# ST MARYS PROPERTY - WESTERN PRECINCT

## Weed Management Plan

For:

**MARYLAND DEVELOPMENT COMPANY**

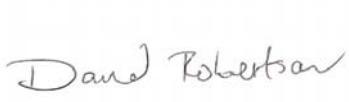
July 2008

Final Report

**Cumberland Ecology**
PO Box 2474, Carlingford Court 2118

**Report No. 7070RP2**

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology

| | |
|---|---|
| Approved by: | David Robertson |
| Position: | Project Director |
| Signed: |  |
| Date: | *16 July, 2008* |

# Table Of Contents

# Table Of Contents



# Table Of Appendices

# Table Of Appendices

# Table Of Appendices



# List of Tables



# List of Figures

# Executive Summary

This Weed Management Plan (WMP) has been prepared for the Western Precinct of the St Marys Property (SMP) in order to comply with the Environmental Planning Strategy. The WMP addresses environmental management issues relating to exotic plant species that may result from the development of the Western Precinct.

This WMP describes weed occurrence in the Western Precinct but more detailed vegetation community and condition descriptions may be found in the Western Precinct Biodiversity Assessment.

Weed management under this WMP focuses on noxious and environmental weeds, including Weeds of National Significance (WONS), but particularly significant weeds of the SMP.

The vegetation of the Western precinct is generally in low to moderate condition with exotic species occurring frequently across most of the precinct. A large proportion of the precinct is covered by exotic grassland, reflecting the agricultural history of the SMP as exotic species would have been introduced to improve pasture and inadvertently introduced with stock. The most significant weeds in the Western Precinct are African Lovegrass (*Eragrostis curvula*), Noogoora Burr (*Xanthium* sp.), Blackberry (*Rubus fruticosus* spp agg) and Small-leaved Privet (*Ligustrum sinense*).

The WMP describes weed control techniques for these significant weeds and management strategies to prevent the spread of weeds in the precinct and surrounding Regional Park. Strategies are specified for the construction and occupation phases of the development of the Western Precinct.

Chapter 1

# Introduction

## 1.1 Purpose

This Weed Management Plan (WMP) has been prepared for the Western Precinct of the St Marys Property (SMP). The aim of this plan is to identify and manage weeds during and after construction on the Western Precinct to prevent both the spread of weeds into the Regional Park and the growth of weeds within the precinct.

The objectives of this plan are to:

- Review existing legislative obligations and weed control guidelines;
- Identify infestations of significant weeds across the Western Precinct;
- Identify and prepare prescriptions for the control of significant weed species within the Western Precinct development area during and after construction;
- Detail a five-year weed control program for the Western Precinct development area; and
- Make provision for weed control guidelines for building and landscaping, and educational material for future residents.

This WMP is designed to meet the appropriate legislative requirements and be guided by relevant weed control policies, guidelines and strategies.

## 1.2 Background

The SMP is a 1,545 hectare area of land which is situated north of St Marys and east of Penrith in Western Sydney. The site is bounded by Ninth Avenue, Palmyra Avenue, Forrester Road, Dunheved Golf Course, The Northern Road and the suburbs of Cambridge Gardens and Werrington County. The SMP is located within both the Blacktown and Penrith Local Government Areas (LGAs). It incorporates areas of cleared agricultural land, developed areas and areas of regenerating Western Sydney woodland vegetation[1].

The SMP was originally used for grazing, and a butchery and saleyard were located on the land. Following the outbreak of World War II, the Australian Government established an explosives and munitions filling factory on these lands. Extensive works were undertaken on the site involving the construction of more than 800 buildings, a transport network including roads and railway lines, as well as major services infrastructure and telecommunications facilities. This complex of munitions factories operated until production ceased in 1994. The site has subsequently been decontaminated, and the great majority of the buildings and other infrastructure removed.

In 1993 the State Government included the SMP in its Urban Development Program for future urban development, in recognition of its ability to meet future regional housing needs. The site is currently owned by St Marys Land Limited and is being jointly developed by ComLand Limited and Lend Lease Development Pty Ltd through the joint venture company, Maryland Development Company.

