



Executive Summary

Natural Area Consulting Management Services (Natural Area) was contracted by the City of Greater Geraldton, from here on after will be referred to as the City, to prepare a Pest and Weed Management Framework. The City is located approximately 370 km north of the Perth Metropolitan Area and covers an area of just over 9,900 km². In addition to the City, there are numerous other stakeholders involved in the management of pests and weeds within this area, including State Government Departments, not-for-profit organisations, community groups and private landholders.

This framework outlines the Federal, State and local legislative context and management requirements for pest and weed species. It outlines the responsibilities of the City and all other vested stakeholders in order to facilitate an effective, consistent and transparent approach to managing pests and weeds, with a cohesive understanding of the roles and responsibilities amongst stakeholders.

This framework identifies the invasive species known to occur within the City, their respective management strategies, as well as a prioritisation system for resource allocation. A total of eight pest animal species are addressed within this framework:

- European Honey Bee (*Apis mellifera*)
- Feral Cat (*Felis catus*)
- Wild Dog (*Canis familiaris familiaris*)
- Pig (*Sus scrofa*)
- Goat (*Capra aegagrus hircus*)
- House Mouse (*Mus musculus*)
- Rabbit (*Oryctolagus cuniculus*)
- Red Fox (*Vulpes vulpes*).

Prioritisation categories for the management of a total of 79 weed species are provided, with proposed management actions being outlined for 18 of these species.

This framework also provides information on the management activities currently being undertaken by the City, within both City managed land and lands not vested with the City, and directions for the future management of pest and weed species.

We respectfully acknowledge the Yamatji people, who are the Traditional Owners and original natural resource managers of the lands and waters in the City of Greater Geraldton. The Nhanhagardi, Wilunyu, Naaguja. We pay our respect to the Elders past, present and future for they hold the memories, the traditions, the culture and hopes of the Yamatji people.

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1 Introduction

Natural Area was engaged by the City of Geraldton, from here on after will be referred to as the City, to undertake the preparation of a Pest and Weed Management Framework for both land managed and not managed by the City. This follows the creation of a draft Invasive Species Plan by the City in 2013, which identified priorities and actions for the management of pests and weeds, including information regarding the distribution of each species and control recommendations.

This framework will instead focus on the legislative context for the management of pest and weed species and outline the responsibilities of the City and all other vested stakeholders. To develop this framework, Natural Area's experienced Environmental Scientists have undertaken:

- a review of past literature and information relevant to the area, including reports, plans and drafts
- a review of relevant State and Commonwealth legislation
- a review of State and Commonwealth databases
 - NRInfo
 - National Map
 - NatureMap
 - Protected Matters Search Tool
 - WALGA Environmental Planning Tool
 - Aboriginal Heritage Inquiry System
 - West Australian Heritage Register
 - Western Australian Organism List.

Information obtained from these reviews has been used to outline:

- a management framework at local government, state and federal levels
- invasive species identified as likely to occur within the City
- the role of the City on both lands managed and not managed by the City
- management recommendations and priorities.

1.1 Location

The City is located approximately 370 km north of the Perth Metropolitan Area and covers an area of 12,625 km², from the coastline to over 100 km inland (Ecoscape, 2020). Over half of the total area of the City (7,798 km²) is classified as rural land, with the remaining area being suburban development. The majority of this rural area (5,846 km²) is privately owned land, for both residential and agricultural purposes, however it also contains approximately 1,300 km² of reserve managed by various governing bodies and just over 600 km² of unallocated crown land (CGG, 2013).

The City is located within the northern portion of the Geraldton Sandplains IBRA region; the Geraldton Hills subregion (GES02) (DoEE, 2022). The climate experienced in the area is Mediterranean, with dry, hot summers and cool, wet winters. According to the Bureau of Meteorology (2022); Geraldton Airport WA, site number 008315, the region has an average:

- rainfall of 340.8 mm pa, with rain falling predominantly between May and August

- maximum temperatures ranging from 21.9 °C in winter to 33.0 °C in summer, with a maximum recorded temperature of 47.3 °C
- minimum temperatures ranging from 9.0 °C in winter to 17.0 °C in summer, with a minimum recorded temperature of 1.1 °C

This region is characterised by undulating lateritic sandplains, as well as alluvial plains and coastal limestone. Vegetation types are predominantly scrub-heaths containing species of the family Proteaceae, and York Gum (*Eucalyptus loxophleba*) and Jam (*Acacia acuminata*) woodlands (Desmond & Chant, 2001).

1.2 Objectives

The preparation of a single Pest and Weed Management Framework for the City will enable the development of an effective, consistent and transparent approach to managing pests and weeds, with a cohesive understanding of the roles and responsibilities amongst stakeholders. The objectives of the Pest and Weed Management Framework are to:

- ensure a wholistic approach to pest and weed management, in line with National, State and Regional initiatives
- acknowledge and encourage those stakeholders actively involved in pest and weed management within the City
- develop an invasive weed species prioritisation list
- outline the responsibilities and expectations of each landholder involved.

1.3 What is an Invasive Species?

1.3.1 Pests

At its most broad, pest animal species are those which have been introduced to an area, either intentionally or unintentionally. However, the perception of what is considered a 'pest' species is likely to vary dependent on location, land use and the community. The Australian Pest Animal Strategy 2017 – 2027 defines pests more specifically as those introduced animal species for which the detrimental impacts outweigh the benefits (Invasive Plants and Animals Committee, 2016a). These species can have negative impacts on the environment, agriculture and heritage values through predation (including herbivory), competition, habitat degradation and the spread of diseases. Nationally, there are approximately 73 vertebrate pest species, including 25 mammal species (Invasive Plants and Animals Committee, 2016a).

1.3.2 Weeds

As defined by the Australian Weeds Strategy 2017 – 2027, a weed is a “plant that requires some form of action to reduce its negative effects on the economy, the environment as well as human health and amenity” (Invasive Plants and Animals Committee, 2016b). This encompasses not only foreign species, being those originating outside of Australia, but also those Australian native species found to occur outside of their native range. Within Western Australia (WA), there are just under 1200

identified weed species. The invasion of these species into native habitats is considered to be a significant threat (State Weed Plan Steering Group, 2001).

Not all weed species have equal impacts, with some affecting natural and anthropological values disproportionately. Weeds can pose a significant risk to the conservation values of land, and to agricultural production for primary producers. Important factors in assessing weed species for management include invasiveness, current distribution, potential distribution, and environmental and economic impacts (Invasive Plants and Animals Committee, 2016). These factors have been used to assess weed species significance at national and state levels.

