with no Australian research undertaken into this weed control method prior to 2022. Recently studies in other regions of the world have tested the ability of electricity to prevent growth and are effective in killing weed species, inclusive of woody weed species. For example, experiments with different plant species showed root destruction down to a depth of 10-15cm, which was sufficient to destroy the vegetation points or rhizomes sufficiently to lead to no or very slow regrowth of plants.⁵¹ Depending on the amount of available electric power, treatment speed,

⁴⁴ Australian Government (2012c)

⁴⁵ CSIRO (2013)

⁴⁶ Department of Primary Industries (2011)

⁴⁷ Vincent (2001)

⁴⁸ Vigneault C., Benoit D.L. (2001)

⁴⁹ Vincent (2001)

⁵⁰ Vincent (2001)

⁵¹ CEDR (2016)

stem density and woodiness of plants, many weeds up to 1m of height can be controlled. The studies results indicate that electricity is a viable alternative to manual, mechanical or chemical methods in some settings. Further research is required in a local context to determine if this methodology would be appropriate for the City.

The DPIRD is partnering with local governments in WA to undertake Australia’s first electric weed trials in 2022 and 2023. There is interest in this methodology as it may provide a new method to control herbicide-resistant weeds, as well as address the publics growing concerns for human and environmental health related to pesticides.⁵² The advantages and disadvantages of electric weed control are outlined in Table 4.

Table 4: Advantages and Disadvantages of Electric Weed Control

Advantages:	Disadvantages:
<ul style="list-style-type: none">• Does not involve the use of chemicals and may be appropriate in areas of chemical sensitivity.• No soil disturbance or erosion.• The dosage can be adjusted to target specific species.• Does not involve the use of water and is more energy efficient than steam and hot water treatment.• No waste.• Cost effective option in some urban settings (i.e. hardstand areas).• Can be effective on a range of weed species, including woody weed species.	<ul style="list-style-type: none">• This method is not certified for use in Australia, however trials are underway.• Equipment is large and bulky and is not suitable for accessing natural areas.• Is non-selective and can harm adjacent plants.• Unknown if the method can kill soil microbes and good bacteria.• May not be an effective method for all weeds.• Research needs to be undertaken regarding whether there is any fire risk.• Some carbon and energy impacts.

⁵² Lehnhoff et al (2022)

4.0 Weed Management at the City

The City implements its integrated weed management program in alignment with the draft *Public Open Space Framework* to ensure the community has access to quality public open space that reflects their needs now and into the future. The draft Framework enables long-term infrastructure management and aims to achieve a more cost-effective and sustainable approach to planning and maintenance. The draft Framework also enables the City to classify public open space according to primary function and manner of use; to identify appropriate infrastructure for each type of public open space; and to inform levels of service and maintenance schedules for each type of public open space. The draft Framework is essential for informing how the City prioritises weed management in public open spaces.

All public open spaces owned or managed by the City fall into one of the four classifications:

- Natural Area
- Sports Park
- Recreation Park
- Urban Landscaping.

This plan also includes weed control within wetlands, that may fall within one of the above public open spaces.

City staff and contractors abide by the following herbicide use procedures:

- Use herbicide products registered by the APVMA.
- Follow all regulations and label instructions applicable to the specific herbicide.
- Comply with the Department of Primary Industries and Regional Development (DPIRD) Permit to Allow Minor Use of an Agvet Chemical Product for the Control of Environmental Weeds in Various Situations.
- Comply with the relevant Department of Health documents such as:
 - A guide to the use of pesticides in Western Australia
 - A guide to the management of pesticides in local government pest control programs in Western Australia
 - Quick contacts for the use of pesticides in WA
 - *Health (Pesticides) Regulations 2011 – Signage Requirements*
 - Guidelines for the safe use of pesticides in non-agricultural workplaces.
- Act in accordance with its internal procedures which outline instructions for training, transport, handling, storage, resident notification, application, records, spills and use of new herbicides.
- Consult resources, such as the DBCA's Florabase website or *Southern Weeds and their Control* (DAFWA Bulletin 4744), in regards to best practice timing and methods of weed control for individual weed species.
- Undertake assessment of authorised chemicals to determine whether or not more suitable alternatives are available, which meet safety requirements and reduce potential environmental impacts. The City minimises the use of herbicides, where possible.

City staff use herbicides in accordance with the City's Spraying Chemicals Work Instruction, an internal procedure in the ISO 9001 Quality Management System (QMS). The Spraying Chemicals Work Instruction is reviewed internally in accordance with the QMS.

To prevent herbicide resistance the City incorporates herbicide rotation into its Annual Maintenance Schedule. If herbicide resistant weeds are identified, the City either utilises alternative herbicides or undertakes hand weeding.

Weed control may be undertaken in areas that contain Aboriginal Heritage places. It is recommended that City staff and contractors comply with the *Aboriginal Cultural Heritage Act 2021* in Aboriginal Heritage places and determine whether the activities may harm Aboriginal places and/or objects and acquire Aboriginal Cultural Heritage Permits when required.

Management Recommendations

1. *Comply with the requirements of the Aboriginal Cultural Heritage Act 2021 when conducting weed control, as required.*

2. *Continue to review and undertake weed control activities in accordance with the ISO 9001 Quality Management System and other relevant legislation.*

4.1 Natural Areas

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

There are a variety of regionally, nationally and internationally significant natural areas located within the City including eight Bush Forever sites which contain species of high conservation value such as Yellagonga Regional Park. Natural areas of significance adjacent to the City include the Marmion Marine Park and Neerabup National Park. The City also manages 28 natural areas listed in the Local Planning Scheme No. 3 as areas with biodiversity and conservation value.

The City manages over 500 hectares of natural areas in 96 reserves containing significant flora and fauna species and ecological communities.

Environmental threats have the potential to degrade natural areas and reduce biodiversity values. Weeds are one of the key environmental threats to biodiversity in natural areas in the City. The City contains 285 identified weed species, including 15 declared pest plants and five WoNS. Effective weed management is required to ensure that measures are taken to prevent, monitor and control the spread of weeds within the City.

Natural areas are public open spaces that can include bushland, coastal and wetland areas. Natural areas are managed to enable some recreational access while protecting local ecological and biodiversity values.

In order to protect native vegetation and ecosystems within the City, Section 4.1 of the Weed Management Plan addresses natural areas weed management. Section 4.1 complements the voluntary work of Friends Group volunteers who contribute substantially to weed management in the City's natural areas.

4.1.1 Purpose

The purpose of Section 4.1 of the Plan is to provide an integrated weed management approach to prevent, monitor and control the spread of weeds in the City's natural areas and conserve local ecological and biodiversity values.

Section 4.1 of the Weed Management Plan includes the following:

- Description of the City's current weed management approach.
- Identification of weed control measures.
- Recommended integrated weed management strategies to prevent, monitor, prioritise and control the spread of weeds.
- Development of education initiatives to engage the organisation, stakeholders and the community in order to raise the awareness of weeds and weed management.
- Development of reporting mechanisms to identify weed risks.
- Recommended partnerships with and support for Friends Groups to facilitate weed management and bushland restoration.

4.1.2 Limitations

Section 4.1 excludes weed management of the following areas managed by the City:

- Parks
- Verges (apart from natural area verges)
- Medians
- Streetscapes.

Section 4.1 also excludes land not managed by the City, including but not limited to:

- Private property
- Natural areas managed by other government agencies or landholders, including Woodvale Nature Reserve, Pinnaroo Valley Memorial Park and Ern Halliday Recreation Camp
- Yellagonga Regional Park (jointly managed by the City of Joondalup, Department of Biodiversity, Conservation and Attractions (DBCA) and City of Wanneroo). The approach for weed control for DBCA managed areas of Yellagonga Regional Park within the City of Joondalup is outlined in the *DBCA Weed Control and Revegetation Plan (2002)*
- The marine environment.

4.1.3 Study Area

The study area for Section 4.1 includes natural areas managed by the City as illustrated in Figure 6. A list of the sites included within Section 4.1 of the Weed Management Plan is provided in Appendix 1 and Appendix 2.

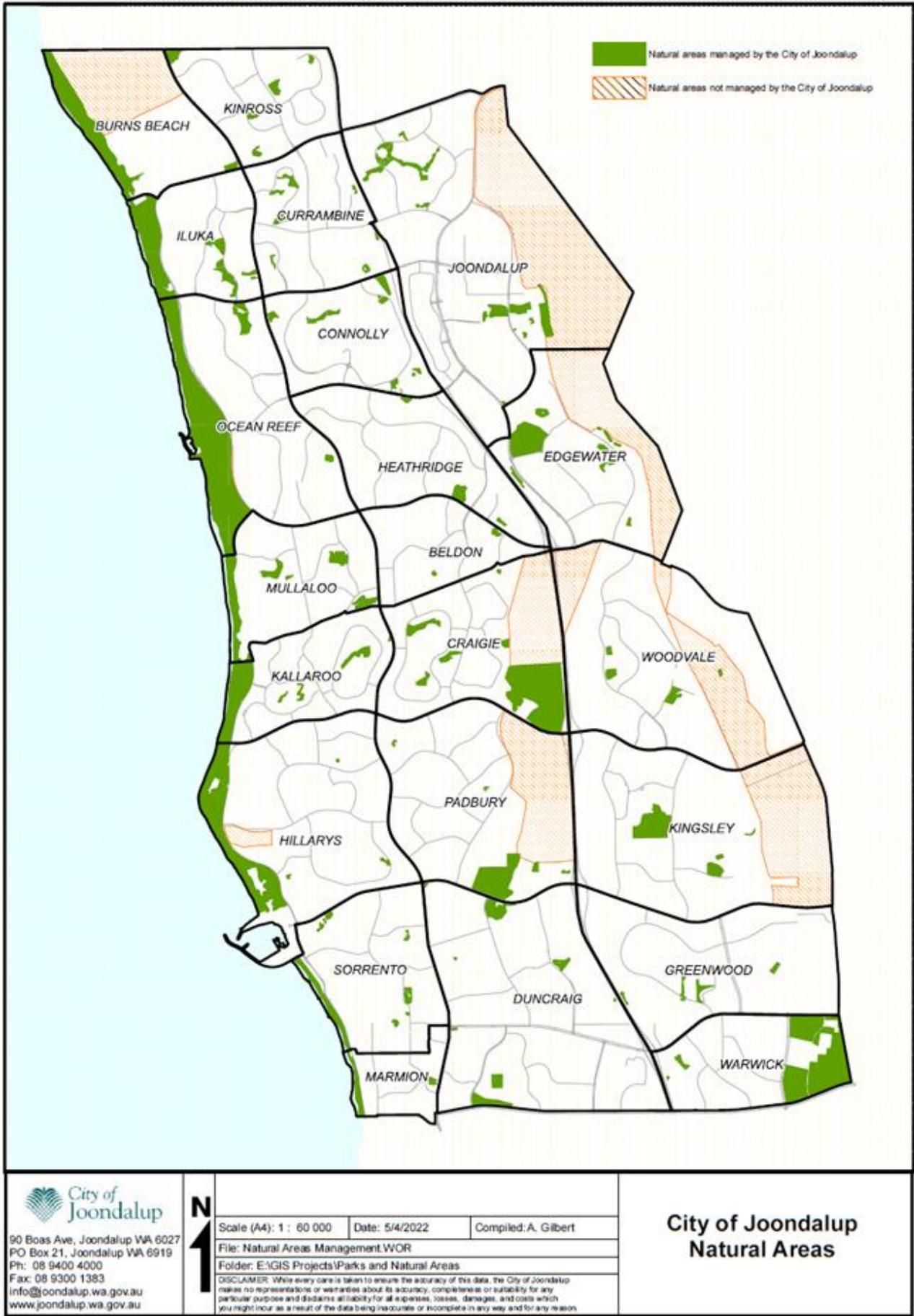


Figure 6: City of Joondalup Natural Areas

4.1.4 Weed Management Site Prioritisation

The City's current approach to weed management prioritisation of natural area sites and within sites is detailed in the following sections.

Prioritisation of sites

The City has 285 identified weed species in natural areas, including 16 priority weeds consisting of 15 declared pest species and 5 WoNS. The City currently conducts weed management in natural areas on a priority basis using four criteria (in descending order), as shown in Figure 7.

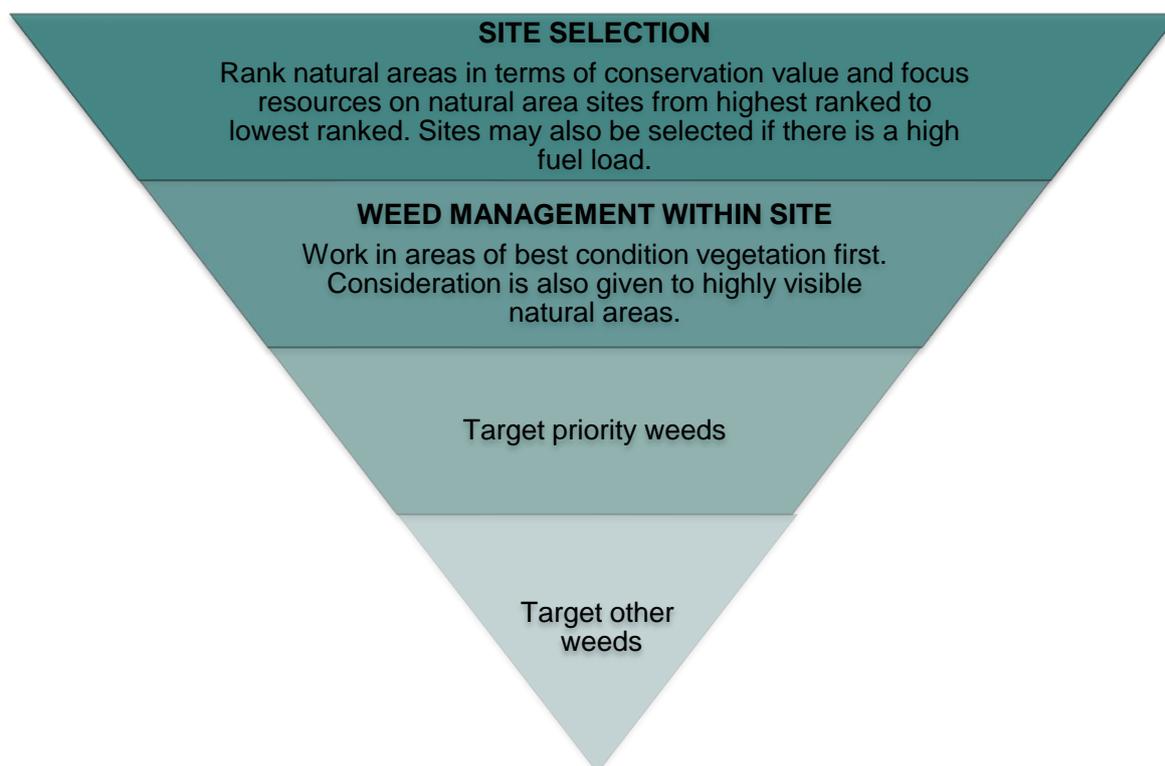


Figure 7: Criteria currently used to prioritise weed management actions for natural areas

Site Selection

Natural Areas are public open spaces predominantly used to protect local ecological and biodiversity values.

The City ranks management of natural areas according to the Local Biodiversity Program Natural Areas Initial Assessment ranking.⁵³ As part of the Local Biodiversity Program, the City assessed all natural areas from 2004 onwards using the ecological criteria of the Natural Area Initial Assessment, resulting in a priority ranking of natural areas. Natural Area Initial Assessments include a desktop assessment and field survey, documenting information such as:

- vegetation complexes
- threatened or significant flora or ecological communities
- structural plant communities
- weed species

⁵³ WALGA (2014)

- vegetation condition assessment
- ecological criteria rankings
- a viability estimate
- fauna species observed.

Priority rankings of sites based on Natural Area Initial Assessments utilise criteria such as:

- Biodiversity conservation value within a regional level (including designated conservation areas, containing significant flora, fauna or ecological communities or forming part of a regional ecological linkage)
- Biodiversity conservation value within a local level
- Representation of ecological communities and amount remaining locally
- Vegetation condition
- Area size of site
- Protection of wetland and coastal vegetation.⁵⁴

The City reassesses its natural areas that do not have a Council endorsed Natural Area Management Plan every 5-7 years using the Natural Areas Initial Assessment tool.

Listed below are the different types of natural areas and details regarding their purpose, use and functional requirements:

- **Major Conservation Natural Areas** are of very high conservation significance and include medium to large areas of vegetation in very good or excellent condition. These areas are likely to contain TEC's or priority ecological communities. These areas are also likely to contain priority flora species or conservation-significant flora species. Conservation-significant fauna species are likely to use the site as habitat, and ecological linkages are likely to exist to other significant conservation areas. These areas are managed by individual Natural Area Management Plans.
- **High Priority Natural Areas** are of high conservation significance and generally include medium to large areas of vegetation in good or very good condition. These areas can contain threatened ecological communities or priority ecological communities. These areas can also contain priority flora species or conservation-significant flora species. Conservation-significant fauna species may use the site as habitat, and ecological linkages may exist to other significant conservation areas.
- **Medium Priority Natural Areas** are of medium conservation significance and generally include small and medium areas of vegetation in good condition, usually fragmented. These areas can contain various vegetation communities, and can also contain priority flora species or conservation-significant flora species. Conservation-significant fauna species may use the site as habitat, but ecological linkages are unlikely to exist to other significant conservation areas.
- **Low Priority Natural Areas** are of low conservation significance and include areas of vegetation in good or degraded condition, usually fragmented. These areas can contain various vegetation communities, and can also contain priority flora species or conservation-significant flora species. Conservation-significant fauna species may use the site as habitat, but ecological linkages are unlikely to exist to other significant conservation areas.

Natural areas are listed by ratings in Appendix 2.

The resources allocated to weed management in natural areas are guided by the ratings of individual sites. Generally the higher the rating of the site, the more resources are allocated to weed management.

⁵⁴ WALGA (2004)

Sites may also be prioritised for weed control if they have a high fuel load and are deemed to be a fire risk.

Weed Management within Sites

The City conducts weed management within individual natural areas according to the Bradley Method by focussing on areas of vegetation in best condition first, followed by areas of decreasing vegetation condition. The Bradley Method also encourages minimal disturbance to the environment and allows for bushland regeneration through clearing of weeds.^{55,56} This is implemented primarily to prioritise conservation of the highest biodiversity values. Vegetation condition in major conservation areas is assessed through flora surveys to inform Natural Area Management Plans approximately every five years. Vegetation condition in other sites is assessed visually by City staff during site inspections. Consideration is also given to highly visible natural areas.

Priority Weeds

The City prioritises weeds based on their invasiveness, ecological impacts, potential and current distribution and feasibility of control. Prioritisation of weeds enables more effective and targeted weed control.

The City classifies environmental weeds as priority weeds if they meet one or more of the following criteria:

- Weed species listed as a WoNS under the National Weeds Strategy (2017).
- The weed species is listed as a Declared Pest Plant according to the Department of Agriculture and Food (2011).
- The weed species is listed as a pest plant under the City's *Pest Plant Local Law 2012*.

A summary of priority weeds identified in the City according to criteria are listed in Table 5. There are currently a total of 16 priority weeds identified in the City. A detailed list of priority weeds can be found in Appendix 4.

Table 5: Priority Weeds Identified in the City of Joondalup According to Criteria (2014).

Priority Weed Criteria	Number of Priority Weeds Identified within City of Joondalup
<i>National Weeds Strategy 2017 -2027</i>	<ul style="list-style-type: none"> • Five Weeds of National Significance (WoNS)
<i>Biosecurity and Agriculture Management Act 2007</i>	<ul style="list-style-type: none"> • 15 declared pest plants, includes all five WoNS
<i>City's Pest Plant Local Law 2012</i>	<ul style="list-style-type: none"> • One pest plant

Integrated Weed Management Approach

Integrated weed management involves using a variety of different techniques to monitor, prevent, prioritise and control weeds and keep weed densities at a manageable level. Using a variety of control methods, rather than just one, also ensures weeds are less able to adapt to the control methods used and less likely to become herbicide resistant.⁵⁷ An integrated approach is required for effective weed management, and therefore the management of weeds within the City includes:

⁵⁵ Leschenault Catchment Council (n.d.)