The SMP was rezoned in January 2001 by *St Marys Regional Environmental Plan No 30* (SREP 30) to permit its development for a combination of urban, employment, regional open space and regional park purposes. The SMP comprises six future development precincts, namely the Western Precinct, Central Precinct, North and South Dunheved Precincts, Ropes Creek Precinct and Eastern Precinct, identified by SREP 30 (Figure 1.1).

In accordance with SREP 30, St Marys Land Limited signed a Deed of Agreement with the NSW State Government in December 2002 which in part details the methodology for the establishment, funding and management of the Regional Park. This is an area approximately 900 ha in size that will be retained for conservation, as a mitigation measure for the development of the six development precincts.

In 2003, the Eastern, North Dunheved and South Dunheved Precincts were released, and Precinct Plans have since been submitted and adopted by Blacktown City Council and Penrith City Council for these areas. The Eastern Precinct is currently under development and development of the Dunheved Precincts is expected to commence in 2008.

In 2006 the Western, Central, and Ropes Creek Precincts were released, allowing the planning process to proceed to the preparation of the Western Precinct Plan. The Western Precinct is located in the western part of the SMP and comprises land zoned for urban and employment uses, however SREP 30 is currently being amended to consolidate the employment zones from the Western and Ropes Creek Precincts into the Central Precinct. Biodiversity certification is being sought for SREP 30 with this amendment.