1.4 Stakeholders

In addition to the City, a number of stakeholders are involved in the management of pests and weeds within City. These include government departments, not-for-profit organisations, community groups and private landholders. All stakeholders in this framework are:

- City of Greater Geraldton
- Department of Biodiversity Conservation and Attractions (DBCA)
- Department of Primary Industries and Regional Development (DPIRD)
- Northern Agricultural Catchment Council (NACC)
- Northern Biosecurity Group
- Yamatji Southern Regional Corporation
- Chapman River Friends
- private landholders
- the community.

Weed control is a shared responsibility between landholders, community groups and government organisations.

1.5 Guiding Principles

In addition to the objectives outlines above, the Pest and Weed Framework is guided by the following broad principles to ensure effective management (Invasive Plants and Animals Committee, 2016a; 2016b):

1. Prevention, early detection and early intervention are the most cost-effective means of management.
2. Effective management requires shared responsibility and co-ordinated management between all stakeholders, as well as long-term commitment and provision of resources.
3. State, national and local legal frameworks can and should be used to meet weed management objectives.
4. Allocation of resources is best decided using a simple and effective priority-setting and planning process, taking into consideration risk assessment, feasibility and likelihood of success.
5. Monitoring the outcomes of management is essential to assess efficacy, whether targets are being met and future directions.

2 Framework for Management

2.1 Federal

2.1.1 *Environmental Protection and Biodiversity Conservation Act 1999*

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of the environment and the conservation of biodiversity, and for related purposes at a national level. This includes the listing of significant flora and fauna species, ecological communities, heritage sites and key threatening processes. The key threatening processes of relevance to the City are as follows:

- Competition and land degradation by the feral European rabbit (*Oryctolagus cuniculus*)
- Competition and land degradation by unmanaged goats (*Capra aegagrus hircus*)
- Predation by feral cats (*Felis catus*)
- Predation by the European Red Fox (*Vulpes vulpes*)
- Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)
- Novel biota and their impact on biodiversity.

2.1.2 *Australian Pest Animal Strategy 2017 – 2027*

The Australian Pest Animal Strategy 2017 – 2027 (Invasive Plants and Animals Committee, 2016a) provides a strategic framework for managing vertebrate pests at a national level, updating the previous strategy in 2007. This outlines three national goals for vertebrate pest management:

1. Prevent the establishment of new pest animal species.
2. Minimise the impact of established pest animals.
3. Improve leadership and coordination for the management of pest animals.

To achieve these goals, the strategy provides a number of priorities as well as guidelines for best practice management.

2.1.3 *Australian Weeds Strategy 2017 – 2027*

The Australian Weeds Strategy 2017 – 2027 (Invasive Plants and Animals Committee, 2016b) provides a strategic framework for managing weeds at a national level. As part of the implementation of the National Weeds Strategy, weeds determined to be significant at the Commonwealth level are identified as Weeds of National Significance (WoNS) by the Australian Government. These species each have individual national strategic management plans, which facilitate coordinated control of the species across the multiple jurisdictions within the country. Currently, 32 weeds of national significance (WoNS) are identified as nationally agreed priority plant species for control and management. This has been defined based on the criteria of: invasiveness and impact characteristics; potential and current area of spread and economic; and environmental and social impacts.

A total of nine WoNS have been previously reported as occurring within the City (DAWE, 2022), these being:

- Bridal Creeper (*Asparagus asparagoides*)
- Ward's Weed (*Carrichtera annua*)
- Boneseed (*Chrysanthemoides monilifera*)
- *Chrysanthemoides monilifera* subsp. *monilifera*
- Common Lantana (*Lantana camara*)
- Prickly Pears (*Opuntia* spp.)
- Salvinia (*Salvinia x molesta*)
- White Horse Nettle (*Solanum elaeagnifolium*)
- Athel Tree (*Tamarix aphylla*).

2.1.4 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for the management of pests and diseases which are detrimental to human, animal or plant health, agriculture, or the environment. It allows for the establishment of biosecurity zones requiring monitoring and/or control, as well as investigation and enforcement of compliance with the Act.

2.2 State

2.2.1 Biosecurity and Agriculture Management Act 2007 (WA)

The Act provides for the control of declared flora and fauna species (declared organisms) that are known to be a significant environmental threat and makes provision for the management, control and prevention of these declared plants and animals. Declared Pest species are listed on the Western Australian Organism List under the *Biosecurity and Agriculture Management Act 2007 (WA)* and are assigned discrete management categories for control (Table 1), with management to be undertaken by landowners/managers (DPIRD, 2022a). Non-compliance with the management requirements of declared pests can be reinforced with fines of up to \$50,000 for the landholder, or reimbursement of costs for remedial action undertaken by the Director General (*Biosecurity and Agriculture Management Act 2007*).

The declared animal pests previously reported within the City of significance to this framework are:

- Feral Cat (*Felis catus*)
- Wild Dog (*Canis familiaris familiaris*)
- Pig (*Sus scrofa*)
- Goat (*Capra aegagrus hircus*)
- Rabbit (*Oryctolagus cuniculus*)
- Red Fox (*Vulpes vulpes*) (DAWE, 2022).

Table 1: Management categories for declared pests

Category	Action
C1	Exclusion: includes species that are not yet established in Western Australia and control measures are to be taken to prevent them entering and establishing.
C2	Eradication: present in low enough numbers or in sufficiently limited areas that eradication is feasible.
C3	Management: established in Western Australia and it is feasible or desirable to manage them in order to limit damage. Control includes the prevention of population size or density increasing or moving into an area where it currently doesn't occur.

(Source: DPIRD, 2022a)

2.2.2 *Environmental Protection Act 1986 (WA)*

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

2.2.3 *Western Australian Biosecurity Strategy 2016 – 2025*

The Western Australian Biosecurity Strategy 2016 – 2025 (Western Australian Agriculture Authority, 2016) provides guidelines for the management of biosecurity issues significant to both industry and the environment at the State level. This includes pests, both plant and animal, and diseases. The State Biosecurity Strategy aims to minimise the impacts of both current and future biosecurity risks through integrated and collaborative management.