⁵⁶ AABR (2013)

⁵⁷ CSIRO (2011)

- weed monitoring
- weed prevention
- weed control
- education and training
- partnerships with external stakeholders.

4.1.5 Weed Monitoring

Ongoing monitoring of the City's natural areas is critical to ensuring the long term management of biodiversity within the City. Weed management can be modified according to weed monitoring results. Weed monitoring is important to:

- identify areas with weed populations
- weed spread
- discover new weeds on a site
- protect significant native flora species
- measure the effectiveness of weed control measures.

There are numerous different approaches to weed monitoring including weed mapping, taking of photographs and identification of weed species and their distribution (observational weed monitoring).

Weed Mapping

Weed mapping involves recording weed populations and distribution and is a form of weed monitoring. Weed mapping is useful to:

- identify and locate weed species to inform management plans and actions
- record progress in weed management
- provide a historical record to guide management actions
- inform weed management at a local government level.⁵⁸

Weed mapping is conducted on a regular basis through City inspections of natural areas to establish the extent of weeds and to identify priority weed species. The outcomes from weed mapping inform the on ground weed management program. Inspections of the City's natural areas are conducted according to the Annual Maintenance Schedule which prioritises sites and the frequency of inspections, i.e. major conservation areas are scheduled for monthly inspections. During inspections, key priority weeds and maintenance issues are identified and marked on site maps as prioritised actions. These actions are then undertaken during the following maintenance visit to the site, if possible.

The City engages consultants to undertake flora, fauna and fungi surveys of major conservation areas approximately every 5-10 years to inform the development of Natural Area Management Plans. The surveys document components of biodiversity and make recommendations to minimise ecological impacts. Weed mapping is conducted as part of this survey with occurrences of priority weed species being recorded and mapped for individual natural areas. The flora and fauna surveys also identify vegetation condition and threatened and priority flora and fauna species on site. Information from flora and fauna surveys is utilised during City inspections of natural areas (through inspection maps) and used to inform maintenance visits.

Identification of weed species and their distribution is undertaken approximately every 5-7 years when the City undertakes its assessment of high priority and medium priority natural

⁵⁸ Australian Weeds Committee (n.d.)

areas using the Natural Areas Initial Assessment tool and in accordance with the Natural Areas Assessment Schedule.

Management Recommendations

3. *Continue mapping of key priority weeds through regular inspections of natural areas in accordance with the Annual Maintenance Schedule to inform on ground weed management actions.*

4. *Continue to assess high priority and medium priority natural areas every 5-7 years using the Natural Areas Initial Assessment Tool, including identification of weed species and their distribution in accordance with the Natural Areas Assessment Schedule.*

Weed Monitoring

The City has implemented two approaches to weed monitoring in the past, photo monitoring and observational weed monitoring. Monitoring weeds through one of these methods or an alternate method is useful to inform and prioritise weed management activities and measure the effectiveness of weed control activities. Quantitative monitoring methods are preferred to qualitative monitoring methods.

Photo Monitoring

Photo monitoring is a photographic record to assess changes occurring in vegetation over time at individual sites taken consistently from the same location. Photo monitoring can be used to assess the effectiveness of weed control on site and could focus on the management of a particular target weed or the recovery of native vegetation. Photo monitoring also requires recording information such as the date, time, location and GPS data.

Photo monitoring is currently conducted within key conservation areas to provide an indication of the effectiveness of weed control methods. Photo monitoring has occurred annually since commencement in 2021.

Observational Weed Monitoring

Observational weed monitoring can be conducted using permanent quadrats or transects to visually assess the percentage cover of weeds, as an indicator of vegetation health. Observational weed monitoring can guide weed control efforts and assess effectiveness of weed management actions. Weed monitoring can also occur by recording weed coverage, weed density and target weed species for weed control programs.

The City has measured the density of environmental weeds in key conservation areas annually at the same time of year up until October 2021. Data is collected in the City's key conservation areas through three transects on each site. The City's density of environmental weeds has generally been decreasing over the past 12 years due to increased weed management, as shown in Figure 8. There have been challenges with accessing the transects in some natural areas and utilising the data to inform weed management. It is proposed that the City monitors and reports on the coverage or area (hectares) where weed control has been undertaken in natural areas rather than the density of environmental weeds using a limited number of transects.

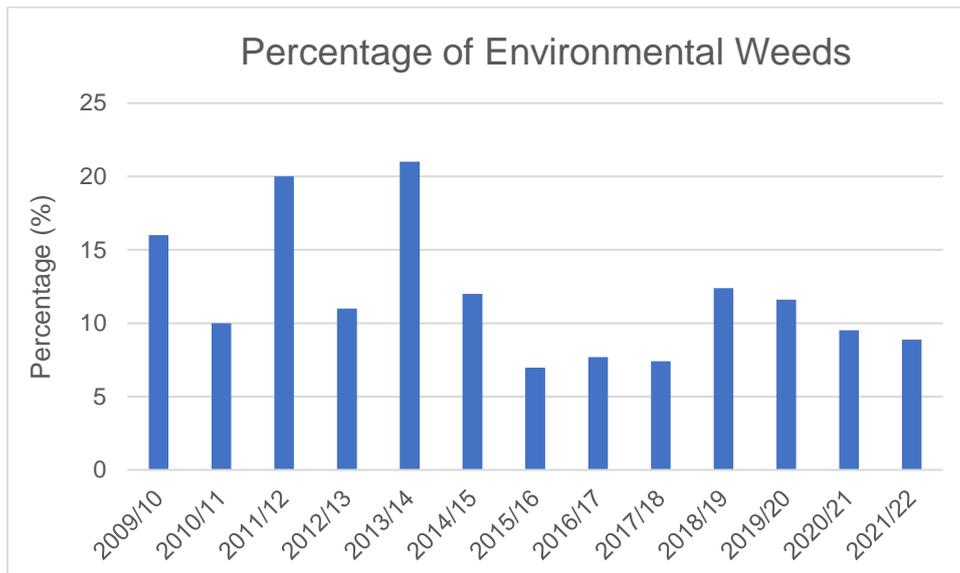


Figure 8: Indicator – Density of Environmental Weeds

Management Recommendations

5. Continue to undertake photo monitoring in major conservation areas when measuring the natural areas key performance indicator annually to assess the effectiveness of ongoing weed control.

6. Record and monitor the coverage (hectares) of weed control in major conservation natural areas.

4.1.6 Weed Prevention

Control of weed species can be both costly and labour intensive. Preventing weed establishment within natural areas is one of the most effective approaches to weed management.⁵⁹

Examples of ways that weeds can establish that can be managed by the City include:

- weeds seeds being attached to footwear, clothing or vehicles
- introduction through landscaping materials
- movement via stormwater
- garden rubbish dumping
- post fire opportunities
- fire prevention activities such as creating firebreaks and access ways.

The City can directly prevent the introduction of weeds through minimising access and disturbance, undertaking weed hygiene measures and minimising the impacts from fire prevention activities when operating in natural areas.

The City can also indirectly prevent weed introduction and spread by educating the community on how they can prevent weeds by not dumping rubbish in natural areas, minimising disturbance of vegetation, undertaking weed hygiene measures and not planting species in gardens that have the potential to become bushland weeds.⁶⁰ Actions that community members can take to prevent weeds are described in more detail in section 5.2.

⁵⁹ State Weed Plan Steering Group (2001)

⁶⁰ DSEWPC (2012)a

Monitoring for new weed populations

Prevention of new weed species being introduced into natural areas is the most effective method of weed control. Eradication of weeds usually requires more resources for weed management than those required for weed prevention, and weed eradication is easiest and most cost effective with the early identification and management of new weed populations.

The City monitors for new weed populations being introduced into its Natural Areas through routine inspections. In addition to monitoring for new weed population being introduced into natural areas or spreading into new sections of natural areas, the City also minimises access and disturbance and undertakes weed hygiene measures.

Management Recommendation

7. Continue to monitor for new weed populations, including new aggressive weed species, identified in the City to prioritise for weed control and prevent spread.

Site Access and Hygiene Management

Accessing natural areas for maintenance or management activities can cause disturbance, creating opportunities for weeds to invade or establish. Limiting or controlled access to natural areas via paths, tracks and conservation fencing can prevent trampling or disturbance to vegetation and soil.

City staff and contractors regularly access natural areas to undertake management activities such as weed control, removing rubbish, undertaking revegetation activities and regular inspections and monitoring. During these activities sites may be accessed by vehicles and/or foot and a variety of machinery and equipment may be used. Where possible, vehicle access on-site is avoided. When vehicles are on site they are kept on tracks and avoid disturbing vegetation where possible. Pedestrians also remain on tracks where possible. Care is taken when operating machinery or equipment to minimise the impact on vegetation and soil surfaces. Natural areas often have conservation fencing, locked gates to access tracks and designated pathways to prevent disturbance to the vegetation and soil.

Weed hygiene is an important weed prevention measure to protect native vegetation from the introduction or spread of weed species through the movement of people, equipment, vehicles or landscaping materials. Weed material or weed seeds can become attached or lodged in footwear, vehicles and equipment and then transported into natural areas where they weren't found previously. Weed material or weed seeds can also be found in landscaping supplies such as plant stock, compost, mulch or sand/soil. Weed hygiene involves practices to ensure only clean and weed free vehicles, equipment, footwear, landscaping supplies and materials are entering natural areas. This is essential for preventing the introduction of weeds or further spreading weeds throughout natural areas.

The City's Pathogen Hygiene Procedure for staff and contractors ensures weed hygiene practices are implemented, including conducting vehicle and equipment inspections, and cleaning and brushing down soil and weed seeds from vehicles, machinery, equipment, tools, footwear, and clothing before they enter and leave natural areas. The City's vehicle washdown bay is located at the Works Operation Centre for washing down vehicles and equipment to enable the removal of material in a contained manner. The regular washing down of vehicles and equipment is a key control measure to prevent weed spread and introduction to the City's public open spaces. Staff and contractors conducting hand weeding in natural areas ensure that weeds are bagged and disposed of appropriately off-site to prevent weed spread.

The supply of plant stock, mulch, soil and compost that contain weeds is a common way for weeds to establish within an area. The City undertakes revegetation in bushland areas, as required. The majority of plant stock used for revegetation is grown at the City nursery and consists of plants, soil, Perlite and Vermiculite. The City's Purchasing Guidelines for the Supply of Landscaping Materials is implemented and ensures that the majority of the remaining plant stock that needs to be supplied is purchased from Nursery Industry Accreditation Scheme Australia (NIASA) accredited nurseries and the City currently purchases Australian Standard certified mulch and potting mix.

Management Recommendation

8. Continue to implement the Pathogen Hygiene Procedure, and Purchasing Guidelines for the Supply of Landscaping Materials to provide direction to staff and contractors and prevent the introduction and spread of weeds within the City.

Fire Management and Response

Whilst fire is an important natural feature of the Australian landscape, human activity such as accidents and arson have resulted in increased incidences of fire within natural areas, which can have a negative effect on biodiversity and encourage growth of highly flammable and invasive weeds.^{61,62}

Natural areas may be disturbed and provide opportunities for weeds to invade or establish through the following fire related activities:

- Fire occurrences
- Hazard Reduction Grass Tree Burning Program
- Manual fuel load reduction
- Construction or maintenance of firebreaks
- Emergency services responding to fire events including use of emergency vehicles and fire suppression activities.

A coordinated and planned approach is required to address fire management within the City in order to reduce the risk of fire occurrences that could result in damage to life, property and the environment. The City implements a Hazard Reduction Grass Tree Burning program within applicable natural areas to reduce bushfire risk including Craigie Open Space Bushland; Hepburn Heights Conservation Area; Warwick Open Space Bushland, Shepherds Bush Reserve and Yellagonga Regional Park.

The City minimises weeds through the Hazard Reduction Grass Tree Burning program by:

- Implementing the City's Pathogen Hygiene Procedure.
- Monitoring the site for signs of weed emergence or erosion, particularly following the first rainfall events post fire when native and weed species will start to germinate.
- Preventing access to the burnt natural area to protect the ash bed and allow vegetation to regenerate.
- Implementing bespoke post fire weed control programs tailored to the site in response to the monitoring outcomes.

The manual fuel load reduction and construction and maintenance of firebreaks are important and necessary fire prevention tools, however it also requires the clearing of native vegetation and allows opportunities for weeds to spread. The City complies with the *Bush Fires Act 1954* which requires firebreaks immediately inside and around all external boundaries of the land.⁶³

⁶¹ City of Joondalup (2012a)

⁶² City of Joondalup (2012b)

⁶³ DFES (2013)

The City developed a *Fire Weed Management Guideline* which informs staff and contractors about weed management whilst undertaking manual fuel load reduction and installing and maintaining firebreaks and access ways.

Management Recommendations

9. *Continue to implement the Fire Weed Management Guideline to inform staff and contractors about weed hygiene when undertaking manual fuel load reduction works and when constructing and maintaining firebreaks and access ways.*

4.1.7 Weed Control

While weed prevention is important for reducing new infestation of weeds from occurring or spreading in natural areas, weed control is necessary for reducing or eradicating weed infestations already occurring in natural areas. While weed control can be an expensive and time consuming exercise, failure to control weeds can have significant environmental impacts including displacing native plant species, harbouring pests and diseases and creating fuel loads for fire. Weeds also alter the structure and distribution of plant communities which has a negative impact on native flora and fauna. Weed control is necessary to protect and restore diverse natural ecosystems.⁶⁴ The City currently uses hand weeding and herbicide weed control methods in natural areas.

Hand Weeding

Hand weeding is used in natural areas as part of an integrated approach. This includes use of hand weeding for smaller infestations, for herbicide resistant weeds or as follow up to herbicide application. Hand weeding is also used in sensitive areas where herbicide use is not recommended. Widespread hand weeding is not used as it is labour intensive and, if applied inappropriately, can result in negative impacts to native vegetation by disturbance of the soil surface and may lead to erosion.

The City supports a total of 19 Friends Groups that conduct a large amount of hand weeding in natural areas. The City acknowledges the large contribution that Friends Groups make to weed control and conservation within natural areas.

Herbicide Use

Herbicides are used in the City as they are effective on large weed populations and can be economical compared to other weed control techniques. Methods of herbicide application used include blanket spray, spot spray, cut and paint, basal bark treatment and wick wiping. Appendix 6 provides further details on these different methods of herbicide application. The City implements herbicide use in natural areas in accordance with the Annual Maintenance Schedule. Natural areas are prioritised for weed control based on their priority status, the type of weeds present, the weed infestation levels and the bush fire management system risk rating.

The City conducts flora surveys including vegetation condition assessments in key natural areas approximately every 5 years. Information obtained from the flora surveys is utilised by the City to create vegetation condition maps which are used to guide weed control activities and prioritise works in best condition vegetation areas on sites.

The City schedules its herbicide application according to rainfall and temperature in order to increase its effectiveness and minimise any adverse impacts. Hand weeding or maintenance is conducted when it rains, rather than using herbicides. Where possible, herbicide application is scheduled prior to seed production.

⁶⁴ Brown and Brooks (2002)

Research and Trials

Weed control methods are improving over time as technologies and research become available. Weed control research and trials can assess the effectiveness of different weed control methods and inform the best weed management approach. Improved understanding of the biology and ecology of individual weeds and the environmental and human-induced factors that influence abundance and distribution are important factors that assist in determining effective weed control approaches.

The City has undertaken a number of weed control trials commencing in 2006-07. The purpose of the trials has been to support the research and development of improved weed control or management. The City's weed control trials are considered in relation to the biology and ecology of individual weeds within a specific natural area.

The City has conducted steam and hot water weed control trials in urban areas rather than natural areas. The unsuitability of using steam and hot water weed control methods in natural areas is well documented and therefore has not been trialled by the City.⁶⁵

The City has a chemical reduction approach to weed management and is trialling alternative treatments to test effectiveness. Natural areas often have challenges associated with accessibility and minimising impacts to biodiversity that limit the effective implementation of alternative weed control treatments. If alternative weed control methods are successful, they are integrated into the City's weed management program.

Weed Control in Specific Circumstances

Specialised weed management activities are required for weed control in specific circumstances including identification of new populations of weeds, weed control on verges and post fire weed management.

Weed Control on Verges

Weeds can spread into natural areas from adjacent verges. Effective weed control of verges adjacent to nearby areas minimises the risk of weed spread. The City conducts weed control on verges of key natural areas consisting of increased mowing of verges to reduce seed spread, spraying of weeds and spreading of certified mulch, where required.

Weed Control Post Fire

The City has unplanned fire occurrences in natural areas on a frequent basis. For example, there were substantial unplanned fire occurrences in Shepherd's Bush Reserve and Warwick Open Space Bushland in 2022. DFES is responsible for fire eradication, whilst the City is responsible for post fire weed management.

Fire is important for native species regeneration and fuel load reduction in urban bushland areas.⁶⁶ The local environment and bushland has evolved with cultural burning practices being implemented as part of traditional Aboriginal land management practices.⁶⁷ Many vegetation communities respond well to fire, and some native species are reliant on fire for regeneration or germination.

However, the disturbance of fire can create an opportunity for rapid growth of competitive weed species, particularly grasses, with minimal competition from native plants. Weed species may have established a long-term soil seed bank that is triggered to germination by fire. Weed

⁶⁵ Natural Areas Consulting (2013)

⁶⁶ Miller and Miller (2020)

⁶⁷ DFES (2020)

species can often be quick to exploit the favourable conditions immediately after fires, germinating prolifically and spreading vigorously in the first few seasons.

DBCA undertook fire management experiments in Kings Park and Bold Park in 2015 and 2016 respectively. Since the experiments DBCA have been undertaking long-term monitoring, with the results showing the following:

- fire enhances the spread and cover of introduced grasses
- weed management treatments are effective in reducing weed cover
- native perennial species richness increased after fire
- burning leads to a decrease in litter fuels.⁶⁸

It is further recognised that where effective weed control is implemented post fire native species biodiversity is likely to increase and native species will be prevalent.⁶⁹

The City implements a Fire Weed Management Guideline to minimise weed occurrence in natural areas post fire. After a fire occurrence the DFES maps the fire scar information and the City make this available on IntraMaps to monitor fire frequency on individual sites. The City also obtains information from DFES regarding fire occurrence history for sites as required.

The City allows for at least three months of natural vegetation regeneration through restricting access after fire before commencing weed control activities. The purpose of restricting any disturbance to the burnt area is to protect the ash bed and allow for natural regeneration. The three month period prevents disturbance and allows native seedlings to resprout.

Post fire the City monitors the fire scar area, particularly following rainfall events, for weed emergence and erosion. Regrowth of weeds are then managed prior to seeding through an integrated weed management approach using a variety of methods. Herbicide treatments, are selected based on the weed species present.

Revegetation is rarely undertaken post fire within natural areas, with the preference to allow natural regeneration. In some fire impacted natural areas post fire revegetation may be undertaken, usually within selected small areas, such as within previously degraded sections of the natural area.

Management Recommendations

10. Continue to implement weed control in natural areas in accordance with the Annual Maintenance Schedule.

11. Continue to conduct weed control on verges adjacent to key natural areas including increasing mowing of verges to reduce weed seed spread, spraying of weeds and spreading of certified mulch, where required.

12. Continue to implement the Fire Weed Management Guidelines to limit the infestation of weeds in the City's natural areas.

⁶⁸ Miller and Miller (2020)

⁶⁹ Miller and Miller (2020)

4.2 Parks and Urban Landscaping Areas

The City manages over 370 parks and reserves and a substantial number of urban landscaping areas such as streetscapes, pedestrian access ways, sumps and swales.

4.2.1 Purpose

The purpose of Section 4.2 of the Plan is to provide an integrated weed management approach to prevent, monitor and control the spread of weeds and conserve the amenity, aesthetics and functionality of the City's parks and urban landscaping areas.

Section 4.2 of the Weed Management Plan includes the following:

- description of the City's current weed management approach
- identification of weed control measures
- recommended integrated weed management strategies to prevent, monitor and control the spread of weeds.