C:\GIS\Cumberland Ecology\7070 St Marys\Central Precinct June 08 Focus GIS

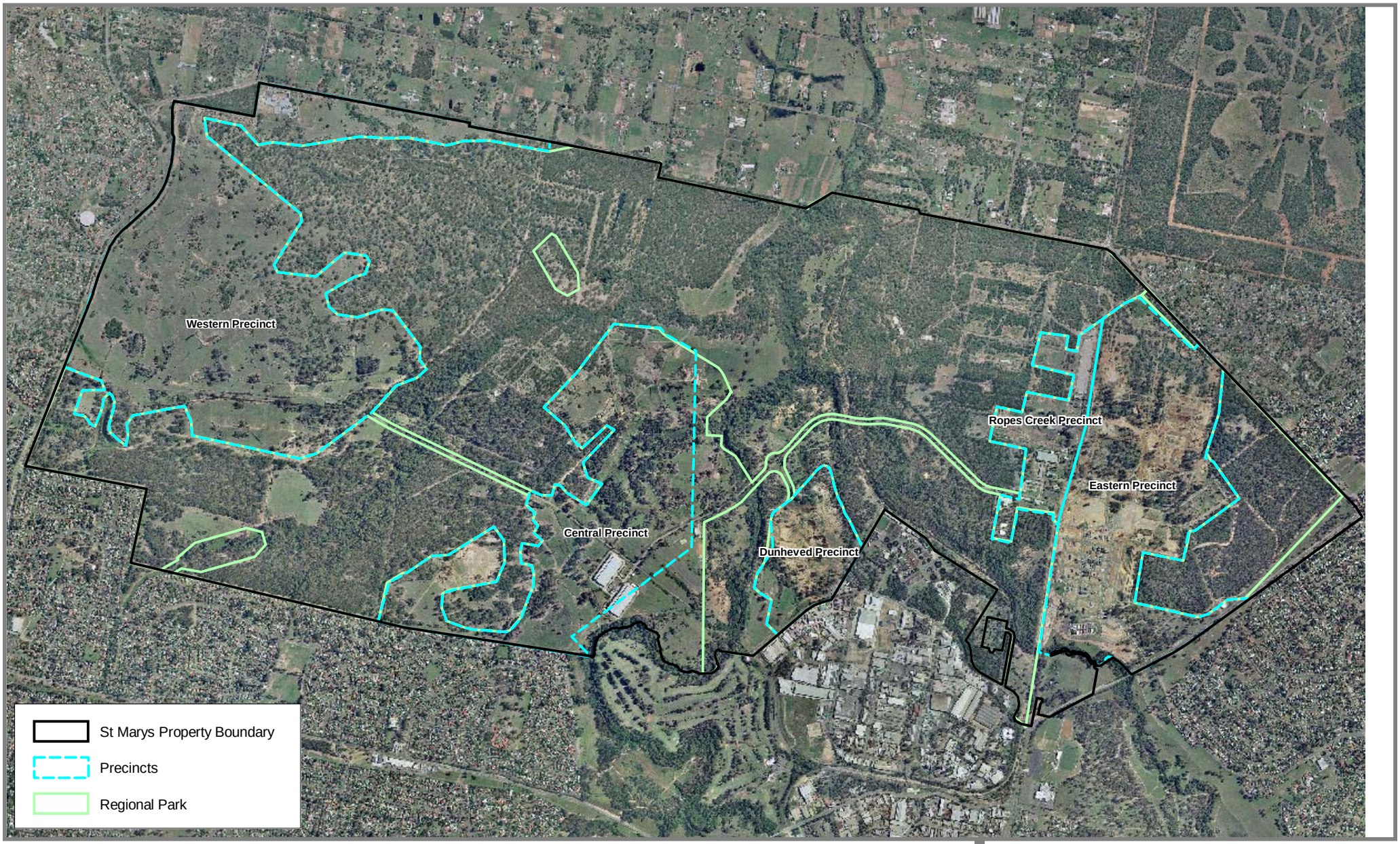



Figure 1.1 Aerial Photograph of the St Marys Property

## 1.3 Policy Context

Weed legislation provides guidelines aiding the development of weed management plans. Conservation legislation is also relevant to weed control programs because the management of weeds can affect, and is often an integral part of the conservation of threatened species and communities.

### *1.3.1 Noxious Weeds Act 1993*

The *Noxious Weeds Act 1993* provides for the identification, classification and control of noxious weeds in New South Wales. Changes to the Act came into force in March 2006 via the *Noxious Weeds Amendment Act 2005*. Plants that are declared noxious weeds by the Minister are placed into the following weed control categories:

- Class 1 – State prohibited weeds
  - These are plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.
- Class 2 – Regionally prohibited weeds
  - These are plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.
- Class 3 – Regionally controlled weeds
  - These are plants that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.
- Class 4 – Locally controlled weeds
  - These are plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.
- Class 5 – Restricted plants
  - These are plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.

A noxious weed that is classified as a Class 1, 2 or 5 noxious weed is referred to in the Noxious Weed Act as a notifiable weed.

### *1.3.2 Commonwealth Legislation*

Relevant Commonwealth legislation that would affect weed control on the SMP includes the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act regulates significant environmental impacts on species and communities listed as threatened under this Act. Care must be taken to minimise the environmental impacts associated with weed program activities. The EPBC Act can be triggered if environmental practices are considered likely to have a significant impact on listed species and communities.

### *1.3.3 NSW Legislation*

The *Threatened Species Conservation Act 1995* (TSC Act) lists a number of species and ecological communities, which are protected under this Act, and should not be disturbed without a permit. This Act regulates significant environmental impacts on species listed under this Act. For proposed weed control actions, the significance of impacts on threatened species under this Act needs to be assessed, which may include application of Assessments of Significance - the so-called 'Seven Part Test'.

### *1.3.4 Sydney Regional Environment Plan 30*

Sydney Regional Environmental Plan No. 30 sets out performance objectives and strategies to ensure desirable environmental outcomes on the SMP[2]. SREP 30 outlines that a precinct plan must include information on the management of the potential impacts of development on the existing physical and environmental characteristics of the land, including significant native flora and fauna habitat and soil characteristics. The information is to include specific details of those characteristics and to explain how development should be planned and configured to minimise adverse impacts on areas of significance for biodiversity.