2.2.4 *A Weed Plan for Western Australia 2001*

A Weed Plan for Western Australia (State Weed Plan Steering Group, 2001) provides guidelines for coordinated, collaborative and effective weed control at the State level in order to minimise the impact of weed species on natural landscapes. The State Weed Plan outlines recommendations for management actions based on the following nine components:

1. Coordination, integration and public awareness
2. Roles and responsibilities
3. Priorities and planning
4. Introduction and spread
5. Integrated weed management
6. Policy support and regulation
7. Resources
8. Education, training and research
9. Monitoring and evaluation

2.2.5 Invasive Species Plan for Western Australia 2015 – 2019

The Invasive Species Plan for Western Australia 2015 – 2019 (DAFWA, 2015) outlines the management of current and potential future invasive species, both flora and vertebrate fauna. This plan addresses management implementation for primarily State departments, incorporating the involvement of local government, industry, community and private stakeholders. Five goals for management are outlined, being:

1. Effective and transparent priority-setting.
2. Effective and coordinated prevention and eradication.
3. Collaborative control of those invasive species already established and/or widespread.
4. Management underpinned by regulatory and compliance mechanisms.
5. Management informed by up-to-date information which is transparent between stakeholders.

Each of these goals is followed by a number of strategies, each with recommended management actions for relevant stakeholders.

2.2.6 *Cat Act 2011* (WA)

The *Cat Act 2011* makes provision for the control and management of cats and promotes and encourages the responsible ownership of cats. In accordance with the Act, cats may be seized where they are found wandering in public areas.

2.2.7 DBCA Midwest Region Impact and Invasiveness Rating 2014

The Department of Biodiversity, Conservation and Attractions, prepared the Weed Prioritisation Process to assist with the on-ground management of weeds in a particular location, considering their environmental impact, invasiveness, current and potential distribution and feasibility of control.

The Weed Prioritisation Process is a tool that has been applied to nine regions within Western Australia, based on ecological impact and invasiveness ratings. Ecological impact classifications are: High (causes acute disruption to ecological processes, vegetation structure, composition and ecosystem function), Medium, Low (causes minimal disruption to ecological processes or biodiversity) or Unknown. Invasiveness classifications are: Rapid, Moderate, Slow and Unknown, and account for factors including establishment, reproduction and long distance (>100 m) dispersal (DPaW, 2013).

Within the Midwest Region, a total of 324 weed species have been assessed and listed in terms of their ecological impact and invasiveness, including 84 high impact species, and 190 rapidly invasive species (DBCA, 2014).

2.3 Local Government

2.3.1 Strategic Community Plan 2021 – 2031

The City of Greater Geraldton Strategic Community Plan 2021 – 2031 outlines future goals and strategies for the development of the City, as well as guidance for policy and actions (CGG, 2021a). This encompasses the community, environment, economy and governance of the City. Environmental goals include:

- A City that is planned, managed and maintained to provide for environmental and community well-being.
- A regional leader in adapting to climate change.
- A well-maintained, SMART, sustainable, liveable city valued by the community.
- A desirable and sustainable built and natural environment responsive to community aspirations.
- An integrated emergency and land management approach.
- The natural environment is valued, protected and celebrated.

2.3.2 City of Greater Geraldton Local Biodiversity Strategy 2013

The City of Greater Geraldton Local Biodiversity Strategy outlines the future direction for actions relating to biodiversity conservation and management, with a focus on practicality and efficacy (CGG, 2013a). This document outlines five goals, and respective recommendations, for the management of biodiversity. These goals are:

1. The retention of at least 3334 ha of natural areas remaining.
2. The protection of natural areas and biodiversity features, with a target of at least 5% of the original extent of natural areas and an increase in protected conservation areas of 1058 ha.
3. The active management of all natural areas of conservation value.
4. Increasing community contribution and reduce negative impacts of community on biodiversity.
5. Ensure the rate of regeneration is greater than that of degradation.

2.3.3 Pest Plant Local Law 2011

The *Agriculture and Related Resources Protection Act 1976* and the *Local Government Act 1995* give local government the ability to make local laws which mandate management of weed species classed as Pest Plants within their Local Government Area (LGA). This can be an important measure to raise community awareness of significant weeds within the LGA and encourage management by private landholders.

The City of Greater Geraldton Pest Plant Local Law 2011 specifies four pest plant species which are required to be controlled by private landholders, however, are not state declared pests. These species are:

- African Boxthorn (*Lycium ferocissimum*)
- Caltrop (*Tribulus terrestris*)
- Fountain Grass (*Cenchrus setaceus*, prev. *Pennisetum setaceum*)
- Crownbeard (*Verbesina encelioides*).

Non-compliance with the Local Law may result in control action being taken by the local government, with expense recovery from the landholder in court.

2.3.4 Natural Areas Management Strategy

The City of Greater Geraldton Natural Areas Management Strategy provides direction and prioritisation for natural areas within the City (Ecoscape, 2020). It outlines a methodology for the prioritisation of sites for management, considerations for survey activities and management levels for sites. The management levels range from 'Rural', requiring minimal monitoring and management, to 'Premier' requiring an action plan, regular monitoring and maintenance. The Strategy specifies a total of 51 key natural areas, of which four are of 'Premier' sites and require 3-year Reserve Action Plans;

- Chapman Estuary
- Chapman River Regional Park
- CRWC – CRRP – Deepdale
- Greenough River.

Within the Strategy, introduced plant and vertebrate pests are identified as threats within the City's natural areas. The presence of these pests and weeds is recommended to be recorded during any natural area assessment and managed promptly.

2.3.5 Pesticide Use Notification Plan

The City of Greater Geraldton Pesticide Use Notification Plan outlines the management of the City's public places using pesticide application (CGG, 2017). The Plan aims to keep the community well-informed of pesticide application to ensure safety and engagement. It outlines the safety analysis process, as well as justification, methodology and locations for pesticide application as a means to control weed species.

3 Invasive Species in the City of Greater Geraldton

3.1 Pest animals

Pest animal species identified for management under this framework include Declared Pests listed under the *Biosecurity and Agriculture Management Act 2007*, as well as pest species of significance to the City (see Table 2). Of these species, none are classified into control categories requiring exclusion (C1) or eradication (C2). A total of five are classified as requiring management (C3), mandating management actions from the landholder to control identified populations. This framework does not encompass the management of other species, such as invasive bird and fish species.

Whilst European Honey Bees are not a declared pest, they have been identified by the City as a pest species requiring management due to their increasing impacts on the environment and community. European Honey Bees pose a risk to native fauna through competition for floral resources and tree hollows, transmission of diseases to native bee species and the pollination and spread of weed species (Paton, 1996; Goulson, 2003). Competition for tree hollows in particular has a large impact on threatened black cockatoo species, such as Carnaby's Black Cockatoo, as hollows are a limited resource and are required for nesting (DPaW, 2003). European Honey Bees can also exhibit swarming and aggressive behaviour, detrimentally impacting the community and recreational use of parks and natural areas.