4.2.2 Limitations

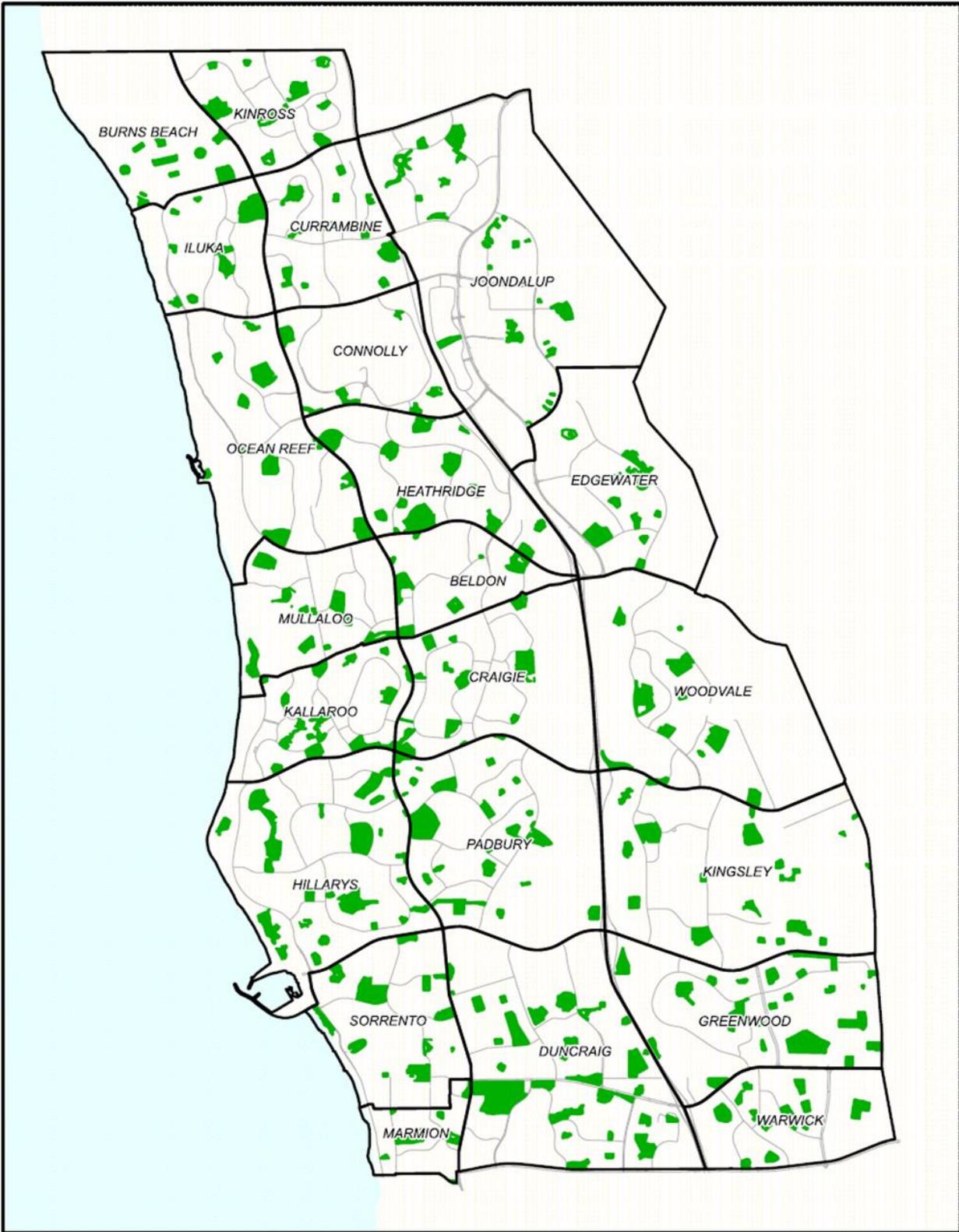
Section 4.2 of the Weed Management Plan excludes weed management of natural areas managed by the City and land not managed by the City such as private property.

4.2.3 Study Area

The study area for Section 4.2 includes parks and urban landscaping areas managed by the City. Urban landscaping areas managed by the City include the following:

- streetscapes
- pedestrian access ways (PAWs)
- sumps and swales.

The parks managed by the City are shown in Figure 9 and streetscapes are shown in Figure 10. Urban landscaping areas are not shown or detailed due to the large number of such areas within the City.



 90 Boas Ave, Joondalup WA 6027 PO Box 21, Joondalup WA 6919 Ph: 08 9400 4000 Fax: 08 9300 1383 info@joondalup.wa.gov.au www.joondalup.wa.gov.au	N 	Scale (A4): 1 : 60 000	Date: 5/4/2022	Compiled: A. Gilbert	City of Joondalup Parks and Open Space
		File: Parks.WOR			
		Folder: E:\GIS Projects\Parks and Natural Areas			
		<small>DISCLAIMER: While every care is taken to ensure the accuracy of this data, the City of Joondalup makes no representations or warranties about its accuracy, completeness or suitability for any particular purpose and disclaims all liability for all expenses, losses, damages, and costs which you might incur as a result of the data being inaccurate or incomplete in any way and for any reason.</small>			

Figure 9: Parks Managed by the City of Joondalup

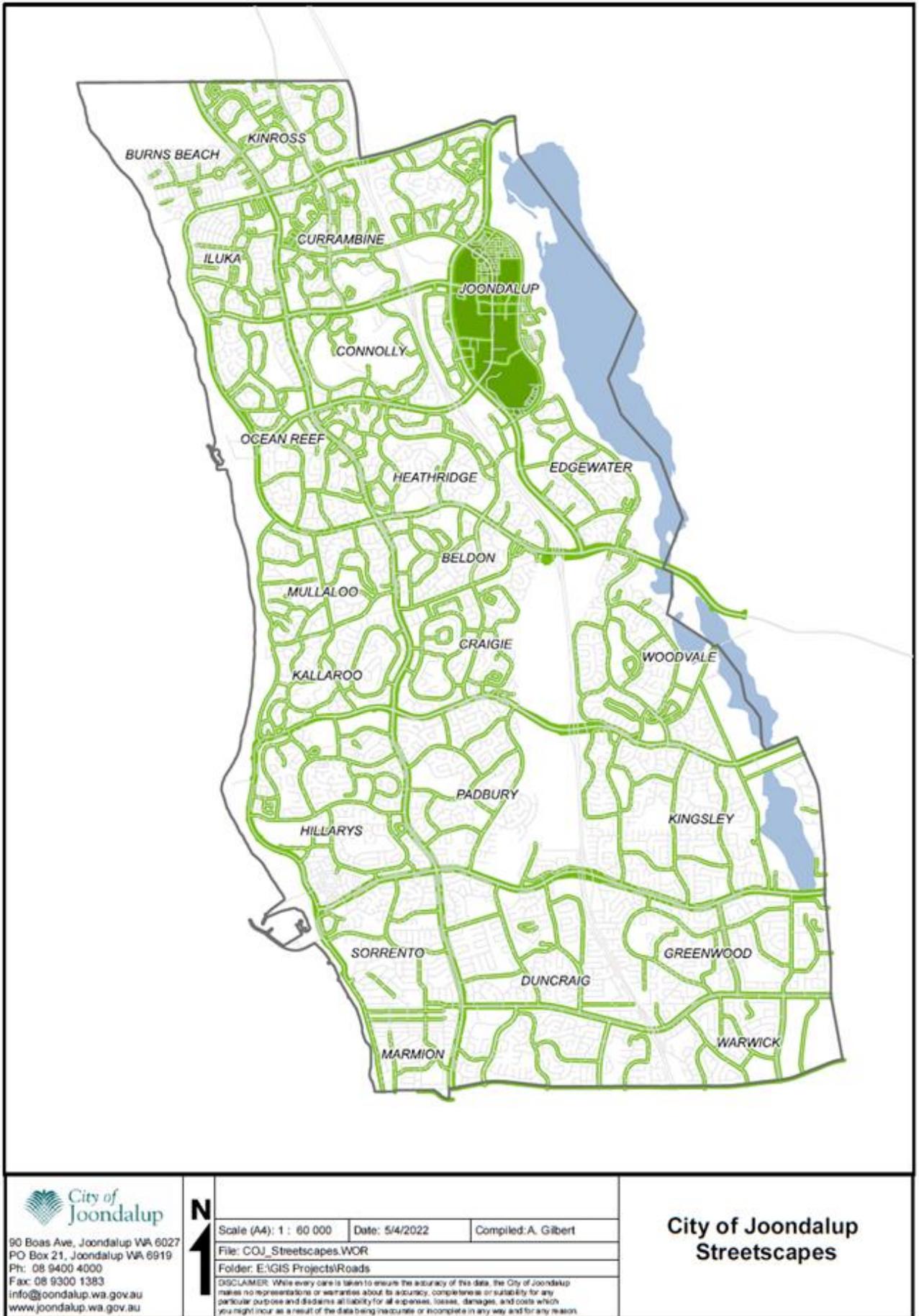


Figure 10: City of Joondalup Streetscape Areas

4.2.4 Service Agreements

The City manages several locations with service agreements, such as Specified Area Rates (SAR) service agreements for the provision of enhanced landscaping services.

Specified Area Rates (SAR) Service Agreement

A SAR is an additional rate charge that is applied separately to designated areas within the City by agreement with the residents association. These rates cover additional maintenance costs for landscaping services (including weed management) over and above services ordinarily provided by the City.

The City currently has four SAR areas:

- Iluka
- Woodvale Waters Estate, Woodvale
- Harbour Rise Estate, Hillarys
- New Burns Beach.

4.2.5 Weed Management Site Prioritisation

The City's current approach to weed management prioritisation of parks and urban landscaping area sites and within sites is detailed in the following sections.

Prioritisation of Sites

The City currently conducts seasonal weed management in parks and urban landscaping areas on a priority basis using four criteria (in descending order), as shown in Figure 11.

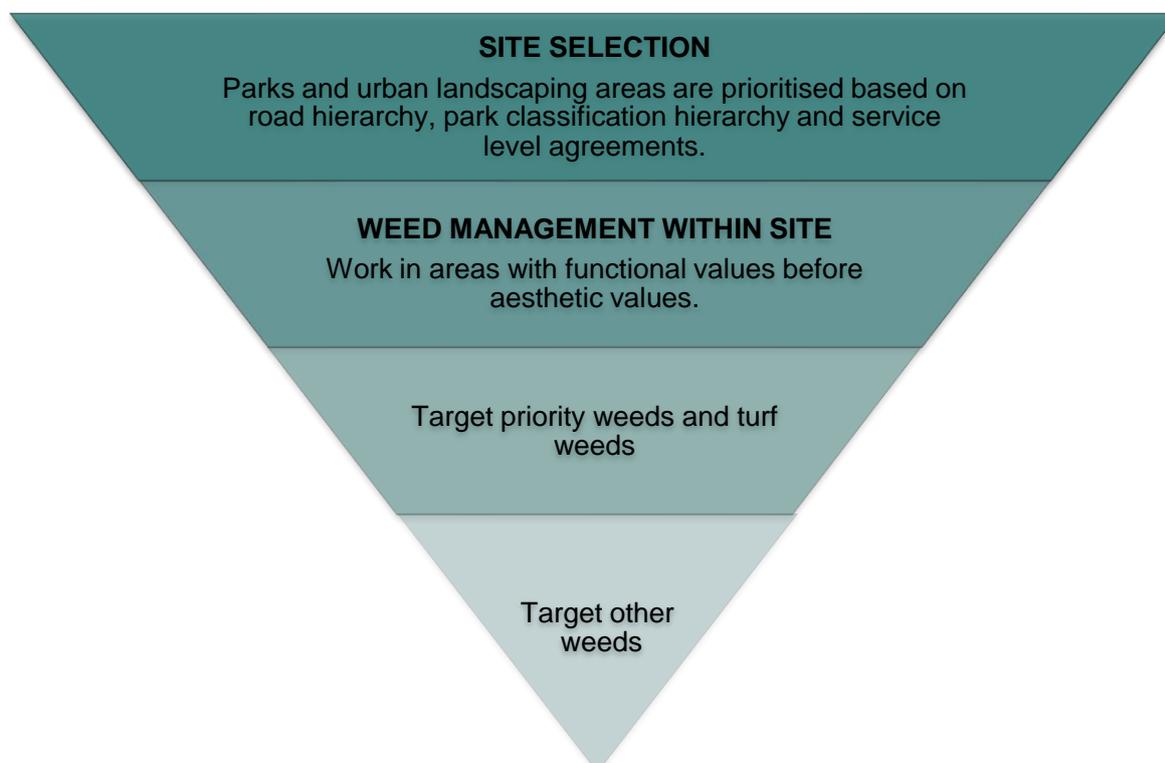


Figure 11: Criteria currently used to prioritise weed management actions for parks and urban landscaping areas

Site Selection

Parks and urban landscaping areas are categorised and prioritised based on the type, profile, amenity or functional requirements of a specific location. A consistent approach is applied to all areas that fall within the same category.

Listed below are the different types of parks and urban landscaping areas and details regarding their purpose, use and functional requirements.

Parks are areas of public open space that contain facilities for recreation and leisure. The draft *Public Open Space Framework* outlines the planning, maintenance and resourcing service levels for the City's public open spaces which also assists in prioritising weed management. Parks are classified using factors such as the site purpose, size and surrounding catchment.

Parks are given priority ratings from 1 to 4, as outlined below. Parks with priority ratings of 1 receive the highest level of weed management, whilst parks with priority ratings of 4 receive the lowest level of weed management. For example, Regional Sports Parks or Regional Recreation Parks (Priority 1) are treated for weeds in accordance with the annual maintenance schedule and inspected at a higher frequency than Local Recreation Parks (Priority 4).

Sports Parks

Sports Parks are public open spaces predominantly used for formal, structured sports activities, such as team competitions, physical skill development and training. They are generally designed to accommodate the playing surface and infrastructure requirements of specific sports. People attend these public open spaces with the primary purpose of engaging in organised sports activity, training, competition or viewing as a spectator.

Sports parks are split into four sub-categories and are prioritised in the following order:

- **Regional Sports Park:** Regional Sports Parks are suitable for larger-scale, significant or regional sports events where multiple sports matches can be undertaken simultaneously. These parks accommodate at least three oval sports fields or six rectangular sports fields, and also accommodate playing courts and/or bowling greens. Regional Sports Parks attract users from the whole of the City and surrounding local governments.. An example of a Regional Sports Park is Percy Doyle Reserve in Duncraig.
- **District Sports Park:** District Sports Parks are suitable for significant sports events where more than more one sports match can be undertaken simultaneously. These parks accommodate at least two oval sports fields or four rectangular sports fields, or accommodate one sports field and either playing courts and/or bowling greens. District Sports Parks attract users form the whole of the City, especially surrounding suburbs.An example of a District Sports Park is Iluka District Open Space in Iluka.
- **Neighbourhood Sports Park:** Neighbourhood Sports Parks are suitable for smaller-scale sports events where between one and two sports matches can be undertaken simultaneously. These parks accommodate at least one oval sports field, two rectangular sports fields. Neighbourhood Sports Parks attract users from within the suburb and surrounding suburbs. An example of a Neighbourhood Sports Park is Barriadale Park in Kingsley.
- **Local Sports Park:** Local Sports Parks are suitable for local sports training and social day time matches. These parks accommodate one sports field or playing courts. Local Sports Parks attract users from within the suburb and surrounding suburbs. An example of a Local Sports Park is Parkside Park in Woodvale.

Recreation Parks

Recreation Parks are public open spaces predominantly used for informal recreation activities, such as walking, jogging, picnicking and play. They are generally designed to accommodate low-wear applications and contain recreation-based infrastructure. People attend these public open spaces with the primary purpose of engaging in social and leisure activities. Recreation Parks are split into four sub-categories and ranked in the following order:

- **Regional Recreation Park:** Regional Recreation Parks are located near a natural place of interest, such as a lake or beach, or located near commercial activities, such as shopping or a café/restaurant. These parks accommodate multiple distinct zones where different types of recreation can be undertaken simultaneously. Regional Recreation Parks encourage long-stay usage for recreational activities and attract users from the whole of the City and surrounding local governments. An example of a Regional Recreation Park is Tom Simpson Park in Mullaloo.
- **District Recreation Park:** District Recreation Parks may be located near a natural place of interest, such as a lake or beach, or located near commercial activities, such as shopping or a café/restaurant. These parks accommodate at least two distinct zones where different types of recreation can be undertaken simultaneously. District Recreation Parks encourage medium to long-stay usage for recreational activities and attract users from the whole of the City, especially surrounding suburbs. An example of a District Recreation Park is Delemare Park in Currambine.
- **Neighbourhood Recreation Park:** Neighbourhood Recreation Parks are usually located within suburban areas. These parks accommodate one medium recreation zone. Neighbourhood Recreation Parks encourage short to medium-stay usage for recreational activities and attract users from the surrounding suburb. An example of a Local Recreation Park is Menteith Park in Kinross.
- **Local Recreation Park:** Local Recreation Parks are usually located within suburban areas. These parks accommodate one small recreation zone. Local Recreation Parks encourage short-stay usage for recreational activities and attract users from the surrounding streets. An example of a Local Recreation Park is Carr Park in Warwick.

Urban Landscaping Areas

Urban landscaping areas are public open spaces predominantly used to contribute to visual amenity and suburban aesthetics. They can act as entry points to the City and include verges, medians and thoroughfares, as well as residual land. Urban landscaping areas are broken down into the following categories and weed management is dependent on the priority rating:

- **Major Urban Landscaping:** Major Urban Landscaping includes large verges and medians located on major traffic routes into and out of the City and within the Joondalup City Centre. These areas act as visual indicators for major entry points and a welcome to residents and visitors. Major Urban Landscaping delivers a high level of visual amenity and an opportunity for public art. An example is the along Joondalup Drive in Joondalup.
- **High Priority Urban Landscaping:** High Priority Urban Landscaping includes verges and medians located on high-level traffic routes, mostly centred around intersection nibs and arterial roads. These areas act as visual indicators for significant locations and help to foster a sense of place. High Priority Urban Landscaping delivers a high level of visual amenity and may provide an opportunity for public art. An example is along Ocean Reef Road in Edgewater.
- **Medium Priority Urban Landscaping:** Medium Priority Urban Landscaping includes verges, roundabouts and thoroughfares located on medium-level traffic routes in suburban areas. These landscaping areas provide vegetation and tree cover and help to mitigate the urban heat island effect. Medium Priority Urban Landscaping delivers a

medium level of visual amenity and enhances local aesthetics. An example is along Mullaloo Drive and Dampier Avenue, in Mullaloo and Kallaroo.

- **Low Priority Urban Landscaping:** Low Priority Urban Landscaping includes verges, remnant land and minor thoroughfares located on low-level traffic routes in suburban areas, as well as extended verges adjacent to arterial or distributor roads. These areas provide some vegetation and may contain tree cover. An example is Craigie Drive and Marmion Avenue in Craigie.

Weed Management within Sites

The City conduct weeds management within parks and urban landscaping areas by focussing on areas with functional values followed by areas with aesthetic values.

Priority Weeds

The City focuses on weed management of broadleaf weeds (most commonly found weeds), skeleton weed (declared pest plant), Noogoora burr (declared pest plant) and Caltrop (local pest plant) for parks and urban landscaping areas.

Broadleaf Weeds

The most common broadleaf weeds that are managed in parks and urban landscaping areas include:

- Fleabane (*Conyza* spp.)
- Dandelion (*Taraxacum officinale*)
- Medic Burr (*Medicago polymorpha*)
- Bindii (*Soliva sessilis*)
- Cudweed (*Gamochaeta calviceps*)
- White Clover (*Trifolium repens*)
- Flat Weed (*Hypochaeris radicata*)
- Common Cotula (*Cotula australis*)
- Blue Lupin (*Lupinus cosentinii*).

Skeleton Weed

Skeleton weed (*Chondrilla juncea*) is a declared pest plant in Western Australia under the *Biosecurity and Agriculture Management Act 2007*. The City is obligated to search for, and eradicate, all skeleton weed found on City managed land. All skeleton weed must be reported to DPIRD and treated to prevent seed set within 48 hours. Occurrences of skeleton weed are added to a City skeleton weed register and locations are inspected annually.

Noogoora burr

Noogoora burr (*Xanthium strumarium*) is a declared pest plant in Western Australia under the *Biosecurity and Agriculture Management Act 2007*. The City is obligated to search for, and eradicate, all Noogoora burr found on City managed land. All occurrences must be reported to DPIRD and treatment includes special disposal measure conditions. Recorded locations of Noogoora burr occurrences are inspected annually.