### *1.3.5 St Marys Environmental Planning Strategy 2000 (EPS)*

The St Marys EPS requires that precinct plans for lands zoned urban or employment include a Weed Management Plan that:

1. *identifies weed control measures during and after development and targets noxious weeds such as privet, African olive, lantana and prickly pear;*

2. *requires land to be revegetated after disturbance or construction activities to reduce the likelihood of weed species growing on the site, consistent with approved soil and water management plans; and*

3. *requires any topsoils brought onto the site to be certified as being free of weeds before use.*

### *1.3.6 Penrith City Council Sustainability Blueprint*

The Penrith Sustainability Blueprint has been prepared as a guide for planning and development of new release areas within the City of Penrith. The key aims are to:

*1. Provide the framework for delivering quality urban environments and sustainable outcomes in release area planning.*

*2. Reflect the 'triple bottom line approach' demonstrating best practice in economic, social and environmental sustainability, not only for current communities, but also for future generations.*

*3. Apply to all new urban release areas, including employment or residential land uses, or a mix of both.*

## 1.4 Glossary of Terms and Abbreviations

**EPBC Act**: *Environment Protection and Biodiversity Conservation Act 1999*;

**PLGA**: Penrith Local Government Area;

**SMP**: St Marys Property

**SREP 30**: Sydney Regional Environment Plan 30;

**St Marys EPS**: St Marys Environmental Planning Strategy 2000;

**TSC Act**: *Threatened Species Conservation Act 1995*;

**WMP**: Weed Management Plan; and

**WONS**: Weeds of National Significance.

## 1.5 Report Structure

The remainder of this WMP is set out as follows:

- Chapter 2: Provides the methodology for identification and recording of weeds on the Western Precinct and the SMP;
- Chapter 3: Describes the distribution and abundance of weeds on the Western Precinct;
- Chapter 4: Discusses general and species specific weed control measures; and
- Chapter 5: Provides a framework for monitoring and review.

Chapter 2

# Methods

This chapter explains the methodology for identifying and recording weed infestations and native vegetation. It includes a review of previous studies, an outline of procedures for field mapping with a Global Positioning System (GPS) and desktop mapping with a geographic information system (GIS).

## 2.1 Literature Review

A literature search was undertaken to obtain information regarding the distribution and abundance of native vegetation and weeds within the Western Precinct.

No detailed reports or maps of the distribution and abundance of weeds in the Western Precinct exist. In 2004 a report by ERM (ERM 2004) mapped significant weed infestations across the entire SMP. Past reports have been reviewed in the preparation of this plan [1,3-8] including weed management plans, flora and fauna assessments, and vegetation maps and reports to provide a broad picture of the vegetation of the SMP.

## 2.2 Mapping and Field Assessment

Significant weeds in the SMP have been mapped on a number of occasions; in July 2002 significant weed infestations across the SMP were mapped by ERM, in 2004 by Cumberland Ecology within the Dunheved Precincts and at the southern border of the Ropes Creek Precinct and along the South Creek corridor and in 2006 by Cumberland Ecology in Ropes Creek Precinct. The Western Precinct was specifically surveyed by Cumberland Ecology in October 2007, and May 2008 for the target weed species previously identified. This included the use of aerial photographs and a Global Positioning System (GPS).

Field assessment of weeds in the Western Precinct was conducted by botanist David Thomas and ecologist Timothy Playford in 2007 and David Thomas with Joanne Ironside in 2008. In 2007 several meander transects were examined throughout the Western Precinct. Weed species and their abundances were recorded. The projective foliage cover of weed species was noted for each vegetation community. In 2008 weed infestations of significant weed species in the Western Precinct were mapped.

Chapter 3

# Results

## 3.1 Native Vegetation

The native vegetation of the SMP, including locations of threatened species and communities is shown and discussed in a suite of ecological reports[3,5,7,9-13]. Four endangered ecological communities, one endangered plant population and several threatened flora species occur on the SMP. The vegetation is predominantly Cumberland Plain Woodland and other communities that grow on the Cumberland Plain. Most of this area has experienced extensive clearing and remediation work and has also been subject to intensive grazing by cattle and kangaroos.