3.1.1 Prioritisation

A prioritisation list of all pest species requiring management has been provided in Table 2 below. It is recommended that all species assigned a management category under the *Biosecurity and Agriculture Management Act 2007* be treated as the highest priority (Pest Management Priority 1), as these require management at the state level under the Department of Primary Industries and Regional Development (DPIRD, 2022b).

All other State listed species should be treated as 'Pest Management Priority 2' for management. Those species not State listed but of significance to the City should be treated as 'Pest Management Priority 3'.

It should be noted that this system of prioritisation should be reviewed regularly and updated to reflect any changes in the status of species, including new listings, upgrading and delisting, as well as changes in impact levels and community priorities.

Table 2: All Management Priority Pest Species

Scientific Name	Common Name	DPIRD Priority	Status	Management Priority
<i>Canis familiaris familiaris</i>	Wild Dog	C3	DP	1
<i>Capra aegagrus hircus</i>	Goat	C3	DP	1
<i>Oryctolagus cuniculus</i>	Rabbit	C3	DP	1
<i>Sus scrofa</i>	Pig	C3	DP	1
<i>Vulpes vulpes</i>	Red Fox	C3	DP	1
<i>Felis catus</i>	Feral Cat		DP	2
<i>Apis mellifera</i>	European Honey Bee			3

Note: C3 = requiring management, DP = Declared Pest.

3.1.2 Management Strategies

Pest species management is composed of four main stages: prevention, eradication, containment, and asset protection (Figure 1). These stages are dictated by the level of invasion and form the basis of effective and best practice pest management and are shown below in Figure 1. It is important to note here however, that the eradication of a pest species is a challenging task to achieve, and feasible only within the initial stages of invasion or within closed systems (such as islands or fenced areas). More commonly, effective management is best to focus on the prevention of incursions of new pest species and/or into new locations, and ongoing asset protection in infested areas. Pest management should be undertaken as part of a well evaluated and coordinated program with clear objectives and a monitoring strategy, to avoid cost- and time-ineffective actions (Braysher et al., 2012).

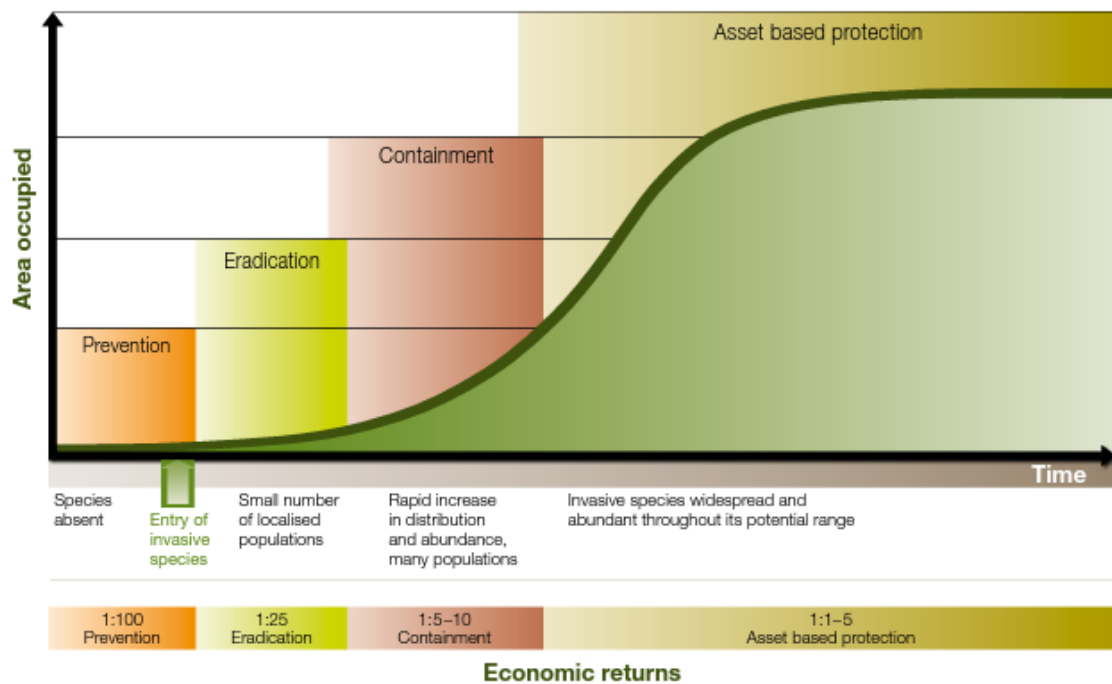


Figure 1: Pest animal species invasion curve and the four stages of management (source: Victorian Government, 2010)

A range of strategies exist for the management of vertebrate pest species, and should be implemented depending on the species, level of infestation, location, and potential risks. Broad categories for management are:

- euthanasia/removal (trapping, baiting, fumigation, mustering and shooting)
- exclusion (fencing)
- biological control (viral release and fertility control)
- habitat manipulation (removal of refuges)
- changes in land use.

Feral vertebrate management (excluding fumigation and fencing) should be undertaken as per the Standard Operating Procedures (SOP's) provided by PestSmart (<https://pestsmart.org.au/>). The following should be taken into consideration:

- Fumigation for rabbits or foxes must be undertaken in alignment with the Department of Health guidelines (Department of Health, 2019), and with approval granted by the Chief Health Officer.
- The fumigation of fox dens must be undertaken using only the fumigate product DEN-CO-FUME and must be undertaken as per product label recommendations.
- The fumigation of rabbit warrens must be undertaken using only aluminum phosphide tablets and must be undertaken as per product label recommendations.
- Fertility control for the management of pigs, rabbits and foxes has not been included in the management strategies below as no suitable agents are currently available for use in Australia.

The installation of fencing can be undertaken to exclude feral pests from certain areas and allow for further control methods, such as baiting, to occur. Exclusion fencing must be installed to a specification consistent with the target pest species. Requirements and recommendations can be found in Long and Robley (2004).

Management for European Honey Bees should be undertaken after careful assessment, to minimise impacts on both native bees and managed bees in the area. Methods for the control of European Honey Bees include the destruction and relocation of hives.