Caltrop

Under the *Biosecurity and Agriculture Management Act 2007* and the *Local Government Act 1995*, the Council of the City of Joondalup made the *Pest Plant Local Law 2012* to require the owner or occupier of private land within the City district to destroy, eradicate or otherwise

control pest plants within a specified time. Caltrop (*Tribulus terrestris*) is designated as a pest plant.

The City maintains a Caltrop register to document confirmed locations of Caltrop on land managed by the City and public property. All Caltrop locations are inspected annually. Figure 12 shows current and dormant Caltrop locations on the Caltrop register as per April 2022.

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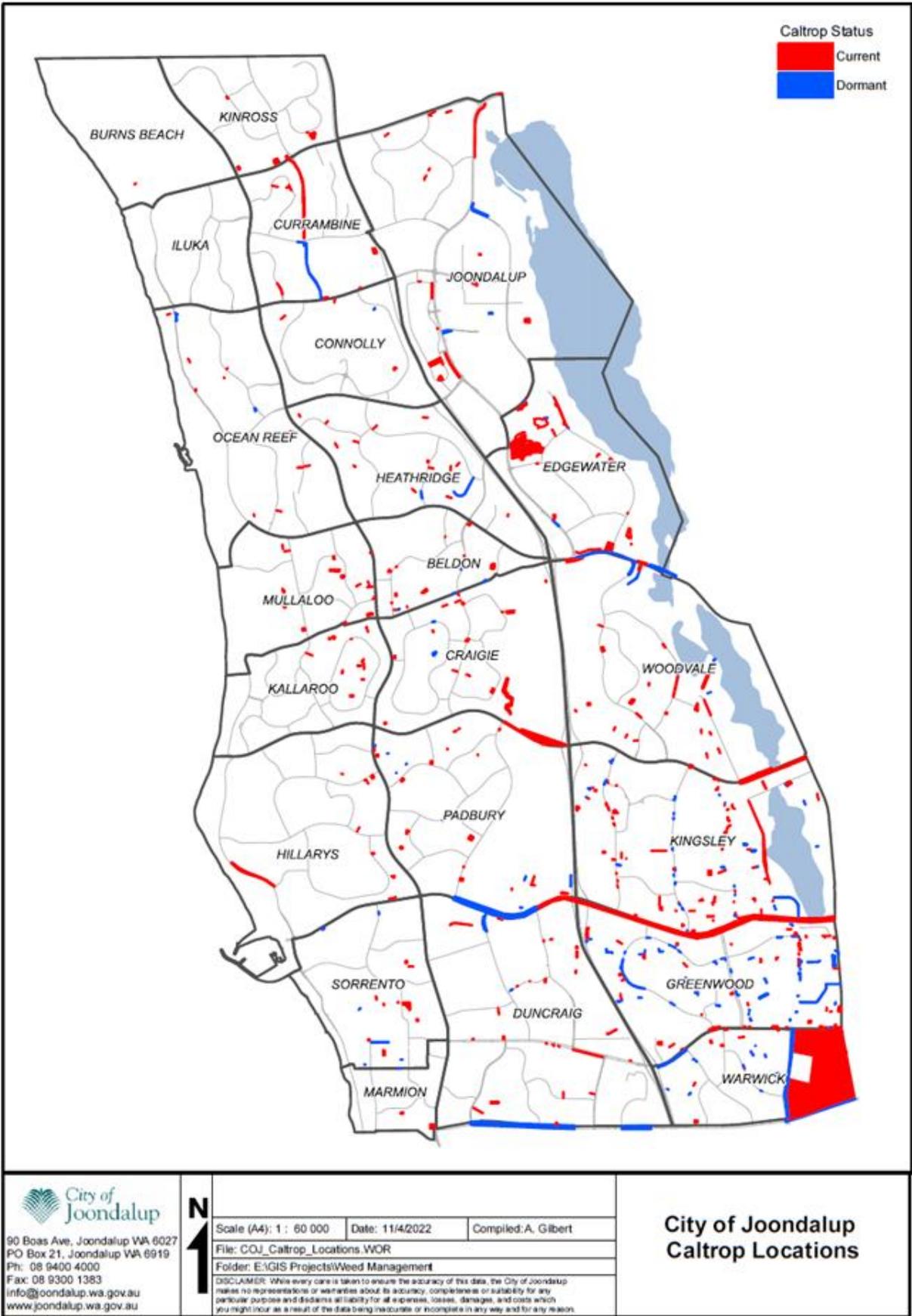


Figure 12: Map of locations on the Caltrop register in April 2022

Integrated Weed Management Approach

Integrated weed management involves using a variety of different techniques to monitor, prevent and control weeds. Using a variety of weed control methods, rather than just one, also ensures weeds are less able to adapt to the control methods used and less likely to become herbicide resistant. An integrated approach is required for effective weed management, and therefore the management of weeds within the City parks and urban landscaping areas includes:

- weed monitoring
- weed prevention
- weed control
- notification and community awareness
- innovation, continual improvement and training.

4.2.6 Weed Monitoring

Ongoing monitoring of the City's priority and high profile areas is beneficial to assist with the long-term management of parks and urban landscaping areas within the City. Weed monitoring is important for identifying and effectively managing weed populations.

Observational weed monitoring is conducted for parks and urban landscaping areas. Observational weed monitoring can guide weed control efforts and assess the effectiveness of weed management actions. Informal weed inspections in parks and urban landscaping areas are regularly undertaken by staff during scheduled maintenance activities and site inspections. The frequency of inspections is determined by the site prioritisation.

When weed issues are identified during inspections, an evaluation is undertaken to determine the most effective and efficient method of control. This can be the immediate treatment of weeds or scheduling of specific weed management actions to effectively manage larger infestations.

4.2.7 Weed Prevention

Prevention of weeds in parks and urban landscaping areas is the most effective method of weed control. Eradication of weeds usually requires more resources for weed management than those required for weed prevention.

The main weed prevention methods that are implemented by the City include mulching, turf management, renovation works, suppression of weed seed banks, best practice landscape design and management, minimising access and disturbance and undertaking weed hygiene measures.

Mulching

Pathogen and weed free mulch is applied to suppress weed growth in garden beds or non-turf areas, as per the City's *Pathogen Management Plan*.

Turf Management Practices

Fertiliser is applied, based on soil and leaf tissue analysis, to improve the quality of the turf and to promote healthy turf. Healthy turf reduces the likelihood of seasonal weeds.

Renovation Works

Renovation works are undertaken to encourage improved density and coverage of turf, reducing the opportunity for weed growth. Weeds are more prevalent in sand and denuded areas.

Weed Seed Bank Suppression

Weed seed banks are suppressed through the use of chemical pre-emergents. These types of chemicals are applied to non-planted garden beds and hardstand areas.

Landscape Design

Landscape design and management can assist with reducing weed growth and ensuring effective weed management can be delivered through, for example, the use of stencilled concrete, hydro-zoning, eco-zoning and irrigation design.

Stencilled concrete has been installed rather than brick paving in some appropriate hardstand areas to assist with weed control and management. Stencilled concrete does not allow weeds to surface as easily as brick paving.

Hydro-zoning and eco-zoning have been applied in numerous City parks to conserve water whilst keeping the area's amenity and function. Hydro-zoning is the installation of irrigation to allow for different zones of a park or reserve to receive different amounts of water based on the type of use of the zones and turf requirements. Eco-zoning is the division of a park or reserve into zones of turf and natural areas to promote biodiversity and conserve water. Hydro-zoning and eco-zoning principles also assist with weed management through suppressing weeds and only watering targeted areas. Figure 13 shows an example of hydro-zoning and eco-zoning undertaken in 2020-21 in Macaulay Park, Duncraig.



Figure 13: Example of hydro-zoning and eco-zoning at Macaulay Park, Duncraig

Hygiene Measures

Hygiene is important to ensure weeds, pathogens and pests are not introduced or spread from or into parks and urban landscaping areas. The City has developed and implements a *Pathogen Management Plan* to protect biodiversity values within the City of Joondalup by minimising the risk of introducing and spreading pathogens (and weeds) within landscaped and natural areas of the City.

City staff and contractors implement a *Pathogen Hygiene Procedure* and undertake hygiene measures on vehicles used for turf renovation activities between each site and at the end of each day. City contractors occasionally undertake turf renovation activities and are required by tenders and contracts to implement hygiene measures between sites and at the end of each day on vehicles used.

The majority of plant stock is supplied from NIASA accredited nurseries and the City currently purchases Australian Standard certified mulch and potting mix. The City has developed

Purchasing Guidelines for the Supply of Landscaping Materials that will be used to eliminate the likelihood of introducing weeds seeds from purchased materials.

4.2.8 Weed Control

While weed prevention is important for reducing new infestation of weeds from occurring or spreading in parks and urban landscaping areas, weed control is necessary for reducing, containing or eradicating weed infestations. While weed control can be expensive and resource intensive, failure to control weeds can have significant impacts including affecting the quality of playing surfaces or the aesthetics and amenity of parks and urban landscaping areas.

The City undertakes an integrated weed management approach to its weed control in parks and urban landscaping including the use of a variety of approved herbicides. Weed control involves using a number of methods to reduce weed infestations to manageable levels or, if possible, to eradicate infestations. Weed control methods used in parks and urban landscaping areas include:

- Chemical weed control – the use of selective and non-selective herbicides to control or suppress weeds.
- Steam and/or hot water (also known as hydrothermal) weed control – the application of hot water and/or steam to a weed plant causing it to die.
- Physical weed control – the removal of weeds by physical or mechanical means, such as mowing, mulching or by hand.

Chemical Weed Control

The majority of weed control in parks and urban landscaping areas is managed by the use of approved herbicides as they are effective on large weed populations and are economical compared to other weed control techniques.

The two main methods of chemical application in parks and urban landscaping areas are blanket and target spraying. Appendix 6 provides further details on the different methods of herbicide application.

Blanket spraying

Blanket spraying is generally undertaken by machinery with boom sprays and is the most effective and efficient method to apply chemicals to large open spaces such as sports ovals.

Broadleaf selective turf weeds are subject to seasonal control generally between July and September. This activity is only conducted on the City's irrigated sporting parks and recreation parks.

Target Spraying

Target spraying can be undertaken using the following methods:

- backpack spray units or vehicle mounted tanks and hoses with applicable control attachments where required.
- wick or sponge wiping via a handheld applicator directly on to targeted plant/s.
- a cut and paint/basal bark treatment which involves painting pesticide directly on to a woody cut plant.

Target spraying is generally used in small areas or where obstacles or site constraints restrict access of larger machinery. Target spraying weeds with herbicide is conducted on an as

required basis with frequency dependent on the service levels in place at the time for the following locations:

- landscaped medians and verges
- kerblines, footpaths and brick paved areas
- Joondalup CBP
- parks infrastructure and tree surrounds.

Weed management within the City's parks and open spaces, verges, median strips and gardens is both seasonally and resource driven.

Steam and Hot Water Weed Control

The City has been trialling steam and hot water treatments to test their effectiveness since 2006-07. Steam and hot water weed control has improved in effectiveness over the past couple of years through the development of suitable machinery and equipment.

Given the positive results of the steam and hot water weed control trials in some locations, as well as the growing community interest, the Council determined, in 2021, that the City would implement non-chemical weed control (inclusive of steam and hot water weed control and physical weed removal) for hardstand areas within a 50m radius of schools, within the footprint of playspaces, as well as the kerbs, footpaths, hardstand (paved) median islands, mulched median islands and general paved areas within the CBP, as shown in Figure 14. The non-chemical weed control includes any weeds exceeding a height or width of 50mm, being mechanically removed and disposed of in an appropriate manner.

The City's non-chemical weed control treatment commenced in July 2022 and will be applied to the same locations until the term of the contract, for up to a period of 3 years. Continuation of the non-chemical weed control treatment will be dependent upon review of the contract.

Figure 15 shows the locations that will be managed by the City through non-chemical weed control. Additional locations that are suitable for this weed control method will be reviewed and incorporated into the City's integrated weed management program.

WeedSeeker technology allows accurate and automated spatial tracking and monitoring of application areas to assist in reducing the amount of chemical use. This technology was trialled in 2020-21 alongside the steam and hot water control and found to be effective at controlling weeds and reducing chemical use through selectively targeting and spot spraying specific weeds.





Figure 14: Photograph of the City's chemical-free weed control in July 2022

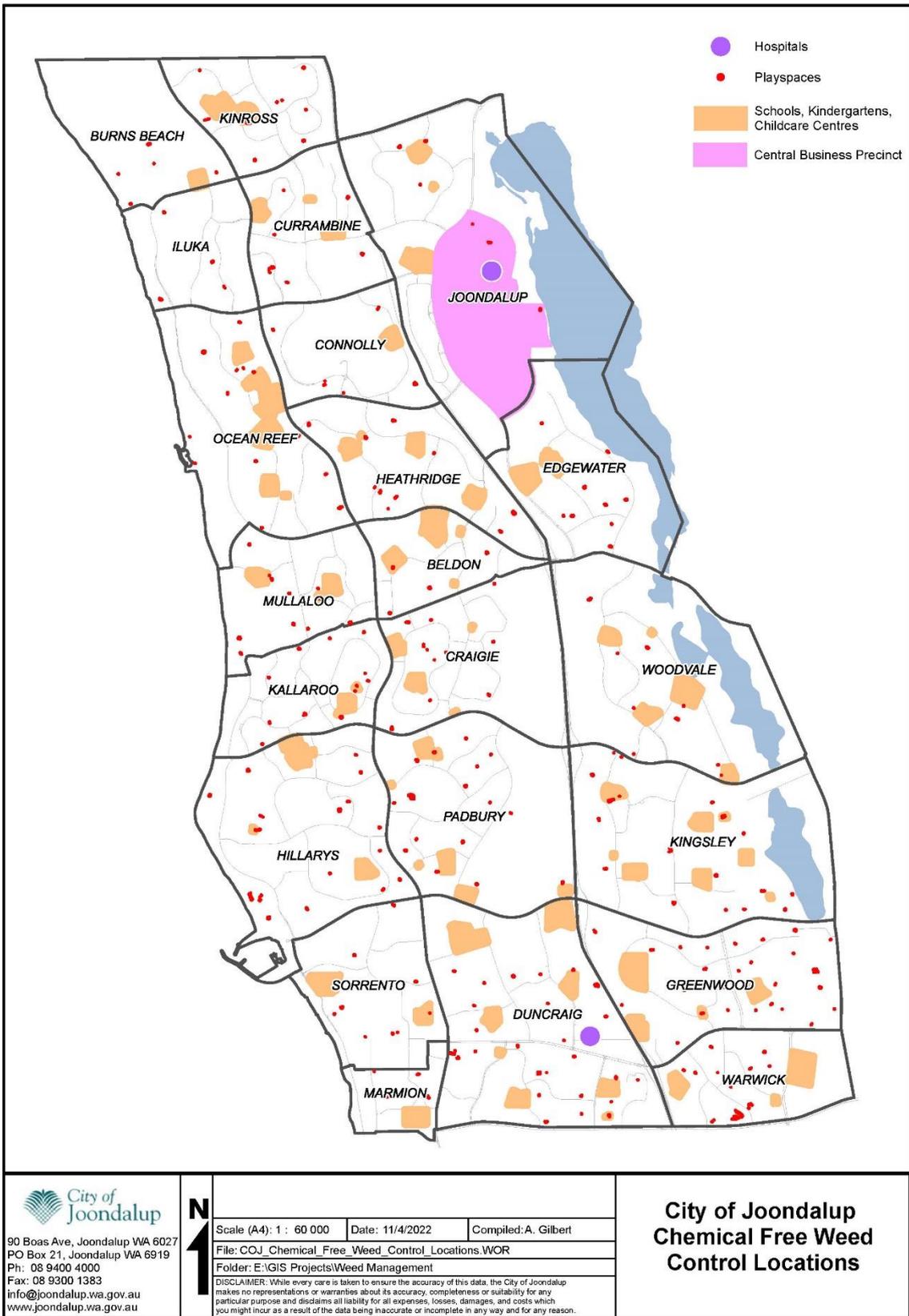


Figure 15: Map of the City’s chemical free weed control locations in 2022⁷⁰

⁷⁰ The CBP chemical free treatment areas include the kerbs, footpaths, hardstand (paved) median islands, mulched median islands and general paved areas only.

Sensitive Facilities

Herbicide use adjacent to sensitive facilities is subject to the City's assessment of authorised chemicals process. Additional consideration is given to the timing of herbicide application in the vicinity of sensitive facilities to minimise potential impacts.

The City considers the following as sensitive facilities:

- School or pre-school
- Kindergarten
- Childcare Centre
- Hospital
- Community Health Centre
- Nursing Home
- Play spaces.

Physical Weed Control

Physical weed control is mainly undertaken in urban landscaping areas when required. This method is utilised when the weed species are significantly impacting on the presentation of the landscape and chemical application is not determined to be the most effective method of removal, as compared to herbicide use. This weed control method is also used within and surrounding the City's sensitive facilities, particularly in areas unable to be accessed by the steam and hot water weed control machinery.

Site Specific Weed Control

Weed control is conducted according to specific site attributes such as parks, streetscapes, SARs, CBP, PAW's and sumps and swales.

Parks

Weed control is conducted in all irrigated sport and recreation parks through the following methods:

- **Turf:** broadleaf selective, target spraying i.e. around infrastructure.
- **Landscaped garden beds:** hand weeding, target spraying, mulch application.
- **Hardstands and footpaths:** target spraying, use of pre-emergent herbicides (where appropriate).

Weed control in landscaped garden beds, hardstands and footpaths in district and local recreation parks is assessed as per scheduled site inspections.

Urban Landscapes

Weed control is conducted from July to October and April to May according to the Annual Maintenance Schedule and is subject to ongoing site inspections and reactive maintenance from October to March. Weed control in streetscapes is conducted through the following methods:

- **Landscaped garden beds:** hand weeding, target spraying, mulch application
- **Turf:** broadleaf selective, target spraying i.e. around infrastructure
- **Kerblines:** target spraying
- **Medians:** blanket spraying, use of pre-emergent herbicides (where appropriate)
- **Hardstands and footpaths:** target spraying, use of pre-emergent herbicides (where appropriate)

- **Entry statements:** hand weeding, target spraying, mulch application.

Commercial Business Precinct

The CBP or Joondalup City Centre receives a higher frequency of weed control activities to maintain the area to a higher standard of appearance. The visual appearance of this area is particularly important given its role in supporting the City's economic activities and positive visitor experiences.

Weed control in the CBP is conducted through the following methods:

- **Parks:** broadleaf selective, target spraying i.e. around infrastructure.
- **Landscaped garden beds:** hand weeding, target spraying, broadleaf selective, mulch application.
- **Streetscapes:** hand-weeding, steam, hot water and steam, target spraying, broadleaf selective, mulch application.
- **Turf:** broadleaf selective, target spraying i.e. around infrastructure.
- **Kerblines:** steam, hot water and steam, mechanical removal.
- **Footpaths:** steam, hot water and steam, mechanical removal.
- **Medians (mulched):** target spraying, mechanical removal and steam/hot water where appropriate.
- **Medians (hardstand):** steam, hot water and steam, mechanical removal.
- **Median (other):** broadleaf spraying, use of pre-emergent herbicides.
- **Hardstands and footpaths:** steam, hot water and steam, mechanical removal.

The CBP will be partly controlled using non-chemical weed control. The CBP chemical free treatment areas include the kerbs, footpaths, hardstand (paved) median islands, some mulched median islands and general paved areas only and is shown in Figure 16.



Figure 16: City of Joondalup Commercial Business Precinct⁷¹

⁷¹ The CBP chemical free treatment areas include the kerbs, footpaths, hardstand (paved) median islands, mulched median islands and general paved areas only.

Pedestrian Access Ways

Weed control on pedestrian access ways (PAWs) is conducted from June to October in accordance with the annual scheduled maintenance and is subject to ongoing site inspections and reactive maintenance from November to May.

Weed control is conducted in PAWs through the following methods:

- Fence lines - target spraying
- Hardstands and footpaths - target spraying, use of pre-emergent herbicides.

City residents who own a property adjoining a PAW and wish to plant and maintain the PAW adjoining their residence can apply to be added to the City's Pedestrian Accessway Planting and Maintenance Register.

If approved by the City, chemical weed control will not be undertaken within the PAW by either the City or the registrants.