There are 6 plant communities found in the Western Precinct:

- Cumberland Plain Woodland;
- Shale-gravel Transition Forest;
- River-flat Eucalypt Forest;
- Native Grassland;
- Exotic Grassland; and
- Freshwater Wetlands.

A large proportion of the Western Precinct contains grassland created by previous clearing of natural woodland and open forest. Remnant and regrowth woodland and forest are estimated to cover 20% of the Western Precinct. The grassland in the precinct comprises a mixture and mosaic of introduced and indigenous species. Weed invasion has resulted in the establishment of variable amounts of introduced species.

## 3.2 Weed Occurrence

### *3.2.1 Significant Weeds*

Weeds are plants that are unwanted in a given situation and may be harmful, dangerous or economically detrimental[14].

For the purposes of this report "significant" weed species are species that are described or listed as:

- Weeds of National Significance (WONS) (Appendix A);
- species listed under the *Noxious Weeds Act 1993* for Hawkesbury River County Council (Appendix B);
- having a high Australian Rating (5) according to the *Noxious Weeds Act 1993*; and
- are environmental weeds occurring in several survey areas throughout Western Precinct and identified as significant weeds for the SMP.

Weeds identified as significant on the SMP include perennial grasses, succulents, shrubs and trees and are listed in Table 3.1. Significant species found in the Western Precinct are shown in bold.

**Table 3.1 SIGNIFICANT WEEDS IN THE SMP**

| Common Name | Scientific Name | WoNS | Class |
|---|---|---|---|
| PERENNIAL GRASSES | | | |
| Pampas Grass | *Cortaderia sp.* | - | 3 |
| **African Love Grass** | ***Eragrostis curvula*** | **-** | **-** |
| HERBACEOUS SCRAMBLER | | | |
| Bridal Creeper | *Asparagus asparagoides* | ✓ | 5 |
| HERBACEOUS WEEDS | | | |
| **Noogoora Burr** | ***Xanthium spp.*** | **-** | **4** |
| Crofton Weed | *Ageratina adenophora* | - | 4 |
| Mother-of-millions | *Bryophyllum delagoense* | - | 3 |
| Prickly Pear | *Opuntia stricta* | - | 4 |
| WOODY PERENNIALS | | | |
| African Olive | *Olea europea subsp. cuspidata* | - | - |
| African Boxthorn | *Lycium ferocissimum* | - | 4 |
| **Blackberry** | ***Rubus fruticosus spp. agg.*** | ✓ | **4** |
| Broad-leaved Privet | *Ligustrum lucidum* | - | 4 |

**Table 3.1 SIGNIFICANT WEEDS IN THE SMP**

| Common Name | Scientific Name | WoNS | Class |
|---|---|---|---|
| Castor Oil Plant | *Ricinus communis* | | - |
| Cotoneaster | *Cotoneaster* | | - |
| **Narrow-leaved Privet** | ***Ligustrum sinense*** | **-** | **4** |
| Lantana | *Lantana camara* | ✓ | 5 |

Significant weed species in the Western Precinct include: African Love Grass (*Eragrostis curvula*), Noogoora Burr (*Xanthium* spp.), Blackberry (*Rubus fruticosus*) and Narrow-leaved Privet (*Ligustrum sinense*). Major weed occurrences are shown in Figure 3.1.

Other significant weeds occasionally occur in the Western precinct and surrounding areas or may have been recorded in the SMP but not the study area. These include African Olive (*Olea europea* subsp. *africana*), African Boxthorn (*Lycium ferocissimum*) Lantana (*Lantana camara*), Broad-leaved Privet (*Ligustrum lucidum*), Bridal Creeper (*Asparagus asparagoides*), Prickly Pear (*Opuntia stricta*), Crofton Weed (A*geratina adenophora*), St John's Wort (*Hypercium perforatum*) and Paterson's Curse (*Echium* spp.) should be eradicated if found in the future. These species occur in the vicinity of the Western Precinct and may occur in the precinct in the future.

Profiles describing the ecological characteristics (appearance, life cycle and dispersal mechanisms) and general recommendations for control of significant weed species within the Western Precinct are provided in Appendix C.