3.2 Weeds

The Draft Invasive Species Plan 2013 for the City identified a total of 144 introduced and/or naturalised weed species from 40 families (CGG, 2013b). Of these, a total of 13 are classified as declared pests (DP), eight are classified as WoNS and four are listed in the City's Pest Plant Local Law (PPLL). Of the declared pest species:

- Two species are classified as requiring eradication (C1), requiring the landholder to report the presence of the pest and undertake control measures to eradicate the plant(s) and prevent further incursions. These are highlighted red in Table 3 below.
- Two species are classified as requiring control (C2), requiring the landholder to report the presence of the pest and undertake control measures to destroy the plant(s) and prevent further incursions.
- Two species are classified as requiring management (C3), requiring the landholder to undertake control measures to reduce the population and its impacts.

Those species identified in the Draft Invasive Species Plan 2013 which are no longer considered to be weeds, namely Bulrush (*Typha orientalis*), have not been included in the prioritisation and management recommendations process. Additionally, three species identified in Section 2.1.3 as WoNS previously reported by DAWE (2022) within the City were not identified in the Draft Invasive Species Plan 2013 and have also not been included. These species are; Bridal Creeper (*Asparagus asparagoides*), Ward's Weed (*Carrichtera annua*) and Boneseed (*Chrysanthemoides monilifera*).

Comparison against the DBCA Midwest Region Impact and Invasiveness Rating (2014) has identified a total of 40 high impact species, and 82 species classified as rapidly invasive. Of these, a total of 32 species are classified as both high impact and rapidly invasive.

3.2.1 Prioritisation

Management prioritisation categories have been assigned to all species dependent on local, State and Federal classifications as well as impact and invasiveness. It is recommended that all species assigned a management category under the *Biosecurity and Agriculture Management Act 2007* be treated as the highest priority (Weed Management Priority 1), as these require management at the state level under the Department of Primary Industries and Regional Development (DPIRD, 2022b). All other Commonwealth and State listed species should be treated as Weed Management Priority 2. These species are shown in Table 3.

Species of Weed Management Priority 3 to 5 encompass those listed as high impact under the DBCA Weed Prioritisation Process for the Midwest Region, with their invasiveness categorised as rapid (Priority 3), medium (Priority 4) and slow (Priority 5).

Species of Weed Management Priority 6 and 7 are those listed as medium impact, with rapid and medium invasiveness ratings respectively.

Species of Weed Management Priority 8 to 10 are those listed as low impact, with rapid, medium and slow invasiveness ratings respectively.

A prioritisation list of all weed species for management has been provided in Appendix 1. It should be noted that this system of prioritisation should be reviewed regularly and updated to reflect any changes in the status of species, including new listings, upgrading and delisting, as well as changes in impact levels and community priorities.

Table 3: Management Priority 1 and 2 Weed Species

Family	Scientific Name	Common Name	DPIRD Priority	Status	DBCA Impact and Invasiveness	Management Priority
Chenopodiaceae	<i>Bassia scoparia</i>		C1	DP		1
Convolvulaceae	<i>Cuscuta campestris</i>	Golden dodder	C3	DP		1
Verbenaceae	<i>Lantana camara</i>	Common Lantana	C1	WoNS DP		1
Cactaceae	<i>Opuntia stricta</i>	Common Prickly Pear	C3	WoNS DP		1
Fabaceae	<i>Parkinsonia aculeata</i>	Parkinsonia	C3	WoNS DP		1
Fabaceae	<i>Prosopis pallida</i>	Mesquite	C2	WoNS DP	HR	1
Salviniaceae	<i>Salvinia molesta</i>	Salvinia	C2	WoNS DP		1
Poaceae	<i>Cenchrus setaceus</i>	Fountain Grass		PPLL	HR	2
Boraginaceae	<i>Echium plantagineum</i>	Paterson's Curse		DP	HR	2
Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn		WoNS PPLL	HR	2
Asteraceae	<i>Onopordum acaulon</i>	Stemless Onopordon		DP		2
Salicaceae	<i>Salix sp.</i>			WoNS		2
Asteraceae	<i>Silybum marianum</i>	Variegated Thistle		DP		2

Solanaceae	<i>Solanum linnaeanum</i>	Apple of Sodom	DP	UR	2
Tamaricaceae	<i>Tamarix aphylla</i>	Athel Tree	WoNS DP		2
Zygophyllaceae	<i>Tribulus terrestris</i>	Caltrop	PPLL	LR	2
Asteraceae	<i>Verbesina encelioides</i>	Crownbeard	PPLL	HR	2
Araceae	<i>Zantedeschia aethiopica</i>	Arum Lily	DP		2

Note: DP = Declared Pest, WoNS = weed of national significance, PPLL= Pest Plant Local Law, H = high impact, L = low impact, U = unknown impact, R = rapidly invasive.

3.2.2 Management Strategies

Natural Area recommends prioritising the treatment and removal of declared pests and WoNS and 'high' impact species initially with species of other impact ratings treated opportunistically. Weed management considerations should include:

- target weed type (s)
- treatment priority
- area of infestation and population density
- control method(s)
- presence of native flora and fauna species
- management of community members near active weed control works.

Characteristics of a particular species determine the most appropriate management. Optimal weed treatment methods and timings can be found on the FloraBase website (DBCA, 2022). Herbicide application should always occur as per the manufacturer's usage and safety specifications as detailed on labels and Safety Data Sheets (SDS), which can be provided by the manufacturer or accessed online. Herbicide application works can target several species during the same management event.

4 Role of Local Government

The responsibilities of local government in the management of pests and weeds within their local government area (LGA) as outlined by the Australian Pest Animal Strategy 2017 – 2027 (Invasive Plants and Animals Committee, 2016a), Australian Weeds Strategy 2017 – 2027 (Invasive Plants and Animals Committee, 2016b) and State Weed Plan (State Weed Plan Steering Group, 2001) can be summarised to the following:

- managing pests and weeds present within their land, in co-operation with landowners
- implementing statutory duties which encourage responsible management
- assisting with data collection and information transparency
- increasing public awareness
- providing support and coordination for community groups and other local initiatives.

4.1 City of Greater Geraldton Managed Land

4.1.1 Natural Areas

An assessment of the City's Natural Areas was undertaken in 2020 as part of the development of the Natural Areas Management Strategy. This assessment determined the presence of 51 Natural Areas covering a total of 2,650 ha (Ecoscape, 2020).