Sumps and Swales

The City has approximately 200 sumps with weed control being undertaken annually and more often if necessary. An example of a sump is shown in Figure 17. Weed control in sumps consists of mowing weeds and use of herbicide applications. It is conducted prior to summer to reduce fuel load and lower the fire hazard risk. Swales are mowed in accordance with the Annual Maintenance Schedule.



Figure 17: Sump at Shepherds Bush Reserve, Kingsley

Pesticide Use Notification

The City has implemented chemical application notification and exclusion registration processes to keep residents and stakeholders informed of the City's weed control application locations and scheduling or alternatively to allow them to register for their residence to be excluded from receiving any chemical weed control treatment.

City residents wishing to be advised in advance of scheduled spraying activities, occurring within 100m of their residence, can apply to be added to the City's Pesticide Use Notification Register. Residents listed on the Pesticide Use Notification Register will receive an automated notification at least 24 hours prior to spraying commencing. Further information on the Pesticide Use Notification Register can be found on the City's website.

Pesticide Use Notification – Locations Map and Schedule

The City also updates the Pesticide Use Notification – Locations Map and Schedule platform on the City's website weekly to provide a visual search tool, inclusive of an interactive map and searchable database, that displays areas where the City undertakes herbicide application activities and the activities status. The implementation of herbicide application as per the schedule is dependent on weather and the availability of operational resources.

Pesticide Exclusion Register

City residents and/or property owners wishing to exclude the verge immediately abutting their property/residence from chemical weed control can apply to be added to the City's Pesticide Exclusion Register.

Registration to the Pesticide Exclusion Register requires the resident to commit to:

- Maintaining their verge in a good and tidy condition, including weed removal
- Re-register at 30 June each year to remain on the Pesticide Exclusion Register
- Adhere to the City's Street Verge Guidelines.
- Understanding that the Pesticide Exclusion Register does not apply to parks, reserves or natural areas
- For tenanted properties, written confirmation from the property owner approving inclusion on the Register must be provided.
- That Main Roads WA roads are exempt from registration.

Innovation, continual improvement and training

The City is committed to delivering an innovative, holistic and integrated weed management program and will continue to undertake research and complete trials into alternate and emerging weed control and monitoring methods.

The City will provide its staff with professional development opportunities to learn and train in emerging weed control methods, best-practice weed management approaches and associated weed management training such as Green Card training. Further information is detailed in Section 5.3.

Management Recommendations

13. Undertake weed control in parks and urban landscaping areas in accordance with the Annual Maintenance Schedule.

14. Implement steam and hot water weed control in accordance with specified scope. Undertake review of non-chemical weed control at expiration of contract.

15. Continue to implement the Pesticide Use Notification Register, Pesticide Use Notification - Location Map and Schedule and Pesticide Exclusion Register.

4.3 Wetlands

Wetlands can contain weeds on the perimeter or aquatic weeds within the water body. The City manages 17 wetlands contained within parks, including being responsible for weed control (see Figure 18). Yellagonga Regional Park wetlands are managed separately through the *Yellagonga Integrated Catchment Management Plan 2021-2026*.

Alternative methods of weed control for weeds on the perimeter of wetlands, such as hand weeding, slashing and matting, to minimise the risk of chemicals entering the water bodies and risk to native fauna and flora, are preferable to using herbicides. Herbicides can enter water bodies through spray drift, dripping from treated plant foliage or landing on a hard surface (e.g. rock or gravel) and washing into the water.⁷² However, some weed species are best controlled with the use of herbicides and can form part of an integrated weed management approach.

Aquatic weeds can be emergent (stems and leaves above waterline), free floating (not attached to the soil), floating leaf (rooted into soil with leaves on water surface) or submerged weeds (rooted into soil with the whole plant submerged under water). Aquatic weeds can be introduced through dumping of invasive garden pond plants or spread through mediums such as birds or boats. Weed control of aquatic weeds poses a risk to wildlife, fish and native plants in the wetland. Early control of aquatic weeds prevents weed spread. Some aquatic weeds can be controlled with the use of herbicides such as glyphosate and diquat.⁷³

The City conducts wetland water quality monitoring three times a year in accordance with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)* to monitor chemical and physical water conditions.

Weeds growing in or around wetlands are controlled either by physical removal or treatment with a herbicide formulated for use in or around wetlands.

The City undertakes regular inspections of wetlands accessing the overall health of the wetlands to assist with prioritising management actions. These inspections include assessment of weeds, litter, fauna, odour and water quality.

The City has developed and implements *Wetland Guidelines* for staff and contractors to minimise weed establishment and spread into and around wetlands.

Bulrush

Bulrush (*Typha orientalis*), previously considered an introduced species, was reclassified as being native to Western Australia by Keighery and McCabe in 2015.⁷⁴ Bulrush is capable of aggressive invasion and can transform wetland ecosystems largely as a result of landscape modifications.⁷⁵ Altered hydrology to permanently wet and increased nutrient flow benefit Bulrush over other native sedges which prefer lower nutrient levels and seasonal drying.⁷⁶

⁷² CRC for Australian Weed Management (2005b)

⁷³ Department of Agriculture and Food (2009)

⁷⁴ Keighery, G (2016)

⁷⁵ Keighery, G (2016)

⁷⁶ Keighery, G (2016)

Bulrush can rapidly change nutrient levels and water levels and flow, requiring active management to prevent it from becoming a weed.⁷⁷

A clearing permit or exemption is required to undertake Bulrush control within its natural range, however exemptions under Schedule 6 Clause 3 of the *Environmental Protection Act 1986* allow the DBCA (including volunteers, and contractors) to undertake control works on DBCA managed land, such as within Yellagonga Regional Park without requiring a permit.^{78,79} The City would require a clearing permit to undertake Bulrush control within any City owned or managed public open spaces, this includes wetlands but also urban landscaping areas such as sumps and drainage infrastructure. The City has not undertaken any Bulrush removal from its wetlands or other public open spaces.

Management Recommendations

16. Continue to implement the Wetland Guidelines to provide direction to staff and contractors conducting weed control activities in and around wetland areas and minimise environmental impacts, where possible.

⁷⁷ Keighery, G (2016)

⁷⁸ Keighery, G. (2016)

⁷⁹ DBCA (2019)

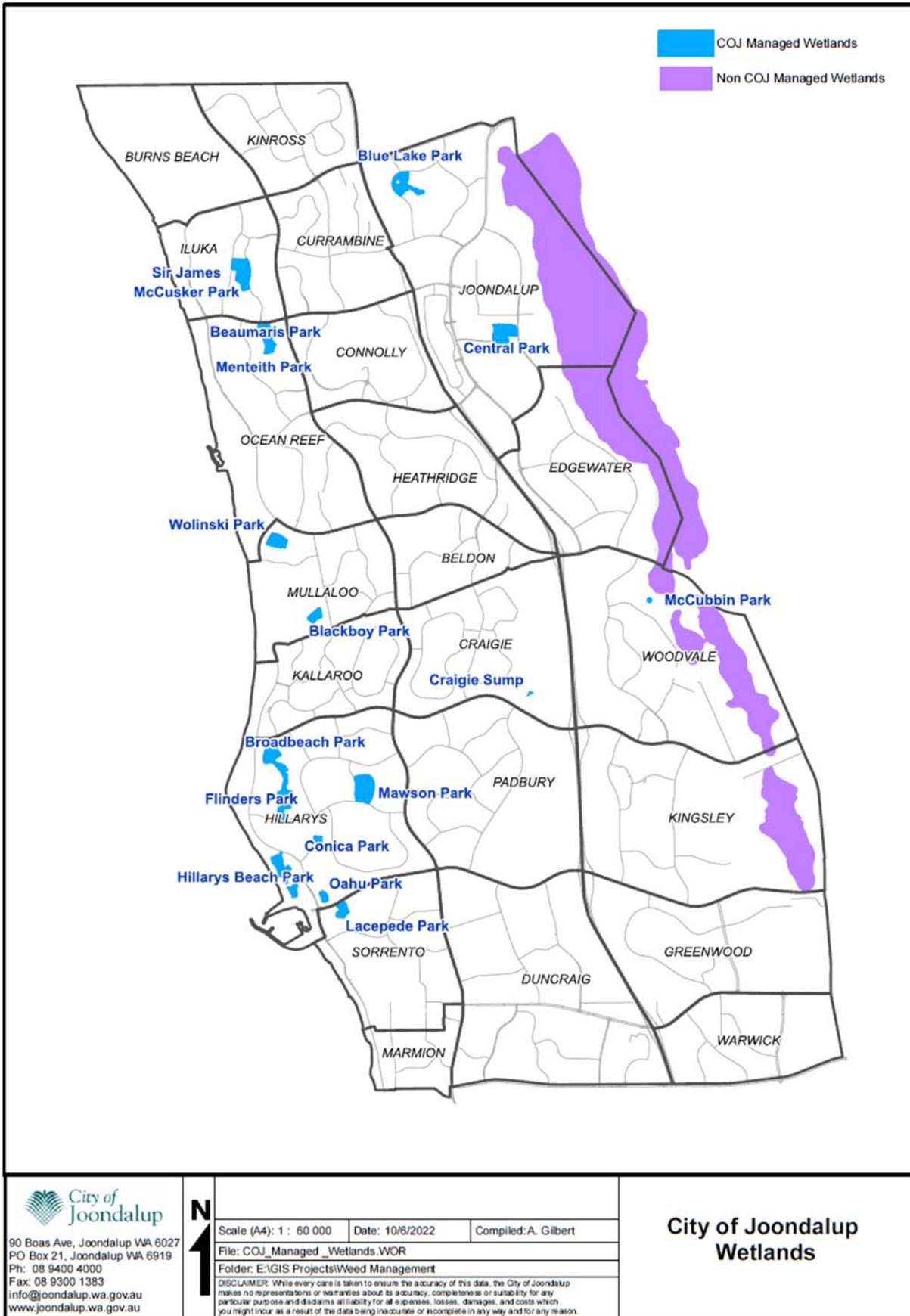


Figure 18: Wetlands managed by the City of Joondalup

Note: The City manages some natural areas adjacent to Yellagonga Regional Park but is not responsible for managing the water bodies.

5.0 Partnerships, Education and Training

An important component of this Plan is to ensure that the local community, visitors and those that manage the City's natural areas and parks have the necessary information to assist in protecting the City's natural areas and parks from the threat of weeds.

5.1 Partnerships

There are many organisations other than the City that have roles and responsibilities in weed management including State government, local governments, WALGA, natural resource management agencies, research organisations and Friends Groups.

The City liaises with a variety of external stakeholders regarding weed management, such as DBCA, DPIRD, Water Corporation, other local governments (e.g. City of Wanneroo and City of Stirling), WALGA, universities, schools and Friends Groups.

The City participates in WALGA's Local Government Herbicide Use and Integrated Weed Management Working Group. The purpose of the Working Group is to build the capacity of local government by sharing information and addressing knowledge gaps to deliver effective weed management programs. The City also advocates for natural areas specific alternate weed control treatment methods to be developed and trialled in WA through the Working Group.

Friends Groups are an important partner of the City in managing natural areas and reducing weeds and contribute substantially to bushland conservation. For example, the City's 19 Friends Groups voluntarily contributed 7,415 hours in 2020/21 towards bushland restoration in 23 natural areas. Friends Groups are involved in a variety of activities, including weed control, for their chosen reserve with the aim of restoring the reserve's conservation values and the community's appreciation for the natural environment.

The City works with Friends Groups to protect, maintain and enhance natural areas and assist Friends Groups through the provision of special purpose grants that can be used for weed control activities and assisting with on-ground works, including weed control. The City has also developed the *City of Joondalup Natural Areas Friends Group Manual* to provide an appropriate framework and process for City support of Friends Groups and volunteers including recognising roles and responsibilities and ensuring environmental best-practice issues such as weed management are understood and implemented.⁸⁰

Management Recommendations

17. Continue to participate in WALGA's Local Government Herbicide Use and Integrated Weed Management Working Group.

18. Continue to investigate opportunities to participate in research projects and take up opportunities for sharing information relating to best practice approaches to weed management.

19. Continue to partner with and support local Friends Groups to facilitate bushland restoration and weed management activities.

⁸⁰ City of Joondalup (n.d.)d

5.2 Community Education

The City implements an Environmental Education Program to raise community awareness regarding weed prevention and control, particularly regarding the City's weed management approach, the impact of weeds and the importance of weed control.⁵⁹

In order to educate the community about how they can prevent weed introduction and spread the City has developed a number of key brochures titled '*Being WEEDwise: Garden Escapees in the City of Joondalup*'⁸¹, '*Being WEEDwise: Environmental Weeds in the City of Joondalup*'⁸² and '*Protecting our Natural Areas and Parks*'.⁸³

The community can support local biodiversity and prevent weed introduction and spread by:

- Conducting weed control in their gardens to prevent weed spread.
- Minimising their access and disturbance to natural areas by staying on tracks, not taking vehicles into natural areas, and not allowing dogs to run off-leash in natural areas.
- Undertaking appropriate hygiene practices such as cleaning footwear when entering and leaving natural areas, removing any weed seeds attached to clothing and removing and disposing appropriately of dog excrement (may contain weed seed).
- Reporting sightings of any priority or declared weeds observed within City owned or managed public open spaces.
- Planting local, native species in their gardens where possible.
- Opting for native species rather than invasive species in private gardens to reduce the spread of invasive species to natural areas.
- Not dumping garden rubbish in natural areas or parks.
- Joining a Friends Group to participate in bushland restoration and maintenance activities.

Schools are also an important avenue for raising awareness and interest in environmental and sustainability issues and creating future community members that are aware of and actively participate in local environmental management. Many schools are located adjacent to bushland areas which creates unique and educational learning opportunities for students.

As part of the Environmental Education Program, the City coordinates an Adopt a Coastline/Bushland program for students from years 4 to 7 to provide an interactive coastline/bushland management program. The coastline component of this program commenced in 2006/07 and the bushland component of this program commenced in 2014/15. The Program has had a positive impact on the natural environment as well as being an important education mechanism.

The City recognises that State Government also plays a big role in education and management of weeds, for example the DPIRD works with a range of land owners and managers, community groups and biosecurity groups, provides weed identification services and contributes to social science through weedwatcher. The DPIRD website provides a range of information, tools and programs that support community education. This includes the Western Australian Organism List, PestFacts WA newsletter, MyPestGuide™ Report to report weeds and the MyWeedWatcher project.

⁸¹ City of Joondalup n.d(a)

⁸² City of Joondalup n.d(b)

⁸³ City of Joondalup n.d.(c)

Management Recommendations

20. Continue to implement an Adopt a Bushland/Coastline program for students to provide an interactive bushland and/or coastline management program.

21. Continue to distribute the 'Being WEEDwise' and 'Protecting our Natural Areas and Parks' brochures through the community.

22. Continue to implement the Environmental Education Program to raise awareness and encourage weed management practices.

5.3 Training

The City continues to ensure its staff have the necessary knowledge and experience to undertake integrated weed management activities to ensure the program is safe, effective and innovative; resources are used productively; potential negative impacts are minimised as well as ensuring the safety of staff. Training is important for the continued development of staff knowledge and expertise. Training is particularly important for staff to learn about emerging weed management methods, such as the stem and hot water weed control method.

City staff are trained in the correct application and safe use of herbicides. Contractors directly involved in the use of herbicides are licenced with the Department of Health under the *Health (Pesticides) Regulations 2011*.

City staff also complete Green Card training, and although focused on plant diseases and pathogens, the hygiene management practices are relevant to weed management.

City staff in the Natural Areas team are qualified with a Certificate in Conservation and Land Management or relevant experience. The City currently conducts regular plant identification training, including weed identification and management. City staff also undertake relevant training to increase knowledge of weed identification, safety and effective methods of weed control.

The City's Friends Groups help to protect, preserve and enhance significant bushland areas within the City and will continue to benefit from training related to weed management. Through ongoing meetings with Friends Groups, the Friends Groups Coordinator shares information about weed hygiene practices to protect the biodiversity of natural areas.

Management Recommendations

23. Ensure City staff working within natural areas and parks continue to undertake relevant training to increase knowledge of weed identification, safety and research on effective methods of weed control.

24. Continue to conduct ongoing weed hygiene practices information sharing with City Friends Groups.

6.0 Implementation

Effective and coordinated implementation of the *Weed Management Plan* is critical to achieving the objectives of the Plan. Implementation of the Plan will be coordinated by annual reporting and review of the Plan.

6.1 Monitoring

The City will report on, evaluate and review the plan as part of an ongoing process.

6.1.1 Performance Measures

The following indicators will be monitored annually to determine the effectiveness of the City's weed management actions.

DRAFT

Indicator	Source	Measure	Reportable Period
Community satisfaction with conservation and natural area management	Customer Satisfaction Monitor	% of respondents satisfied with service	Biennial
Vegetation condition of City Major Conservation Natural Areas	Vegetation assessments (five yearly)	% of area per vegetation condition classification (as per the Keighery scale)	Once every five years per Major Conservation Natural Area
Fuel load of City Major Conservation Natural Areas	Fuel load assessments	Fuel load (tonnes/hectare)	Once every five years per Major Conservation Natural Area
Weed control in City Major Conservation Natural Areas.	Contractor monthly reports	Coverage (hectares) of weed control.	Annual
Community satisfaction with parks	Customer Satisfaction Monitor	% of respondents satisfied with service	Biennial
Weed control in playspaces	Non-chemical weed control contractor monthly reports	% of playspaces using non-chemical weed control methods	Annual
Weed control in sensitive areas	Non-chemical weed control contractor monthly reports	% kerblines and footpaths within 50 m of sensitive activities using non-chemical weed control	Annual
Community awareness of weed management	Corporate Business Plan	Number of events/initiatives.	Annual
Volunteer Hours	Friends Group Annual Work Plans	Total number of volunteer hours by City of Joondalup Friends Groups	Annual
Expenditure for weed management	Annual Budget	Total annual budget allocated to weed management per year	Annual

Note: the City's non-chemical weed control treatment commenced in July 2022 and will be applied to the same locations until the term of the contract and then be dependent upon review of the contract.

6.1.2 Reporting

The progress of recommended management actions and performance measures within the Plan will be reported against on an annual basis via the City's State of the Environment Report.

6.1.3 Review

The Weed Management Plan is to be reviewed and updated every 10 years with a major review undertaken every 5 years. This aligns with the timeframes for capital works programming and natural area management plans and will ensure the City is managing weeds in accordance with best practice approaches.

6.2 Recommendations

A total of 24 management actions have been recommended to coordinate and improve the City's weed management activities. A list of the recommended management actions is provided in the following table.

DRAFT

Recommended Management Actions

No.	Recommended Management Action	Relevant Natural Areas	to Parks and Urban Landscaping Areas
1	Comply with the requirements of the <i>Aboriginal Cultural Heritage Act 2021</i> when conducting weed control, as required.	●	●
2	Continue to review and undertake weed control activities in accordance with the ISO 9001 Quality Management System and other relevant legislation.	●	●
3	Continue mapping of key priority weeds through regular inspections of natural areas in accordance with the Annual Maintenance Schedule to inform on ground weed management actions.	●	
4	Continue to assess high priority and medium priority natural areas every 5-7 years using the Natural Areas Initial Assessment Tool, including identification of weed species and their distribution in accordance with the Natural Areas Assessment Schedule.	●	
5	Continue to undertake photo monitoring in major conservation areas when measuring the natural areas key performance indicator annually to assess the effectiveness of ongoing weed control.	●	
6	Record and monitor the coverage (hectares) of weed control in major conservation natural areas.	●	
7	Continue to monitor for new weed populations, including new aggressive weed species, identified in the City to prioritise for weed control and prevent spread.	●	●
8	Continue to implement the Pathogen Hygiene Procedure, and Purchasing Guidelines for the Supply of Landscaping Materials to provide direction to staff and contractors and prevent the introduction and spread of weeds within the City.	●	●
9	Continue to implement the Fire Weed Management Guideline to inform staff and contractors about weed hygiene when undertaking manual fuel load reduction works and when constructing and maintaining firebreaks and access ways.	●	
10	Continue to implement weed control in natural areas in accordance with the Annual Maintenance Schedule.	●	
11	Continue to conduct weed control on verges adjacent to key natural areas including increasing mowing of verges to reduce weed seed spread, spraying of weeds and spreading of certified mulch, where required.	●	●

No.	Recommended Management Action	Relevant Natural Areas	to Relevant to Parks and Urban Landscaping Areas
12	Continue to implement the Fire Weed Management Guidelines to limit the infestation of weeds in the City's natural areas.	●	
13	Undertake weed control in parks and urban landscaping areas in accordance with the Annual Maintenance Schedule.		●
14	Implement steam and hot water weed control in accordance with specified scope. Undertake review of non-chemical weed control at expiration of contract.		●
15	Continue to implement the Pesticide Use Notification Register, Pesticide Use Notification - Location Map and Schedule and Pesticide Exclusion Register.	●	●
16	Continue to implement the Wetland Guidelines to provide direction to staff and contractors conducting weed control activities in and around wetland areas and minimise environmental impacts, where possible.	●	●
17	Continue to participate in WALGA's Local Government Herbicide Use and Integrated Weed Management Working Group.	●	●
18	Continue to investigate opportunities to participate in research projects and take up opportunities for sharing information relating to best practice approaches to weed management.	●	●
19	Continue to partner with and support local Friends Groups to facilitate bushland restoration and weed management activities.	●	
20	Continue to implement an Adopt a Bushland/Coastline program for students to provide an interactive bushland and/or coastline management program.	●	
21	Continue to distribute the 'Being WEEDwise' and 'Protecting our Natural Areas and Parks' brochures through the community.	●	●
22	Continue to implement the Environmental Education Program to raise awareness and encourage weed management practices.	●	●
23	Ensure City staff working within natural areas and parks continue to undertake relevant training to increase knowledge of weed identification, safety and research on effective methods of weed control.	●	●
24	Continue to conduct ongoing weed hygiene practices information sharing with City Friends Groups.	●	

7.0 References

ArborCarbon (2014) Using airborne MSI to manage weeds in urban bushland: City of Joondalup Natural Areas, Perth, Western Australia.