### *3.2.2 Other Weeds*

A further 30 weed species were detected in the Western Precinct during surveys. Weeds that were found to be very common in some of the survey transects in the Western Precinct include: *Briza subaristata*, Couch (*Cynodon dactylon*), Fireweed (*Senecio madagascariensis*), Flatweed (*Hypochaeris radicata*), Carpet Grass (*Axonopus affinis*), a Cudweed (*Gnaphalium* sp.), *Centaurium* sp. and *Linum monogynum*.

A full list of weed species detected in the Western Precinct is shown in Appendix D.

### *3.2.3 Distribution and Abundance*

Weed distribution within the Western Precinct is strongly influenced by past and present land uses, with the greatest amount of weeds occurring in disturbed areas and grassland. The relatively undisturbed forest vegetation that occurs within the adjacent Regional Park is significantly less weed invaded than the Western Precinct as it has been historically less disturbed.

Most of the Western Precinct contained introduced species, mainly herbaceous types associated with disturbed areas and farms. The majority of the Western Precinct consists of grassland and regenerating woodland. Pasture improvement throughout existing grassland areas in the Western Precinct has resulted in the establishment of some weed species and the grassland comprised a mosaic of introduced and indigenous species. Exotic species were dominant in some locations and common species included African Love-grass (*Eragrostis curvula*), Couch Grass (*Cynodon dactylon*) and *Briza subaristata*. Other common weed species included: Carpet Grass (*Axonopus affinis*), Paspalum (*Paspalum dilatatum*), Blackberry Nightshade (*Solanum nigrum*), Fireweed (*Senecio madagascariensis*), Purpletop (*Verbena* spp.) and Flatweed (*Hypochaeris radicata*). Carpet Grass occurred in a wide range of microhabitat situations; however it was most common in lower-lying situations that were moister than higher or slightly more steeply sloping areas. Areas of woodland and regenerating woodland contained lower proportions of exotic species, although those recorded were similar to the grassland.

Weeds in the Cumberland Plain Woodland were generally groundcovers, and included: Couch (*Cynodon dactylon*), Carpet Grass (*Axonopus affinis*), Blackberry Nightshade (*Solanum nigrum*), *Briza subaristata*, and Scarlet Pimpernel (*Anagallis arvensis*).

The most common introduced grassland was dominated by Couch (*Cynodon dactylon*), Carpet Grass (*Axonopus affinis*) and *Briza subaristata*. Other common species included: African Love Grass (*Eragrostis curvula*), Paspalum (*Paspalum dilatatum*), Blackberry Nightshade (*Solanum nigrum*), Fireweed (*Senecio madagascariensis*), Flatweed (*Hypochaeris radicata*) and Scarlet Pimpernel (*Anagallis arvensis*). The grassland that was dominated by natives has some infestations of exotic species. These included: Couch (*Cynodon dactylon*), *Briza subaristata* and Blackberry Nightshade (*Solanum nigrum*).

In the wet meadow exotic Asteraceae were common species. Couch (*Cynodon dactylon*) was dominant particularly at the dry margins. Juveniles of the noxious *Xanthium* sp. were recorded in significant numbers in the south of the precinct, near the border with the Regional Park.

Some species declared Class 3 Noxious (*Rubus fruticosus*, *Xanthium* sp.) and Class 4 and 5 environmental weeds (*Asparagus aethiopicus* and *Ligustrum sinense*) were recorded from the precinct in low numbers. These were isolated specimens or clumps and no significant infestations were recorded.

### *i. Major Weeds*

Major weeds include those species that require the input of significant levels of resources to achieve control and are potential major threats to environmental values in the Western Precinct development area. They include *Xanthium sp*., African Love Grass, Blackberry and Narrow-leaved Privet.