These Natural Areas encompass habitat types including wetlands and coastal foreshore areas and are known to contain 17 species/communities of conservation significance (Ecoscape, 2020). Two Threatened Ecological Communities (TEC's) are known to occur within the City, with these being 'Eucalypt Woodlands of the Western Australian Wheatbelt', listed as Critically Endangered, and 'Subtropical and Temperate Coastal Saltmarsh', listed as Vulnerable (DAWE, 2022). Key threats to both communities include the invasion of introduced pests and weeds, through processes such as resource competition, herbivory, altered vegetation structure and altered ecosystem function. As such, research into and the implementation of swift, cost-effective and integrated pest and weed management is of high priority for the conservation of these TEC's (Department of the Environment, 2015; Department of Sustainability, Environment, Water, Population and Communities, 2013).

The management of these Natural Areas is undertaken by the City's Environmental Officers, with the primary goal being to protect the environmental, recreational, and cultural values of these areas. All management is undertaken as per the prioritisation framework outlined in the Natural Areas Management Strategy, with high importance placed on the four areas classified as 'Premier' sites: Chapman Estuary, Chapman River Regional Park, CRWC – CRRP – Deepdale and Greenough River (Ecoscape, 2020). Works undertaken within Natural Areas currently focus primarily on the control of rabbits, European Honeybees and priority weed species, and include:

- vertebrate pest control
 - feral cat trapping
 - release of Rabbit Haemorrhagic Disease Virus (RHDV1 K5)
 - rabbit baiting with pindone
 - rabbit warren destruction

- relocation or destruction of European Honeybee hives
- weed control (manual, mechanical and chemical)
 - perimeter maintenance
 - post-burn maintenance
 - revegetation for weed exclusion
- fencing.

Management should continue to focus on the Premier Natural Areas, as this will allow for the most cost-effective protection of environmental resources. It should also, however, account for areas for which invasions are currently in the 'prevention' and 'eradication' stages (see Section 3.1.2) and areas bordering Premier Natural Areas or unimpacted areas, to avoid incursions and the establishment of new populations. Where necessary, management strategies should incorporate the control of other and/or multiple Management Priority one pest and weed species. Regular monitoring of control areas will be required to evaluate the efficacy of and ongoing need for management actions. As likely the most regular users of Natural Areas, the local community can be utilised for monitoring purposes through 'citizen science' initiatives. The public should be encouraged to report observations, both direct and indirect, of pest and weed presence through resources such as MyPestGuide™ (DPIRD, 2022) or the development of a more local initiative. Whilst data obtained in this fashion is often subject to misidentification and human error, it can provide valuable data on pest and weed presence to be verified by qualified monitoring.

4.1.2 Public Open Space & Road Reserves

In addition to the Natural Areas mentioned above, the City also manages numerous Public Open Space areas, Parks and road verges. Public Open Spaces are areas, both green spaces and built, of recreational and cultural land-use for the community. These can include areas of parkland, nature space, sporting areas and recreational facilities. Pest and weed management are undertaken in the following areas:

- 4460 km of sealed and unsealed roads encompassing road reserves within urban and rural locations
- 75 ha of Active Reserves
- 318 ha of Passive Reserves
- 365 ha of Foreshore Reserves (including both built and natural).

These areas may be managed by a residential or commercial land developer for a period of time following development in accordance with a Development Application or by another party with agreement with the City. Parks Reserves and Public Open Spaces may include beaches and foreshore reserves which have a unique and high recreational value to the local community. Public Open Spaces are managed as per the City's Public Open Space Strategy (CGG, 2015). Within Urban Areas, verges are managed as per the "You and Your Street Verge" document (CGG, 2021).

4.2 Land not Managed by the City of Greater Geraldton

The responsibility of the City extends from managing its own lands, to enabling and encouraging the management of lands owned by other public and private landholders. Communication with and assistance of other stakeholders by the City will increase management effort, but also ensure an alignment of priorities and methods amongst land managers to increase efficiency.

The first step in this process is to increase awareness of the importance of managing pest and weed species. This can occur through educational programs outlining the species of significance, their impacts and control methods, and the responsibility of landholders in their management. The Case Study below highlights an effective example of community educational programs.

Where educational and advocacy programs are not feasible or have not been effective, the City also has a responsibility to enforce its statutory duties, such as under the *Biosecurity and Agriculture Management Act 2007* and Pest Plant Local Law (2011), to encourage the management of pest and weed species.

To establish coordinated pest and weed species management, ensuring effective use of resources and coverage of target areas, the City must play a role in data collection, collation and transparency. To do so, ongoing liaison with government stakeholders, not-for-profit organisations, community groups and private landholders is required to keep up-to-date and accessible records of species presence and any management actions undertaken. This will allow for a broad scale understanding of species distribution, areas currently being managed and by who, and areas still requiring management. The collation of this data may also aid in encouraging management by public and private landholders, who previously may have been unaware of surrounding works.

Case Study - African Boxthorn (*Lycium ferocissimum*) Management

African Boxthorn is a weed of national significance (WoNS) and a species listed in the Pest Plant Local Law (2011). The City, in conjunction with the Northern Agricultural Catchment Council (NACC), hosts free community events called Boxthorn Blitz workshops designed to educate the public on African Boxthorn and best practice management techniques. Members of the public are provided with a kit (the Boxthorn Blitz Bag) to facilitate treatment of plants within private and community land. Initiatives such as this act to increase community engagement and accountability and should be applied where possible.



Boxthorn Blitz event (Nicky Martin)

5 Glossary

Term	Definition
Conservation significant (flora or communities)	Those species or communities listed as protected at the State level, under the <i>Biodiversity Conservation Act 2016</i> , or Commonwealth level, under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> .
CRRP	Chapman River Regional Park
CRWC	Chapman River Wildlife Corridor
DAWE	Department of Agriculture, Water and the Environment (superseded)
DBCA	Department of Biodiversity, Conservation and Attractions
DoEE	Department of the Environment and Energy (superseded)
DP	declared pest
DPaW	Department of Parks and Wildlife (superseded)
DPIRD	Department of Primary Industries and Regional Development
EPA	Environmental Protection Authority
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
European rabbit; rabbits	European rabbits living within the wild
Feral cat	Domestic cats living within the wild
Feral dog	Domestic dogs living within the wild
Feral goat	Domestic goats living within the wild
Feral pig; pigs	Domestic pigs living within the wild
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
NACC	Northern Agricultural Catchment Group
Pindone	A poison used for the management of European rabbits. It is an anticoagulant which inhibits blood clots and causes fatal haemorrhages.
PPLL	City of Greater Geraldton Pest Plant Local Law
Red fox; foxes	Red foxes living within the wild
RHDV1 K5	Rabbit Haemorrhagic Disease Virus K5 Strain
SDS	Safety Data Sheets
SOP	Standard Operating Procedure
TEC	Threatened Ecological Community
City	City of Greater Geraldton
WALGA	Western Australian Local Government Association
WoNS	weeds of national significance