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Artarmon, New South Wales.

Australian Association of Bush Regenerators (AABR), 2013, *The Bradley Method*, viewed 1 August 2022, <http://www.aabr.org.au/learn/what-i-bush-regeneration/general-principles/the-bradley-method/>.

Australian Glyphosate Sustainability Working Group, n.d., *Sustainable Glyphosate Use on Roadsides, Railways, Public Utilities and Parks*.

Australian Government, 2012a, *Impact of Weeds*, viewed 1 August 2022, <http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/why/impact.html>

Australian Government, 2012b, *Weeds in Australia*, viewed 1 August 2022, <http://www.environment.gov.au/biodiversity/invasive/weeds/index.html>.

Australian Government, 2012c, *Biological Control*, viewed 1 August 2022, <http://www.environment.gov.au/biodiversity/invasive/weeds/management/biological-control.html>

Australian Government, n.d., *Climate Change: Extreme climate events*, viewed 11 December 2013, <http://www.climatechange.gov.au/climate-change/grants/australian-climate-change-science-program/extreme-climate-events>.

Australian Government, 2022, *Australia State of the Environment 2021*, viewed 1 August 2022, <https://soe.dcceew.gov.au/>.

Australian Weeds Committee, n.d., *Weed Mapping*, viewed 1 August 2022, <https://weeds.org.au/monitor/>.

Banks, J. And Sandral, G., 2007, *Report on Weed Control using hot water/ steam and herbicides in the City of Joondalup*. Prepared for the City of Joondalup, Perth, Western Australia.

Banks and associates 2009, *Weed Control Trials comparing hydrothermal and herbicides in the City of Joondalup*. Prepared for the City of Joondalup, Perth, Western Australia.

Bettink, K. and Keighery, G., 2008, *Environmental Weed Census and Prioritisation, Swan NRM Region*, Swan Catchment Council and Department of Environment and Conservation, Perth, Western Australia.

Brown and Brooks, 2002, *Bushland Weeds: A practical guide to their management*, Perth, Western Australia.

City of Joondalup, n.d.(a), *Being WEEDwise – Environmental Weeds in the City of Joondalup*, Perth, Western Australia.

City of Joondalup, n.d.(b), *Being WEEDwise – Garden Escapees in the City of Joondalup*, Perth, Western Australia.

City of Joondalup, n.d.(c), *Protecting our Natural Areas and Parks*, Perth, Western Australia.

City of Joondalup, n.d.(d), *Natural Areas – Friends Group Manual*, Perth, Western Australia.

City of Joondalup, 2012a, *Draft City of Joondalup Environment Plan 2012-2015*, Perth, Western Australia.

City of Joondalup, 2012b, *Lilburne Park Management Plan*, Perth, Western Australia.

City of Joondalup, 2013, *Pathogen Management Plan 2013-2016*, Perth, Western Australia.

City of Joondalup, 2014, *City of Joondalup – Minutes of Meeting of Council – 17.02.14*, viewed 1 August 2022, http://www.joondalup.wa.gov.au/files/councilmeetings/2014/CJ140217_MIN.pdf.

City of Joondalup, 2021, *City of Joondalup Weed Management Trial Presentation*, Perth, Western Australia.

City of Joondalup, 2022, *City of Joondalup – Minutes of Meeting of Council – 19-Jul-2022*, viewed 1 August 2022, https://api.joondalup.wa.gov.au/files/councilmeetings/2022/220719_CNCL_MIN.pdf

City of Nedlands, 2013, *Weed control decision saves more than \$83,000*, Media Release November 2013, Perth, Western Australia.

Collins, M, 1999, *Thermal Weed Control, A Technology with a Future? Twelfth Australian Weeds Conference*, Hobart, Tasmania.

Conservation International, 2014, *Hotspots*, viewed 1 August 2022, <http://www.conservation.org/how/pages/hotspots.aspx>.

Cooperative Research Centre (CRC) for Australian Weed Management, 2004, *Introductory Weed Management Manual*, Department of Environment and Heritage, Australia.

Cooperative Research Centre (CRC) for Australian Weed Management, 2005a, *Herbicide Guidelines: Knowing when and how to use them*, Glen Osmond, South Australia.

Cooperative Research Centre (CRC) for Australian Weed Management, 2005b, *Herbicide Guidelines: For use in and around water*, Glen Osmond, South Australia.

Commonwealth, Science and Industry Research Organisation (CSIRO), 2011, *Biological Control of Weeds*, viewed 1 August 2022, <https://www.csiro.au/en/research/plants/Pathogens-Pests-Weeds/Biological-control-of-weeds>.

Commonwealth, Science and Industry Research Organisation (CSIRO), 2013, *Integrated Weed Management*, viewed 1 August 2022, <https://research.csiro.au/weed-biocontrol/>.

Demand Media Inc., 2013, *How Does Organic Weed Killer Work?*, viewed 1 August 2022, http://www.ehow.com/how-does_4709678_organic-weed-killer-work.html.

Department of Agriculture and Food, n.d. *Weeds*, viewed 1 August 2022, <https://www.agric.wa.gov.au/rangelands/environmental-weed-risk-assessments>.

Department of Agriculture and Food, 2014, *Aquatic Weeds*, viewed 1 August 2022, <https://www.agric.wa.gov.au/invasive-species/aquatic-weeds>.

Department of Agriculture and Food, 2011, *Declared Plants in Western Australia*, Perth, Western Australia.

Department of Biodiversity, Conservation and Attractions (DBCA), 2019, Reclassification of *Typha orientalis* as native to Western Australia and the implications under *Environmental Protection Act 1986* and the Swan and Canning Rivers Management Regulations 2007, Perth, Western Australia, viewed 31 March 2022, https://www.udiaawa.com.au/wp-content/uploads/2019/05/Reclassification-of-Typha-orientalis-as-native-to-WA_implications-under-EP-Act_SCRM-Regs-external.pdf.

Department of Parks and Wildlife (DPaW), 1999, *Environmental Weed Strategy for WA*, Perth, Western Australia.

Department of Parks and Wildlife (DPaW), 2002, *Weed Control and Revegetation Plan*, Perth, Western Australia.

Department of Parks and Wildlife (DPaW), 2013, *Weed Prioritisation Process for DPaW*, Perth, Western Australia.

Department of Fire and Emergency Services (DFES), 2013, *Bush Fires Act 1957*, Perth, Western Australia.

Department of Planning, n.d., *Weeds and Weed Management*, viewed 27 August 2013, http://www.planning.wa.gov.au/dop_pub_pdf/8_weeds_management.pdf.

Department of Primary Industries (DPI), 2011, *Noxious and environmental weed control handbook – a guide to weed control in non-crop, aquatic and bushland situations, 5th Edition*. New South Wales.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC)a, 2012, *Weed Prevention*, viewed 1 August 2013, <http://www.environment.gov.au/biodiversity/invasive/weeds/management/prevention.html>.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC)b, 2012, *Why are weeds a problem?* viewed 13 February 2013, <http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/why/index.html>

Dunne, C., 2005, *Managing Phytophthora Dieback in Bushland*, Dieback Working Group and the Threatened Species Network, Perth, Western Australia.

Eurobodalla Shire Council, n.d., *Weed Control Methods*, viewed 8 August 2013, <http://www.esc.nsw.gov.au/site/Weeds/control%20methods.htm>.

Fire and Emergency Services Authority (FESA) of Western Australia, 2011, *Biodiversity Conservation and Fire in Road and Rail Reserves: Management Guidelines*, Perth, Western Australia.

Groves, R.H., Boden, R. and Lonsdale, W.M., 2005, *Jumping the Garden Fence: Invasive Garden Plants in Australia and their Environmental and Agricultural Impacts*, CSIRO report prepared for WWF-Australia, WWF-Australia, Sydney, New South Wales.

Hudek, L., Enez, A., and Brau, L., 2021, Comparative Analyses of Glyphosate Alternative Weed Management Strategies on Plant Coverage, Soil and Soil Biota. Sustainability, viewed on 9 May 2022, <https://doi.org/10.3390/su132011454>.

Houghton Mifflin Company, 2009, *The American Heritage Dictionary of the English Language*, viewed 30 November 2012, <http://www.thefreedictionary.com/herbicide>.

Johansson, E., n.d., *Alternative Weed Control Methods*, viewed on 27 August 2013, <http://www.kootenayweeds.com/pdf/AlternativeControl.pdf>.

John Banks and Associates, 2007, *Report on Weed Control Using Hot Water/ Steam in the City of Joondalup*, Prepared for the City of Joondalup.

John Banks and Associates, 2009, *Weed Control Trials Comparing Hydrothermal and Herbicides in the City of Joondalup*, Prepared for the City of Joondalup.

Keightery, G., 2016, Typha Orientalis in Western Australia' in Bushland News, Issue 97.

Leschenault Catchment Council, n.d., *Bringing Back the Bush*, viewed 16 February 2015, <http://www.leschenaultcc.com/uploads/BBTB%20Bradley%20Method%20-%20A4%20web%20version.pdf>.

Natural Area Consulting, 2013, *Draft City of Joondalup Weed Treatment Trial – Interim Report December 2013*, unpublished report.

Natural Resource Management (NRM) Ministerial Council, 2007, *The Australian Weeds Strategy: A national strategy for weed management in Australia*, Canberra, Australian Capital Territory.

New South Wales (NSW) Government, n.d., *Weeds*, viewed on 26 November 2012, <http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds>.

Nursery and Garden Industry, no date, *Way to Grow!*, viewed on 9 December 2013, <http://ngiq.asn.au/wp-content/uploads/FINAL-NIASA-Production-A4-Brochure-05.pdf>.

Penn State, 2014, *Adjuvants for Enhancing Herbicide Performance*, viewed on 2 April 2014, <http://extension.psu.edu/pests/weeds/control/adjuvants-for-enhancing-herbicide-performance>.

Scott, J.K., Webber, B.L., Murphy, H., Ota, N., Kriticos, D.J. and Loechel, B. (2014) AdaptNRM Weeds and climate change: supporting weed management adaptation. Available at: www.AdaptNRM.org

State Weed Plan Steering Group, 2001, *A Weed Plan for Western Australia*, Perth, Western Australia.

The University of Queensland, 2011, *Weeds of Australia*, viewed on 26 November 2012, <http://keyserver.lucidcentral.org/weeds/data/03030800-0b07-490a-8d04-0605030c0f01/media/Html/Index.htm#A>.

Water and Rivers Commission, 2001, *Water notes: Herbicide Use in Wetlands*, Perth, Western Australia.

WeedScience.org, 2013, *Herbicide Resistant Weeds in Australia*, viewed 27 August 2013, <http://weedsience.org/summary/Country.aspx>.

Western Australian Herbarium, n.d., *Florabase*, viewed on 26 November 2012, <http://florabase.dec.wa.gov.au/>.

Western Australian Local Government Association (WALGA), 2014, *Biodiversity Program*, viewed 25 April 2014, <http://pbp.walga.asn.au/Home.aspx>

Western Australian Local Government Association (WALGA), 2004, *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region*, viewed 13 August 2014, <http://pbp.walga.asn.au/Publications/LocalGovernmentBiodiversityPlanningGuidelines.aspx>.

Vigneault C., Benoît D.L. (2001) *Electrical Weed Control: Theory and Applications*. Springer, Berlin, Heidelberg. Viewed 28 February 2022, https://doi.org/10.1007/978-3-662-04584-8_12

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8.0 Appendices

Appendix 1 – Natural Area Sites within Study Area (Alphabetically)

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Appendix 3 – Relevant Local, State and Federal Legislation, Policies, Plans and Strategies

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Appendix 6 – Weed Control Methods

Appendix 7 – Wetlands within City of Joondalup

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Appendix 1 – Natural Area Sites within Study Area (Alphabetically)

Natural Area	Suburb
Adelaide Park	Craigie
Alfreton Park	Duncraig
Beaumaris Park	Ocean Reef
Bethany Park	Iluka
Blue Lake Park	Joondalup
Bonnie Doon Park	Connolly
Brisbane Park	Padbury
Burns Beach Foreshore Reserve	Burns Beach
Cadogan Park	Kingsley
Caledonia Park	Currambine
Callander Park	Kinross
Candlewood Park	Joondalup
Carnaby Reserve	Connolly
Castlecrag Park	Kallaroo
Cawarra Park	Craigie
Central Park	Joondalup
Chadlington Park	Padbury
Chichester Park	Woodvale
Christchurch Park	Currambine
Clermont Park	Currambine
Conidae Park	Heathridge
Craigie Open Space	Craigie
Cranston Park	Kinross
Culwalla Park	Kallaroo
Delamere Park	Currambine
Duncraig Library Bushland	Duncraig
Earlsferry Park	Kinross
Fairway Park	Connolly
Fernwood Park	Padbury
Finney Park	Marmion
Garrong Park	Edgewater
Glenbar Park	Duncraig
Greenshank Park	Joondalup
Gunida Park	Mullaloo
Haddington Park	Beldon
Harman Park	Sorrento
Hawker Park	Warwick
Hepburn Heights Conservation Area	Padbury
Hillarys Foreshore Reserve	Hillarys
Hilton Park	Duncraig
Huntingdale Park	Connolly
Huxley Park	Burns Beach
Iluka Foreshore Reserve	Iluka
Kallaroo Foreshore Reserve	Kallaroo
Kallaroo Park	Mullaloo
Kiernan Park	Kallaroo
Kilrenny Park	Greenwood
Korella Park	Mullaloo
Kuta Park	Iluka

Natural Area	Suburb
Lacepede Park	Sorrento
Lady Evelyn Park	Joondalup
Lakeside Park	Joondalup
Lakevalley Park	Edgewater
Ledge Park	Sorrento
Lilburne Park	Duncraig
Littorina Park	Heathridge
Lookout Park	Edgewater
Lysander Park	Heathridge
MacNaughton Park	Kinross
Madana Park	Craigie
Magpie Reserve	Marmion
Manapouri Park	Joondalup
Mandalay Park	Craigie
Marbella Park	Hillarys
Maritana Park	Kallaroo
Marmion Foreshore Reserve	Marmion
Menteith Park	Kinross
Mullaloo Foreshore Reserve	Mullaloo
Nanika Park	Joondalup
Naturaliste Park	Iluka
Negresco Park	Currambine
Neil Hawkins Park	Joondalup
Ocean Reef Foreshore Reserve	Ocean Reef
Okely Park	Edgewater
Pentland Park	Duncraig
Periwinkle Park	Mullaloo
Picnic Cove Park	Edgewater
Pine Valley Park	Connolly
Porteous Park	Sorrento
Quarry Park	Edgewater
Quarry Ramble Park	Edgewater
Riversdale Park	Currambine
Robin Park	Sorrento
Sandalford Park	Beldon
Shepherds Bush Reserve	Kingsley
Sir James McCusker Park	Iluka
Sorrento Foreshore Reserve	Sorrento
St Clair Park	Edgewater
St Michael's Park	Connolly
Stilt Park	Joondalup
Sweeney Park	Padbury
Timberlane Park	Woodvale
Trig Point Park	Ocean Reef
Trigonometric Park	Duncraig
Walsh Park	Joondalup
Warrandyte Park	Craigie
Warwick Open Space Bushland	Warwick
Water Tower Park	Joondalup

Appendix 2 – Prioritisation of City of Joondalup Natural Areas

Site	Suburb	Priority	Bush Forever Site	Local Planning Scheme No. 3, Environmental Conservation Zoning	Friends Group
Warwick Open Space Bushland	Warwick	Major Conservation Natural Area	●		●
Craigie Open Space Bushland	Craigie	Major Conservation Natural Area	●		●
Hepburn Conservation Area*	Padbury	Major Conservation Natural Area	●		●
Shepherd's Bush Park*	Kingsley	Major Conservation Natural Area	●		●
Lilburne Park	Duncraig	Major Conservation Natural Area		●	
Marmion Foreshore Reserve	Marmion	Major Conservation Natural Area			●
Sorrento Foreshore Reserve	Sorrento	Major Conservation Natural Area			●
Hillarys Foreshore Reserve	Hillarys	Major Conservation Natural Area	●		●
Kallaroo Foreshore Reserve	Kallaroo	Major Conservation Natural Area	●		●
Mullaloo Foreshore Reserve	Mullaloo	Major Conservation Natural Area	●		●
Ocean Reef Foreshore Reserve	Ocean Reef	Major Conservation Natural Area	●		●
Iluka Beach Foreshore Reserve^	Iluka	Major Conservation Natural Area	●		●
Burns Beach Foreshore Reserve	Burns Beach	Major Conservation Natural Area	●		
Cranston Park	Kinross	High Priority Natural Area			
Fairway Park	Connolly	High Priority Natural Area		●	
Lakeside Park	Joondalup	High Priority Natural Area			
Lakevalley Park	Edgewater	High Priority Natural Area		●	
Saint Clair / Quarry Park	Edgewater	High Priority Natural Area			
St Michaels Park	Connolly	High Priority Natural Area		●	
Lady Evelyn Park^	Joondalup	High Priority Natural Area			

Site	Suburb	Priority	Bush Forever Site	Local Planning Scheme No. 3, Environmental Conservation Zoning	Friends Group
Timberlane Park	Woodvale	High Priority Natural Area		●	
Beaumaris Park	Ocean Reef	High Priority Natural Area		●	
Bonnie Doon Park	Connolly	High Priority Natural Area		●	
Cadogan Park	Kingsley	High Priority Natural Area		●	●
Central Park	Joondalup	High Priority Natural Area			●
Clermont Park	Currambine	High Priority Natural Area		●	
Naturaliste Park	Iluka	High Priority Natural Area		●	
Chadlington Park	Padbury	High Priority Natural Area			
Neil Hawkins Park ^{^*}	Joondalup	High Priority Natural Area	●		●
Cawarra Park	Craigie	High Priority Natural Area		●	
Glenbar Park	Duncraig	High Priority Natural Area		●	●
Littorina Park [^]	Heathridge	High Priority Natural Area		●	
Maritana Park	Kallaroo	High Priority Natural Area		●	●
Periwinkle Park	Mullaloo	High Priority Natural Area		●	●
Porteous Park	Sorrento	High Priority Natural Area		●	●
Trigonometric Park	Duncraig	High Priority Natural Area			●
Blue Lake Park [^]	Joondalup	High Priority Natural Area		●	
Water Tower Park [^]	Joondalup	High Priority Natural Area		●	
Carnaby Reserve	Connolly	High Priority Natural Area		●	●
Kallaroo Park	Mullaloo	High Priority Natural Area			
MacNaughton Park	Kinross	High Priority Natural Area			
Nanika Park [^]	Joondalup	High Priority Natural Area		●	
Sandalford Park	Beldon	High Priority Natural Area		●	
Sir James McCusker Park	Iluka	High Priority Natural Area			
Huxley Park	Burns Beach	Medium Priority Natural Area			
Chichester Park	Woodvale	Medium Priority Natural Area			
Garrong Park	Edgewater	Medium Priority Natural Area			

Site	Suburb	Priority	Bush Forever Site	Local Planning Scheme No. 3, Environmental Conservation Zoning	Friends Group
Korella Park	Mullaloo	Medium Priority Natural Area			
Madana Park	Craigie	Medium Priority Natural Area			
Mandalay Park	Craigie	Medium Priority Natural Area			
Warrandyte Park	Craigie	Medium Priority Natural Area			
Alfreton Park	Dun Craig	Medium Priority Natural Area		•	
Dun Craig Library Bushland	Dun Craig	Medium Priority Natural Area			•
Harman Park	Sorrento	Medium Priority Natural Area			•
Lacepede Park	Sorrento	Medium Priority Natural Area			
Picnic Cove Park	Edgewater	Medium Priority Natural Area	•		•
Negresco Park^	Currambine	Medium Priority Natural Area			
Robin Park	Sorrento	Medium Priority Natural Area			•
Finney Park	Marmion	Medium Priority Natural Area			
Bethany Park	Iluka	Medium Priority Natural Area			
Caledonia Park	Currambine	Medium Priority Natural Area		•	
Huntingdale Park	Connolly	Medium Priority Natural Area			
Kuta Park	Iluka	Medium Priority Natural Area			
Manapouri Park^	Joondalup	Medium Priority Natural Area			
Greenshank Park	Joondalup	Medium Priority Natural Area			
Pine Valley Park	Connolly	Medium Priority Natural Area		•	
Adelaide Park	Craigie	Medium Priority Natural Area			
Callander Park	Kinross	Medium Priority Natural Area			
Castlecrag Park	Kallaroo	Medium Priority Natural Area			
Conidae Park	Heathridge	Medium Priority Natural Area			
Earlsferry Park	Kinross	Medium Priority Natural Area			
Lysander Park	Heathridge	Medium Priority Natural Area			
Menteith Park	Kinross	Medium Priority Natural Area			
Okely Park	Edgewater	Medium Priority Natural Area			

Site	Suburb	Priority	Bush Forever Site	Local Planning Scheme No. 3, Environmental Conservation Zoning	Friends Group
Brisbane Park	Padbury	Medium Priority Natural Area			
Candlewood Park [^]	Joondalup	Medium Priority Natural Area		●	
Gunida Park	Mullaloo	Medium Priority Natural Area			
Ledge Park	Sorrento	Medium Priority Natural Area			
Quarry Ramble Park	Edgewater	Medium Priority Natural Area		●	
Trig Point Park	Ocean Reef	Medium Priority Natural Area			

Note: Sites in Appendix 1 that are not listed in the above table are classified as low priority and no weed management activities are undertaken.