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Appendix 1 Weed Species List and Prioritisation

Family	Scientific Name	Common Name	DPIRD Priority	Status	DBCA Impact and Invasiveness	Management Priority
Chenopodiaceae	<i>Bassia scoparia</i>		C1	DP		1
Convolvulaceae	<i>Cuscuta campestris</i>	Golden dodder	C3	DP		1
Verbenaceae	<i>Lantana camara</i>	Common Lantana	C1	WoNS, DP		1
Cactaceae	<i>Opuntia stricta</i>	Common Prickly Pear	C3	WoNS, DP		1
Fabaceae	<i>Parkinsonia aculeata</i>	Parkinsonia	C3	WoNS, DP		1
Fabaceae	<i>Prosopis pallida</i>	Mesquite	C2	WoNS, DP	HR	1
Salviniaceae	<i>Salvinia molesta</i>	Salvinia	C2	WoNS, DP		1
Poaceae	<i>Cenchrus setaceus</i>	Fountain Grass		PPLL	HR	2
Boraginaceae	<i>Echium plantagineum</i>	Paterson's Curse		DP	HR	2
Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn		WoNS, PPLL	HR	2
Asteraceae	<i>Onopordum acaulon</i>	Stemless Onopordon		DP		2
Salicaceae	<i>Salix sp.</i>			WoNS		2
Asteraceae	<i>Silybum marianum</i>	Variegated Thistle		DP		2
Solanaceae	<i>Solanum linnaeanum</i>	Apple of Sodom		DP	UR	2
Tamaricaceae	<i>Tamarix aphylla</i>	Athel Tree		WoNS, DP		2
Zygophyllaceae	<i>Tribulus terrestris</i>	Caltrop		PPLL	LR	2
Asteraceae	<i>Verbesina encelioides</i>	Crownbeard		PPLL	HR	2

Araceae	<i>Zantedeschia aethiopica</i>	Arum Lily	DP	2
Asteraceae	<i>Arctotheca calendula</i>	Cape Weed	HR	3
Poaceae	<i>Arundo donax</i>	Giant Reed	HR	3
Poaceae	<i>Avena barbata</i>	Bearded Oat	HR	3
Poaceae	<i>Avena fatua</i>	Wild Oat	HR	3
Orobanchaceae	<i>Bellardia trixago</i>	Bellardia	HR	3
Brassicaceae	<i>Brassica tournefortii</i>	Mediterranean Turnip	HR	3
Poaceae	<i>Bromus diandrus</i>	Great Brome	HR	3
Poaceae	<i>Cenchrus ciliaris</i>	Buffel Grass	HR	3
Poaceae	<i>Cenchrus setiger</i>	Birdwood Grass	HR	3
Poaceae	<i>Cynodon dactylon</i>	Couch	HR	3
Poaceae	<i>Ehrharta calycina</i>	Perennial Veldt Grass	HR	3
Poaceae	<i>Eragrostis curvula</i>	African Lovegrass	HR	3
Euphorbiaceae	<i>Euphorbia peplus</i>	Petty Spurge	HR	3
Euphorbiaceae	<i>Euphorbia terracina</i>	Geraldton Carnation Weed	HR	3
Papaveraceae	<i>Fumaria capreolata</i>	Whiteflower Fumitory	HR	3
Asteraceae	<i>Gazania linearis</i>	Gazania	HR	3
Poaceae	<i>Hyparrhenia hirta</i>	Tambookie Grass	HR	3
Juncaceae	<i>Juncus acutus</i> subsp. <i>acutus</i>	Spiny Rush	HR	3
Asteraceae	<i>Leontodon rhagadioloides</i>	Cretan Weed	HR	3

Plumbaginaceae	<i>Limonium lobatum</i>	Winged Sea Lavender	HR	3
Aizoaceae	<i>Mesembryanthemum nodiflorum</i>	Slender Iceplant	HR	3
Brassicaceae	<i>Raphanus raphanistrum</i>	Wild Radish	HR	3
Anacardiaceae	<i>Schinus molle var. areira</i>	Pepper Tree	HR	3
Anacardiaceae	<i>Schinus terebinthifolia</i>	Brazilian/Japanese Pepper	HR	3
Aizoaceae	<i>Tetragonia decumbens</i>	Sea Spinach	HR	3
Asteraceae	<i>Urospermum picroides</i>	False Hawkbit	HR	3
Asteraceae	<i>Ursinia anthemoides</i>	Ursinia	HR	3
Euphorbiaceae	<i>Ricinus communis</i>	Castor Oil Plant	HM	4
Fabaceae	<i>Trifolium campestre</i>	Hop Clover	HM	4
Fabaceae	<i>Trifolium glomeratum</i>	Cluster Clover	HM	4
Fabaceae	<i>Vachellia farnesiana</i>	Mimosa Bush	HM	4
Asparagaceae	<i>Agave americana</i>	Century Plant	HS	5
Poaceae	<i>Cenchrus clandestinus</i>	Kikuyu Grass	HS	5
Oxalidaceae	<i>Oxalis pes-caprae</i>	Soursob	HS	5
Arecaceae	<i>Phoenix dactylifera</i>	Date Palm	HS	5
Brassicaceae	<i>Brassica barrelieri</i>	Smooth Stemmed Turnip	MR	6
Brassicaceae	<i>Brassica rapa</i>	Wild Turnip	MR	6
Orobanchaceae	<i>Parentucellia latifolia</i>	Common Bartsia	MR	6
Fabaceae	<i>Acacia saligna</i>	Orange Wattle	MM	7