* = State Heritage Site

[^] = Aboriginal Heritage Site

Appendix 3 – Relevant Local, State and Federal Legislation, Policies, Plans and Strategies

Local Government

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

Strategic Community Plan

The *City of Joondalup Strategic Community Plan 2022 – 2032* highlights the focus on conservation, rehabilitation and accessibility of the City's natural assets and the importance of engaging with the community, key stakeholders and relevant agencies.

Environment Plan

The *City of Joondalup Environment Plan 2014 – 2019* provides strategic direction in the delivery of environmental initiatives within the City.

Biodiversity Action Plan

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

City of Joondalup Pest Plant Local Law 2012

Under the *Agriculture and Related Resources Protection Act 1976* and the *Local Government Act 1995*, the Council of the City of Joondalup made the *Pest Plant Local Law 2012* to require the owner or occupier of private land within the City district to destroy, eradicate or otherwise control pest plants within a specified time. Caltrop (*Tribulus terrestris*) is designated as a pest plant. Caltrop has been identified within the City.

Local Biodiversity Program (formerly Perth Biodiversity Project)

The City of Joondalup is one of 32 local governments participating in the Western Australian Local Government Association's (WALGA's) Local Biodiversity Program. The aim of the Local Biodiversity Program is to support local governments to effectively integrate biodiversity conservation into land use planning to protect and manage local natural areas.

As part of the Local Biodiversity Program, the City assessed all natural areas from 2004 onwards using the ecological criteria of the Natural Area Initial Assessment process, resulting in a priority ranking of natural areas. The City assess major conservation, high priority and medium priority natural areas approximately every 5-7 years using this assessment tool.

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

- vegetation complexes;
- threatened or significant flora or ecological communities;
- structural plant communities;
- weed species;
- vegetation condition assessment;
- ecological criteria rankings;

- a viability estimate; and
- fauna species observed.

Herbicide Use and Integrated Weed Management for Local Government Communications Strategy and Action Plan, 2021

WALGA established the *Local Government Herbicide and Integrated Weed Management Working Group*, to build the capacity of Local Government to develop and implement effective weed control programs that are most suitable for their local context.

The City has representatives on the Working Group.

State Government

Relevant Legislation, Policies and Documents

Biodiversity Conservation (BC) Act 2016

The BC Act provides for the conservation and protection of biodiversity, particularly threatened species and threatened ecological communities. Although the Act does not directly refer to invasive weed species; invasive weed species can that threaten or may threaten biodiversity.

Biosecurity and Agriculture Management Act 2007

The Act gives provision to prevent new animals and plant pests (vermin and weeds) and diseases from entering WA and manages the impact and spread of those pests already present in the State. The Act also gives provision to safely manage the use of agricultural chemicals. There are 67 species on the list of declared pest plants in WA.

The City contains 8 known declared pest plants.

Environmental Protection (EP) Act 1986

The EP Act provides for the protection of the environment and prevention of environmental harm, nuisances and contamination. The *Environmental Protection Act 1994* also sets out enforcement tools that can be used when offences or acts of non-compliance are identified.

Work Health and Safety Act 2020

The *Work Health and Safety Act 2020* requires organisations to keep a current register of hazardous chemicals used in the workplace, provide workers with information and training on the risks associated with their use (storage, handling and disposal) and to take precautions to eliminate or minimise the risk of injury.

Health (Pesticide) Regulations 2011

The WA Department of Health administers the *Health (Pesticides) Regulations 2011*, which provide for the safe use and application of pesticides, including herbicides, through appropriate registration and licensing of businesses and persons involved in weed control.

Minor Use of Chemicals Permit

The Department of Agriculture and Food Western Australia (WA) (now known as DPIRD) are the Permit Holder of a Permit to Allow Minor Use of an Agvet Chemical Product for the Control of Environmental Weeds in Various Situations (Permit number PER1333). This permit is in

force from 2 March 2012 to 31 March 2025.). This permit was issued by the Australian Government Australian Pesticides and Veterinary Medicines Authority and allows the use of stated products in a manner other than specified on the approved product label in WA.

Possession of an off-label permit allows use of certain chemicals for specific applications not written on the label. The permit is approved for use by all people controlling weeds in wetlands, forests, bushlands and non-crop areas, but is not for use in residential areas. The permit specifies the methods that must be followed for herbicide use, including the chemicals and dose rates that can be applied to environmental weeds.

Also useful for bushland management are off-label permits for declared plants (Permit number PER13236) valid from 2 December 2011 to 31 December 2022 and for the control of *Phytophthora* in native vegetation (Permit number PER13534) valid from 28 November 2012 to 31 October 2023. There are also further limitations on the herbicides that can be used in water catchment areas (Circular Number PSC 88).

State Weed Plan 2001

A Weed Plan for WA (2001), referred to as the 'State Weed Plan' was developed by the State Weed Plan Steering Group to help achieve coordinated, effective weed management throughout WA.

Federal Government

Biosecurity Act 2015

The *Biosecurity Act 2015* is co-administered by the Ministers responsible for Agriculture and Water Resources, and Health, and aims to provide Australia a strong biosecurity system to protect our way of life from the threat of exotic pests and diseases to our unique environment, the economy, our health and our agricultural industries.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act can, among other things, list key threatening processes, such as invasive weed species that threaten or may threaten the survival, abundance or evolutionary development of a native species or ecological community.

Australian Weeds Strategy 2017 - 2027

The Australian Weeds Strategy provides a national framework for addressing weed issues whilst maintaining the sustainability of Australia's primary industries and reducing the impact of weeds on the environment.

National Established Pests and Diseases of National Significance Management Framework

This framework establishes policy principles to guide government decision making to better manage pests and diseases of national significance; clarifies the role of government; and establishes criteria to determine which established pests and diseases should be deemed 'nationally significant.'

There are currently 32 Weeds of National Significance (WoNS) in Australia. The City contains 5 known Weeds of National Significance.

Appendix 4 – Examples of City of Joondalup Priority Weeds

Table 6 outlines the pest plant, declared pest plants and Weeds of National Significance within the City.

Table 6: Pest Plants, Declared Plants and Weeds of National Significance in the City of Joondalup

Latin Name	Common Name	Declared Pest Plant	Weeds of National Significance	Image
<i>*Argemone mexicana</i>	Mexican Poppy	Yes – C1		 <p>Photo: DPIRD</p>
<i>*Asparagus asparagoides</i>	Bridal Creeper	Yes – No Control Category	Yes	 <p><i>Asparagus asparagoides</i> Photos: J.P. Pigott & R. Randall</p> <p>Photos: J.P. Pigott and R. Randall (WA Herbarium n.d.)</p>
<i>*Chondrilla juncea</i>	Skeleton Weed	Yes – C3	-	 <p><i>Chondrilla juncea</i> Photos: B. Hoskins & J. Dodd</p> <p>Photos: B. Hoskins and J. Dodd (WA Herbarium n.d.)</p>
<i>*Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	Boneseed	Yes- C2	Yes	 <p><i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i> Photos: H. Cherry & R. Knox</p> <p>Photos: H. Cherry and R. Knox (WA Herbarium n.d.)</p>

Latin Name	Common Name	Declared Pest Plant	Weeds of National Significance	Image
<i>*Cirsium arvense</i>	Perennial Thistle, Canada Thistle	Yes- C1	-	 <p>Photo: C.G. Wilson (Aust Government 2012)</p>
<i>*Hydrocotyle verticillata</i>	Shield Pennywort	Yes – C1		 <p>Photo: DPIRD</p>
<i>*Lantana camara</i>	Lantana	Yes – C3	Yes	 <p>Photo: A. Johnson (NSW Government n.d.)</p>
<i>*Moraea flaccida</i>	One-leaf Cape Tulip	No control category		 <p>Photo: DPIRD</p>
<i>*Moraea miniata</i>	Two-leaf Cape Tulip	No control category		 <p>Photo: DPIRD</p>

Latin Name	Common Name	Declared Pest Plant	Weeds of National Significance	Image
* <i>Salvinia molesta</i>	Salvinia	Yes - C2	Yes	 <p><i>Salvinia molesta</i> Photo: AGWEST</p> <p>Photo: AGWEST (WA Herbarium n.d.)</p>
* <i>Silybum marianum</i>	Variegated Thistle	No control category	-	 <p><i>Silybum marianum</i> Photos: R. Knox & J. Dodd</p> <p>Photos: R. Knox and J. Dodd (WA Herbarium n.d.)</p>
* <i>Solanum linnaeanum</i>	Apple of Sodom	No control category		 <p>Photo: DPIRD</p>
* <i>Tamarix aphylla</i>	Athel Tree, Tamarisk, Tamarix	No control category	Yes	 <p><i>Tamarix aphylla</i> Photos: K.C. Richardson</p> <p>Photos: K.C. Richardson (WA Herbarium n.d.)</p>

Latin Name	Common Name	Declared Pest Plant	Weeds of National Significance	Image
* <i>Tribulus terrestris</i>	Caltrop*	-	-	 <p><i>Tribulus terrestris</i> Photos: S.M. Armstrong, J. Dodd & R. Knox Photos: S.M. Armstrong, J. Dodd and R. Knox (WA Herbarium n.d.)</p>
* <i>Xanthium strumarium</i>	Noogoora burr	Yes – C3		 <p>Photo: DPIRD</p>
* <i>Zantedeschia aethiopica</i>	Arum Lily	No control category		 <p><i>Zantedeschia aethiopica</i> Photos: K. Dean, R. Knox & AGWA Photos: K. Dean, R. Knox and AGWA (WA Herbarium n.d.)</p>

Notes:

* = Pest plant under *Local Government Act 1995*

The following summarises the effect of the declaration categories for plants under the *Biosecurity and Agriculture Management Act 2007*:

- C1: Exclusion – Pests are assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
- C2: Eradication - Pests are assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still feasible.
- C3: Management - Pests are assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Appendix 5 – Weeds Identified in City of Joondalup and Weed Status

Scientific Name	Common Name	Weeds of National Significance	WA Declared Pest Plant	Local Pest Plant
<i>Acacia baileyana</i>	Cootamundra Wattle			
<i>Acacia dealbata</i>				
<i>Acacia iteaphylla</i>	Flinders Range Wattle			
<i>Acacia longifolia</i>	Sydney Wattle			
<i>Acacia longifolia subsp. sophorae</i>				
<i>Acacia microbotrya</i>	Manna Wattle			
<i>Acacia podalyriifolia</i>	Queensland Silver Wattle			
<i>Acacia pycnantha</i>	Golden Wattle			
<i>Acacia trigonophylla</i>				
<i>Acacia xanthina</i>	White-stemmed Wattle			
<i>Acetosa vesicaria</i>	Ruby Dock			
<i>Agave americana</i>	Century Plant			
<i>Agonis flexuosa</i> [^]	Weeping Peppermint			
<i>Aira caryophyllea</i>	Silvery Hairgrass			
<i>Aira cupaniana</i>	Silvery Hairgrass			
<i>Aizoon pubescens</i>	Coastal Galenia			
<i>Alyssum linifolium</i>	Flax-leaf Alyssum			
<i>Ammophila arenaria</i>	Marram Grass			
<i>Aphanes arvensis</i>	Parsley Piert			
<i>Aptenia cordifolia</i>	Gartenflora			
<i>Arctotheca calendula</i>	Cape Weed			
<i>Arctotheca populifolia</i>	Dune Acrotheca			
<i>Arctotis stoechadifolia</i>	White Arctotis			
<i>Arenaria leptoclados</i>				
<i>Argemone mexicana</i>	Mexican Poppy		●	
<i>Argemone ochroleuca</i>	Mexican Poppy			
<i>Argyranthemum frutescens</i>	Marguerite			
<i>Asparagus asparagoides</i>	Bridal Creeper	●	●	
<i>Asphodelus fistulosus</i>	Onion Weed			
<i>Avena barbata</i>	Bearded Oat			
<i>Avena fatua</i>	Wild Oat			
<i>Babiana nana</i>	Baboon Flower			
<i>Banksia nivea</i>	Honeypot Dryandra			
<i>Banksia prionotes (Wheatbelt Form)</i>	Acorn Banksia			
<i>Bellardia trixago</i>	Bellardia			
<i>Brassica barrelieri</i>				
<i>Brassica tournefortii</i>	Mediterranean Turnip			
<i>Briza maxima</i>	Blowfly Grass			
<i>Briza minor</i>	Shivery Grass			

Scientific Name	Common Name	Weeds of National Significance	WA Declared Pest Plant	Local Pest Plant
<i>Bromus catharticus</i>	Prairie Grass			
<i>Bromus diandrus</i>	Brome Grass			
<i>Bromus hordeaceus</i>	Soft Brome			
<i>Bromus madritensis</i>	Madrid Brome			
<i>Bromus rubens</i>	Red Brome Grass			
<i>Cakile maritima</i>	Sea Rocket			
<i>Callistemon citrinus</i>				
<i>Callitris preissii</i> [^]	Rottnest Island Pine			
<i>Calothamnus rupestris</i>	Mouse Ears			
<i>Carduus pycnocephalus</i>	Slender Thistle			
<i>Carpobrotus aequilaterus</i>	Angular Pigface			
<i>Carpobrotus edulis</i>	Hottentot Fig (Pig Face)			
<i>Casuarina equisetifolia</i>	Sheoak			
<i>Catapodium rigidum</i>	Rigid Fescue			
<i>Cenchrus clandestinus</i>	Kikuyu			
<i>Cenchrus echinatus</i>	Mossman River Grass, Burrgrass			
<i>Cenchrus setaceus</i>	Fountain Grass			
<i>Centaurea melitensis</i>	Maltese Cockspur			
<i>Centaureum erythraea</i>	Common Centaury			
<i>Centaureum pulchellum</i>	Lesser Centaury			
<i>Centranthus macrosiphon</i>	Spanish Valerian			
<i>Centranthus ruber</i>	Red Valerian			
<i>Cerastium glomeratum</i>	Mouse Ear Chickweed			
<i>Ceratonia siliqua</i>	Carob Tree			
<i>Chamaecytisus palmensis</i>	Tagasaste			
<i>Chamelaucium uncinatum</i>	Geraldton Wax			
<i>Chasmanthe floribunda</i>	African Cornflag			
<i>Chenopodium macrospermum</i>				
<i>Chondrilla juncea</i>	Skeleton Weed		●	
<i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	Boneseed	●	●	
<i>Cicendia filiformis</i>	Slender Cicendia			
<i>Cirsium arvense</i>	Perennial Thistle, Canada Thistle		●	
<i>Cirsium vulgare</i>	Spear Thistle			
<i>Citrullus lanatus</i>	Pie Melon			
<i>Conospermum triplinervium</i>	Tree Smokebush			
<i>Coprosma repens</i>	Mirror Plant			
<i>Cortaderia selloana</i>	Pampas Grass			
<i>Cotula australis</i>	Common Cotula			
<i>Cotula turbinata</i>	Funnel Weed			

Scientific Name	Common Name	Weeds of National Significance	WA Declared Pest Plant	Local Pest Plant
<i>Crassula alata</i>				
<i>Crassula glomerata</i>				
<i>Crassula thunbergiana</i>				
<i>Cucumis myriocarpus</i>	Paddy Melon			
<i>Cuscuta epithymum</i>	Lesser Dodder			
<i>Cuscuta planiflora</i>	Small-seeded Alfalfa Dodder			
<i>Cynara cardunculus</i>	Artichoke Thistle, Cardoon			
<i>Cynodon dactylon</i>	Couch			
<i>Cyperus eragrostis</i>	Umbrella Grass			
<i>Cyperus rotundus</i>	Nut Grass			
<i>Cyperus tenellus</i>	Tiny Flagsedge			
<i>Digitaria ciliaris</i>	Summer Grass			
<i>Digitaria sanguinalis</i>	Crab Grass			
<i>Dimorphotheca ecklonis</i>	Veldt Daisy			
<i>Diplolaena dampieri</i>	Southern Diplolaena			
<i>Diplotaxis muralis</i>	Wall Rocket			
<i>Diplotaxis tenuifolia</i>	Sand Rocket			
<i>Disa bracteata</i>	South African Orchid			
<i>Dischisma arenarium</i>				
<i>Dischisma capitatum</i>	Woolly-headed Dischisma			
<i>Dittrichia graveolens</i>	Stinkwort			
<i>Dysphania ambrosioides</i>	Mexican Tea			
<i>Echium plantagineum</i>	Paterson's Curse			
<i>Ehrharta calycina</i>	Perennial Veldt Grass			
<i>Ehrharta longiflora</i>	Annual Veldt Grass			
<i>Eleusine indica</i>	Crowsfoot			
<i>Emex australis</i>	Doublegee			
<i>Emex spinosa</i>	Lesser Jack			
<i>Eragrostis curvula</i>	African Lovegrass			
<i>Erigeron bonariensis</i>	Flaxleaf Fleabane			
<i>Erigeron canadensis</i>				
<i>Erigeron sumatrensis</i>	Tall Fleabane			
<i>Erodium botrys</i>	Long Storksbill			
<i>Erodium cicutarium</i>	Common Storksbill			
<i>Erodium cygnorum</i>	Blue Heronsbill			
<i>Erodium moschatum</i>	Musky Crowfoot			
<i>Eucalyptus caesia</i>	Caesia			
<i>Eucalyptus platypus</i>	Moort			
<i>Eucalyptus utilis</i>	Coastal Moort			
<i>Euphorbia cyathophora</i>	Painted Spurge			
<i>Euphorbia paralias</i>	Sea Spurge			

Scientific Name	Common Name	Weeds of National Significance	WA Declared Pest Plant	Local Pest Plant
<i>Euphorbia peplus</i>	Petty Spurge			
<i>Euphorbia terracina</i>	Geraldton Carnation Weed			
<i>Ferraria crispera</i>	Black Flag			
<i>Ficus carica</i>	Fig			
<i>Foeniculum vulgare</i>	Fennel			
<i>Freesia alba x leichtlinii</i>				
<i>Freesia sp.</i>	Freesia			
<i>Fumaria bastardii</i>				
<i>Fumaria capreolata</i>	Whiteflower Fumitory			
<i>Fumaria muralis</i>	Wall Fumitory			
<i>Galenia pubescens var. pubescens</i>	Coastal Galenia			
<i>Galium murale</i>	Small Goosegrass			
<i>Gamochaeta calviceps</i>	Cudweed			
<i>Gamochaeta coarctata</i>				
<i>Gazania linearis</i>	Gazania			
<i>Genista monspessulana</i>	Cape Broom			
<i>Geranium molle</i>	Dove's Foot Cranesbill			
<i>Gladiolus angustus</i>	Long Tubed Painted Lady			
<i>Gladiolus caryophyllaceus</i>	Wild Pink Gladiolus			
<i>Gladiolus undulatus</i>	Wavy Gladiolus			
<i>Gomphocarpus fruticosus</i>	Narrowleaf Cottonbush			
<i>Grevillea leucopteris</i>	White Plume Grevillea			
<i>Grevillea robusta</i>	Silky Oak			
<i>Hedypnois rhagadiolooides subsp. Cretica</i>				
<i>Heliophila pusilla</i>				
<i>Hesperantha falcata</i>				
<i>Hordeum leporinum</i>	Barley Grass			
<i>Hydrocotyle verticillata</i>	Shield Pennywort		●	
<i>Hyparrhenia hirta</i>	Tambookie Grass			
<i>Hypochaeris glabra</i>	Smooth Catsear			
<i>Hypochaeris radicata</i>	Flat Weed			
<i>Ipomoea cairica</i>	Coast Morning Glory			
<i>Ipomoea indica</i>	Morning Glory			
<i>Isolepis marginata</i>	Course Club-rush			
<i>Ixia maculata</i>	Yellow Ixia			
<i>Lachenalia bulbifera</i>				
<i>Lachenalia reflexa</i>	Yellow Soldier, Cape Cowslip			
<i>Lactuca saligna</i>	Wild Lettuce			
<i>Lactuca serriola</i>	Prickly Lettuce			
<i>Lagurus ovatus</i>	Hare's Tail Grass			

Scientific Name	Common Name	Weeds of National Significance	WA Declared Pest Plant	Local Pest Plant
<i>Lantana camara</i>	Lantana	●	●	
<i>Lathyrus tingitanus</i>	Tangier Pea			
<i>Lavandula stoechas</i>	Italian Lavender			
<i>Leptospermum laevigatum</i>	Victorian (Coastal) Tea Tree			
<i>Leontodon rhagadioloides</i>	Cretan Weed			
<i>Lobularia maritima</i>	Sweet Alyssum			
<i>Lolium perenne</i>	Perennial Rye Grass			
<i>Lolium rigidum</i>	Wimmera Ryegrass			
<i>Lupinus albus</i>	White Lupin			
<i>Lupinus angustifolius</i>	Narrowleaf Lupin			
<i>Lupinus cosentinii</i>	Blue Lupin			
<i>Lysimachia arvensis</i>	Pimpernel			
<i>Lysimachia arvensis</i> var. <i>caerulea</i>				
<i>Malva arborea</i>	Tree Mallow			
<i>Malva parviflora</i>	Marshmallow			
<i>Matthiola incana</i>	Common Stocks			
<i>Medicago littoralis</i>	Strand Medic			
<i>Medicago polymorpha</i>	Burr Medic			
<i>Melaleuca lanceolata</i>	Rottnest Teatree			
<i>Melaleuca nesophila</i>	Mindiyed			
<i>Melia azedarach</i>	White Cedar			
<i>Melilotus indicus</i>	Yellow Sweet Clover			
<i>Melinis repens</i>	Ruby Grass			
<i>Mesembryanthemum crystallinum</i>	Ice Plant			
<i>Monoculus monstrosus</i>				
<i>Montanoa</i> sp.				
<i>Moraea flaccida</i>	One-leaf Cape Tulip		●	
<i>Moraea miniata</i>	Two-leaf Cape Tulip		●	
<i>Morus alba</i>	White Mulberry			
<i>Nothoscordum gracile</i>	False Garlic			
<i>Oenothera drummondii</i>	Beach Evening Primrose			
<i>Oenothera glazioviana</i>	Evening Primrose			
<i>Oenothera stricta</i>	Common Evening Primrose			
<i>Olea europaea</i>	Olive			
<i>Onopordum acaulon</i>	Stemless Thistle			
<i>Ornithogalum arabicum</i>	Lesser Cape Lily			
<i>Ornithopus pinnatus</i>	Slender Serradella			
<i>Orobanche minor</i>	Lesser Broomrape			
<i>Osteospermum ecklonis</i>	Cape Daisy			
<i>Oxalis</i>	Oxalis			

Scientific Name	Common Name	Weeds of National Significance	WA Declared Pest Plant	Local Pest Plant
<i>Oxalis incarnata</i>	Oxalis incarnata			
<i>Oxalis pes-caprae</i>	Soursob			
<i>Oxalis purpurea</i>	Largeflower Wood Sorrel			
<i>Papaver rhoeas</i>	Field Poppy			
<i>Parentucellia latifolia</i>	Common Barista			
<i>Paspalum dilatatum</i>	Dallis Grass			
<i>Passiflora foetida</i>	Stinking Passion Flower			
<i>Pelargonium capitatum</i>	Rose Pelargonium			
<i>Pentameris airoides</i>	False Hairgrass			
<i>Pentameris airoides</i> <i>subsp. Airoides</i>				
<i>Pentameris pallida</i>	Pentameris pallida			
<i>Petrorhagia dubia</i>	Hairy Pink			
<i>Petrorhagia velutina</i>	Velvet Pink			
<i>Phoenix dactylifera</i>	Date Palm			
<i>Phyllopodium cordatum</i>				
<i>Phytolacca octandra</i>	Red Ink Weed			
<i>Plantago lanceolata</i>	Rainbow Plantain			
<i>Poa annua</i>	Winter Grass			
<i>Polycarpon tetraphyllum</i>	Fourleaf Allseed			
<i>Polygala myrtifolia</i>	Butterfly Bush			
<i>Polypogon monspeliensis</i>	Annual Beardgrass			
<i>Poinsettia</i>	Poinsettia			
<i>Raphanus raphanistrum</i>	Wild Radish			
<i>Retama raetam</i>	White Broom			
<i>Ricinus communis</i>	Castor Oil Plant			
<i>Romulea flava</i>				
<i>Romulea rosea</i>	Guildford Grass			
<i>Romulea rosea</i> var. <i>australis</i>	Guildford Grass			
<i>Rostraria cristata</i>	Annual Cat's-tail Grass			
<i>Rumex acetosella</i>	Sorrel			
<i>Sagina apetala</i>	Annual Pearlwort			
<i>Salvinia molesta</i>	Salvinia	●	●	
<i>Scaevola paludosa</i>				
<i>Schinus terebinthifolious</i>	Brazilian Pepper			
<i>Senecio elegans</i>	Purple Groundsel			
<i>Senecio mikanioides</i>	Cape Ivy			
<i>Senecio vulgaris</i>	Common Groundsel			
<i>Silene gallica</i>	French Catchfly			
<i>Silene gallica</i> var. <i>gallica</i>				
<i>Silybum marianum</i>	Variegated Thistle		●	
<i>Solanum linnaeanum</i>	Apple of Sodom		●	

Scientific Name	Common Name	Weeds of National Significance	WA Declared Pest Plant	Local Pest Plant
<i>Solanum nigrum</i>	Black Berry Nightshade			
<i>Soliva sessilis</i>	Bindii			
<i>Sonchus asper</i>	Rough Sowthistle			
<i>Sonchus oleraceus</i>	Common Sowthistle			
<i>Sparaxis bulbifera</i>				
<i>Sporobolus africanus</i>	Parramatta Grass			
<i>Stellaria media</i>	Chickweed			
<i>Stenotaphrum secundatum</i>	Buffalo Grass			
<i>Tagetes minuta</i>	Stinking Roger			
<i>Tamarix aphylla</i>	Athel Tree, Tamarisk, Tamarix	•	•	
<i>Taraxacum officinale</i>	Dandelion			
<i>Tetragonia decumbens</i>	Sea Spinach			
<i>Thinopyrum distichum</i>				
<i>Thinopyrum junceiforme</i>	Sea Wheatgrass			
<i>Trachyantra divaricata</i>	False Onion Weed			
<i>Tribulus terrestris</i>	Caltrop			•
<i>Tribolium uniolae</i>	Tribolium			
<i>Trifolium arvense</i>	Hare's Foot Clover			
<i>Trifolium arvense</i> var. <i>arvense</i>				
<i>Trifolium campestre</i>	Hop Clover			
<i>Trifolium dubium</i>	Suckling Clover			
<i>Trifolium hirtum</i>	Rose Clover			
<i>Trifolium repens</i>	White Clover			
<i>Trifolium subterraneum</i>	Subterranean Clover			
<i>Trifolium tomentosum</i>	Woolly Clover			
<i>Triticum aestivum</i>	Wheat			
<i>Tropaeolum majus</i>	Nasturtium			
<i>Typha orientalis</i> *	Non-local Bulrush			
<i>Urospermum picroides</i>	False Hawkbit			
<i>Ursinia anthemoides</i>	Ursinia			
<i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>				
<i>Vellereophyton dealbatum</i>	White Cudweed			
<i>Verbascum virgatum</i>	Twiggy Mullien			
<i>Verbena rigida</i> var. <i>rigida</i>				
<i>Verbesina encelioides</i>	Golden Crownbeard			
<i>Vicia sativa</i>	Common Vetch			
<i>Vulpia bromoides</i>	Squirrel Tail Fescue			
<i>Vulpia fasciculata</i>				
<i>Vulpia muralis</i>				
<i>Vulpia myuros</i>	Rat's Tail Fescue			

Scientific Name	Common Name	Weeds of National Significance	WA Declared Pest Plant	Local Pest Plant
<i>Wahlenbergia capensis</i>	Cape Bluebell			
<i>Washingtonia filifera</i>	Desert Fan Palm			
<i>Watsonia meriana</i> var. <i>bulbillifera</i>	Watsonia			
<i>Watsonia meriana</i> var. <i>meriana</i>	Watsonia			
<i>Xanthium strumarium</i>	Noogoora burr		●	
<i>Zantedeschia aethiopica</i>	Arum Lily		●	

^ Indicates species that are naturalised and may be native to certain areas of the City of Joondalup.

* Indicates a species that has recently been reclassified as native but can be highly invasive.

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Appendix 6 – Weed Control Methods

Weed Control Methods Used by the City of Joondalup

Weed Control Method	Suitable Species for	Notes	Advantages	Disadvantages
Hand removal or digging	Many annual species and for relatively small infestations	Need to remove the entire plant	<ul style="list-style-type: none"> • Young plants can be easy to pull out if soil is moist • Allows for selective removal of weeds 	<ul style="list-style-type: none"> • Can be difficult to remove plants if soil is dry or plants are large • Time consuming and labour intensive • Digging can cause soil disturbance and disturb the root systems of native vegetation
Spot spray	Small populations of weeds	Application of diluted herbicide with hand-held spray guns	<ul style="list-style-type: none"> • Targeted weed application • Quick and cheap method to control low populations of weeds spread over large areas 	<ul style="list-style-type: none"> • Time consuming in large areas
Cut and paint	Woody weeds (low numbers)	The plant is cut off close to ground level with a horizontal cut and undiluted herbicide (according to Permit or label) is applied immediately to the cut surface ⁸⁴	Targeted weed application	<ul style="list-style-type: none"> • Time consuming for large populations • Weed has to be felled prior to treatment • Can cause root suckers
Basal bark treatment	Woody weeds and root suckers (low numbers)	Diluted herbicide (rates according to Permit or label) is painted or sprayed on to the bark at the base, from ground level to 30cm high. ⁸⁴	<ul style="list-style-type: none"> • Targeted weed application • No risk of regrowth 	<ul style="list-style-type: none"> • Time consuming for large populations

⁸⁴ Eurobodalla Shire Council (n.d.)

Weed Control Method	Suitable Species for	Notes	Advantages	Disadvantages
Wick wiping	Tall weeds	Herbicides can be wiped on to individual plants with a weed wiper, rope wick applicator or sponge roller.	Targeted weed application	<ul style="list-style-type: none"> • Only controls weeds which grow above surrounding vegetation. • Time consuming • Rope wicks can be ineffective due to dripping and clogging with dirt • Multiple treatments may be required
Mowing	Annual species	Mowing down aboveground biomass. To be done before seed set.	<ul style="list-style-type: none"> • Delays production of seed • Will eventually deplete the soil seed store 	<ul style="list-style-type: none"> • Not a permanent method of control • Can result in spreading of seed, if plants have already seeded⁸⁵ • Should be combined with another weed control method
Mulching using loose particles of organic matter	All	Most effective if weeds are cleared before applying. Certified weed and pathogen free mulch should be used. Planting species in mulch suppresses weed growth. ⁸⁶	<ul style="list-style-type: none"> • Provides organic matter as it breaks down • Helps retain water 	<ul style="list-style-type: none"> • Some weeds may still grow • Difficult to apply around non-target species
Slashing or brushcutting	Annual species	Slashing or brushcutting aboveground biomass. To be done before seed set.	<ul style="list-style-type: none"> • Delays production of seed • Will eventually deplete the soil seed store 	<ul style="list-style-type: none"> • Not a permanent method of control • Can result in spreading of seed, if plants have already seeded⁸⁷ • Should be combined with another weed control method
Steam	Young weeds	Jets of steam are applied to weeds through standard spray nozzles enclosed under a steel housing	<ul style="list-style-type: none"> • More effective than flame weeders 	<ul style="list-style-type: none"> • Requires significant energy and water • Difficult to get the steam to condense on the plant to make use of the latent heat • May not reduce subsequent weed seedling emergence⁹²

⁸⁵ Eurobodalla Shire Council (n.d.)

⁸⁶ Johansson (n.d.)

⁸⁷ Eurobodalla Shire Council (n.d.)

Weed Control Method	Suitable Species	for	Notes	Advantages	Disadvantages
Boiling water	Annuals perennials	and	Boil water and pour stream on to the crown of the weed.	<ul style="list-style-type: none"> • Works well in concrete, paved and rock areas⁸⁸ 	<ul style="list-style-type: none"> • Safety hazards • May effect non-targeted species • Time consuming • Water usage • May need to be repeated

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⁸⁸ Johansson (n.d.)

Weed Control Methods Not Used by the City of Joondalup

Weed Control Method	Suitable Species for	Notes	Advantages	Disadvantages
Smothering using materials such as black plastic, fibre, carpet, cardboard, newspaper, wood chips or jute matting.	All	Most effective if weeds are cleared before applying. Suppresses or kills weeds by creating a barrier between the weeds and sunlight.	<ul style="list-style-type: none"> Prevent germination of weed seeds. 	<ul style="list-style-type: none"> Expensive Materials can be difficult to apply around established plants Possible issues with water and nutrient penetration Clean up of degraded materials can be time consuming
Scrape and paint	Large vines and scrambling plants with a woody stem	Scrape 20cm to 100cm of the stem with a knife, for a third of the diameter of the stem (or scrape on two sides if stem is over 1cm in diameter), to expose the sapwood just below the bark. Apply undiluted herbicide (rates according to Permit or label) immediately to the scraped section. ⁸⁴	<ul style="list-style-type: none"> Effective method of weed control 	<ul style="list-style-type: none"> Time consuming for large populations
Stem injection	Woody weeds (low numbers)	Purpose-built stem injection devices can be used, or a hammer and chisel or cordless drill. An angled cut or hole is made into the sapwood just below and bark and undiluted herbicide (rates according to Permit or label) is applied into the cut immediately. Avoid drilling further than the sapwood into the heartwood as it doesn't take up the herbicide. ⁸⁴	<ul style="list-style-type: none"> Targeted weed application 	<ul style="list-style-type: none"> Time consuming for large populations

Weed Control Method	Suitable Species for	Notes	Advantages	Disadvantages
Granules	Various	Granules or pellets (root absorbed herbicide) are applied to the surface of moist soil or into the top soil	<ul style="list-style-type: none"> • No spray drift • Controlled release can reduce the need for repeat applications 	<ul style="list-style-type: none"> • Rain or moisture is required • Herbicides are expensive • Even spread can be difficult • Limited choice of herbicides • Potential for herbicide to be washed off site • May effect non-targeted species
Drowning of emergent species by cutting the species beneath the water level in winter ⁸⁹	Emergent species (e.g. Bulrush and Kikuyu)	Suited to wetlands. Need to cut species below water level.	<ul style="list-style-type: none"> • Effective on a significant number of emergent species targeted 	<ul style="list-style-type: none"> • Time consuming • Water levels may change
Solarisation, or heating, of weeds to high temperatures under plastic	Low-growing and semi-aquatic weeds	Weeds are smothered with plastic sheeting until seeds or plants have been cooked. ⁹⁰ Works best when weeds are growing in full sun. ⁹¹	<ul style="list-style-type: none"> • Best used for small infestations 	<ul style="list-style-type: none"> • May not kill seed stored in the soil • Plastic may need to be weighted down and left in place for months • Time consuming • Vegetation needs to be cleared from the area
Flame weeding	Young weeds and grasses, some annual and perennial weeds	Direct propane flame at weeds. A thin blast of heat (1000°C) causes the water within the cell stalk to boil.	<ul style="list-style-type: none"> • Leaves no chemical residue • No soil disturbance • More effective than infrared radiation 	<ul style="list-style-type: none"> • Safety and fire hazards • May require a series of flamings (2-3 weeks apart) • Gas usage

⁸⁹ Water and Rivers Commission (2001)

⁹⁰ Department of Planning (n.d.)

⁹¹ Eurobodalla Shire Council (n.d.)

Weed Control Method	Suitable Species for	Notes	Advantages	Disadvantages
Infrared radiation	Shallow rooted weeds	Uses gas burners and has no visible flame on the combustion surface.	<ul style="list-style-type: none"> Cover a more closely defined area than flame weeders 	<ul style="list-style-type: none"> Need time to heat up Gas usage Unsure of effectiveness against deep rooted weeds⁹²
Acidic	Annuals, biennials and some perennials	Contain approx 15-20% acidic ingredients such as lemon, lime or vinegar, sprayed directly on the leaves, causing them to die. ⁹³	<ul style="list-style-type: none"> Leaves no soil residue 	<ul style="list-style-type: none"> May effect non-targeted species Foliage must be sprayed so it is completely wet Health risks
Fatty acids	Annual weeds, grasses and broadleaf weeds	Coconut fatty acid is often an ingredient. Dissolves membranes of plants leaves, causing the leaves to die.	<ul style="list-style-type: none"> Will not move through soil to harm nearby plants Fast acting Leave no residue in the soil⁹⁴ 	<ul style="list-style-type: none"> May effect non-targeted species Repeat applications may be required on larger weeds
Germination inhibitors	Newly grown weeds	The most common is corn gluten meal. Prevents new plants from germinating but does not harm established plants.	<ul style="list-style-type: none"> Non-toxic Suppresses germination of seeds 	<ul style="list-style-type: none"> No effect on established weeds Can inhibit germination of non-target species⁹⁴

⁹² Bond, Turner and Grundy (2003)

⁹³ Demand Media Inc. (2013)

⁹⁴ Johansson (n.d.)

Appendix 7 – Wetlands in the City of Joondalup

Wetland	Suburb
Beaumaris Park	Ocean Reef
Blackboy Park	Mullaloo
Blue Lake Park	Joondalup
Broadbeach Park	Hillarys
Central Park	Joondalup
Conica Park	Hillarys
Craigie Open Space	Craigie
Flinders Park (North and South)	Hillarys
Lacepede Park	Sorrento
Mawson Park	Hillarys
McCubbin Park	Woodvale
Oahu Park	Hillarys
Sir James McCusker Park (North and South)	Iluka
Whitfords Nodes Park South	Hillarys
Wolinski Park	Mullaloo

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