Fabaceae	<i>Lupinus cosentinii</i>	Narrow Leaf Lupin	MM	7
Poaceae	<i>Polypogon monspeliensis</i>	Annual Beardgrass	MM	7
Gentianaceae	<i>Centaurium erythraea</i>	Common Centaury	LR	8
Cucurbitaceae	<i>Citrullus amarus</i>		LR	8
Cucurbitaceae	<i>Citrullus colocynthis</i>		LR	8
Geraniaceae	<i>Erodium botrys</i>	Long Storksbill	LR	8
Geraniaceae	<i>Erodium cicutarium</i>	Common Storksbill	LR	8
Boraginaceae	<i>Heliotropium europaeum</i>	Common Heliotrope	LR	8
Asteraceae	<i>Hypochaeris glabra</i>	Smooth Cats-ear	LR	8
Primulaceae	<i>Lysimachia arvensis</i>	Pimpernel	LR	8
Solanaceae	<i>Nicotiana glauca</i>	Tree Tobacco	LR	8
Caryophyllaceae	<i>Petrorhagia dubia</i>	Velvet Pink	LR	8
Polygonaceae	<i>Rumex hypogaeus</i>	Doublegee	LR	8
Caryophyllaceae	<i>Spergula arvensis</i>	Corn Spurry	LR	8
Caryophyllaceae	<i>Spergula pentandra</i>	Five Anther Spurry	LR	8
Lamiaceae	<i>Stachys arvensis</i>	Staggerweed	LR	8
Asteraceae	<i>Helianthus sp.</i>	Sunflower	LM	9
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Fourleaf Allseed	LM	9
Tropaeolaceae	<i>Tropaeolum majus</i>	Garden Nasturtium	LM	9
Poaceae	<i>Avena sativa</i>	Common Oat	LS	10
Plumbaginaceae	<i>Limonium sinuatum</i>	Perennial Sea Lavender	LS	10

Papaveraceae	<i>Argemone ochroleuca</i>	Mexican Poppy	UR
Poaceae	<i>Bambusa species</i>	Bamboo	
Asteraceae	<i>Berkheya rigida</i>	African Thistle	
Poaceae	<i>Briza maxima</i>	Blowfly Grass	UR
Poaceae	<i>Briza minor</i>	Shivery Grass	UR
Poaceae	<i>Bromus hordeaceus</i>	Soft Brome	US
Poaceae	<i>Bromus rubens</i>	Red Brome	UR
Brassicaceae	<i>Cakile maritima</i>	Sea Rocket	UR
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle	UR
Asteraceae	<i>Carthamus tinctorius</i>	Safflower	
Poaceae	<i>Cenchrus echinatus</i>	Burrgrass, Walkaway Burr	
Poaceae	<i>Cenchrus longispinus</i>	Spiny Burrgrass	
Poaceae	<i>Centaurea calcitrapa</i>	Star Thistle	
Caryophyllaceae	<i>Cerastium glomeratum</i>	Mouse Ear Chickweed	UM
Fabaceae	<i>Chamaecytisus palmensis</i>	Tagasaste	
Poaceae	<i>Chloris gayana</i>	Rhodes Grass	UR
Poaceae	<i>Chloris truncata</i>	Windmill Grass	
Poaceae	<i>Chloris virgata</i>	Feathertop Rhodes Grass	UR
Poaceae	<i>Chrysopogon zizanioides</i>	Vetiver Grass	
Cucurbitaceae	<i>Cucumis myriocarpus</i>	Prickly Paddy Melon	UR

Poaceae	<i>Dactyloctenium radulans</i>	Button Grass	
Solanaceae	<i>Datura inoxia</i>	Downy Thornapple/Lily-weed	
Solanaceae	<i>Datura stramonium</i>	Common Thornapple	
Solanaceae	<i>Datura wrightii</i>	Hairy Thornapple	
Poaceae	<i>Ehrharta longiflora</i>	Annual Veldt Grass	UR
Asteraceae	<i>Erigeron bonariensis</i>		UR
Asteraceae	<i>Erigeron sumatrensis</i>		UR
Iridaceae	<i>Ferraria crispa</i>	Black Flag	
Iridaceae	<i>Freesia alba x leichtlinii</i>	Freesia	
Rubiaceae	<i>Galium murale</i>	Small Goosegrass	UR
Asteraceae	<i>Glebionis coronaria</i>	Summer Chrysanthemum	
Poaceae	<i>Hordeum leporinum</i>	Barley Grass	UR
Poaceae	<i>Hordeum marinum</i>	Barley Sea Grass	UR
Juncaceae	<i>Juncus acutus</i>	Spiny Rush	
Poaceae	<i>Lagurus ovatus</i>	Hare's Tail Grass	UR
Poaceae	<i>Lamarckia aurea</i>	Goldentop	UR
Iridaceae	<i>Lapeirousia anceps</i>		
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass	UR
Poaceae	<i>Lolium rigidum</i>	Wimmera Ryegrass	UR
Fabaceae	<i>Medicago polymorpha</i>	Burr Medic	UR

Meliaceae	<i>Melia azedarach</i>	White Cedar	
Poaceae	<i>Melinis repens</i>	Red Natal Grass	
Asteraceae	<i>Monoculus monstrosus</i>	Stinking Roger	UR
Campanulaceae	<i>Monopsis debilis</i>	Monopsis	UR
Oleaceae	<i>Olea europaea</i>	Olive	
Poaceae	<i>Pentameris airoides</i>	False Hairgrass	UR
Plantaginaceae	<i>Plantago coronopus</i>	Buckshorn Plantain	UR
Asteraceae	<i>Reichardia tingitana</i>	False Sowthistle	UR
Fabaceae	<i>Retama raetam</i>	Bridal Broom	
Polygonaceae	<i>Rumex acetosella</i>	Sorrel	
Solanaceae	<i>Solanum hoplopetalum</i>	Thorny Solanum	UR
Solanaceae	<i>Solanum lasiophyllum</i>	Flannel Bush	
Solanaceae	<i>Solanum nigrum</i>	Black Berry Nightshade	UR
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle	UR
Poaceae	<i>Stenotaphrum secundatum</i>	Buffalo Grass	
Tamaricaceae	<i>Tamarix ramosissima</i>	Tamarix	
Asteraceae	<i>Taraxacum khatoonae</i>	Dandelion	
Fabaceae	<i>Trifolium angustifolium</i>	Narrowleaf Clover	UM
Fabaceae	<i>Trifolium arvense</i>	Hare's Foot Clover	UM
Fabaceae	<i>Trifolium hirtum</i>	Rose Clover	UM
Poaceae	<i>Triticum aestivum</i>	Wheat	

Poaceae	<i>Vulpia fasciculata</i>	Dune/Sand Fescue	UR
Poaceae	<i>Vulpia myuros</i>	Rat's Tail Fescue	UR
Campanulaceae	<i>Wahlenbergia capensis</i>	Cape Bluebell	UR
Iridaceae	<i>Watsonia spp.</i>	Watsonia	
Scrophulariaceae	<i>Zaluzianskya divaricata</i>	Spreading Night Phlox	UR