- *Xanthium sp*. is locally common in the south of the Western Precinct, near the border with the Regional Park and occurs occasionally in other areas of the Precinct. Although not widespread or dominant, this species is important to control as it may spread and affect the values of the Regional Park;

- African Love Grass occurs in the Western Precinct, primarily as small patches mixed in with native grassland. In previous studies of the SMP, it has been found to occur particularly in open disturbed areas and has also been found colonising the road verges on the edges of the Regional Park;

- Blackberry occurs along drainage lines and depressions in the Western Precinct, in dense thickets;

- Narrow-leaved Privet, a noxious weed species, also occurs within the Precinct but is currently very limited in its distribution, being restricted to scattered small patches. This species however, occurs as dense infestations on the banks of South Creek, within the Dunheved Precincts and tends to be a major weed in other parts of the SMP.

*ii. Other Weeds*

This category includes weeds that are either not widespread or require medium to low effort to control. Weeds that require minimal control are low to medium threats to environmental values of the Western Precinct development area and adjacent Regional Park.

Other undeclared environmental weeds were also present including Moth Vine (*Araujia sericifera*) and Firethorn (*Pyracantha* sp.).

Other significant species including: African Olive (*Olea europaea ssp africana*), Lantana (*Lantana camara*), Broad-leaved Privet (*Ligustrum lucidum*), St Johns Wort (*Hypericum perforatum*) and Patersons Curse (*Echium* sp.) occur in the land adjacent to the Western Precinct. Some have been previously recorded from the SMP and are a priority for control if they are detected in the Western Precinct. The other significant weeds that occur on the SMP have the potential to occur in the Western Precinct and would best be controlled when their abundance is low (see Table 3.1 for list of significant weed species in the SMP).

Non-significant weeds species occurring in small infestations should also be considered for control. See Appendix D for list of all weed species occurring in the Western Precinct.

C:\GIS\Cumberland Ecology\7070 St Marys\Western Precinct May 08


Figure 3.1 Major weed infestations in the Western Precinct

Chapter 4

# Weed Control Measures

## 4.1 Introduction

Generally, weeds are exotic plants that grow at the expense of a native plant and that produce large numbers of seeds or other propagules and so can reproduce and spread quickly. They typically benefit from disturbance to soils or native vegetation. Grazing, soil erosion, floods, fires, urban run-off, increased nutrients, sedimentation or mechanical soil disturbance can trigger major outbreaks of weeds. Weeds can:

- compete with native plants;
- reduce germination of native plants;
- suppress native tree and seedling growth;
- alter fire regimes;
- modify nutrient cycling within an ecosystem;
- change soil conditions;
- affect food and habitat opportunities for native fauna;
- provide harbour for feral animals; and
- reduce recreation potential of bushland.

Such outbreaks are often from seeds that have lain dormant in the soil until disturbance, providing the conditions necessary for germination.

Weeds can spread and establish by the following pathways:

- seeds and other propagules travelling on vehicles, people and animals from one place to another;
- invading open areas that have been disturbed by over grazing, earthworks and other activities that disturb the soil;
- establishing in areas with reduced tree cover (poorly competitive weeds); and

- dispersing from infested areas to weed free areas via wind or water.

There are a number of protocols that can be implemented to reduce the spread of weeds generally, particularly by minimising disturbance. Establishing and maintaining such protocols to prevent the establishment and spread of weeds will reduce the costs of weed control in the long term in the Western Precinct.

The following section outlines general control methods and guidelines to prevent weed spread and establishment and suppress and eradicate significant weeds during and after the development. It is recommended that the management of weeds on the Western Precinct will take up to 5 years (3 years for active management after which time the weed status is re-assessed followed by a 2 year maintenance program). This should be sufficient to control weeds which have a high resilience and take 2-3 years to suppress.

## 4.2 General Weed Control Measures

### *4.2.1 Preventing Weed Spread and Establishment*

Prevention of a weed problem is the most cost-effective action possible [15]. Preventing weed spread and establishment will help to minimise the detrimental impacts that weeds may have on the Western Precinct. The prevention of weed spread and establishment will ensure that the impacts of a weed are contained in a known area and should reduce the distribution and abundance of weeds.

In order to carry out prevention strategies the ways in which specific weed species are spread and establish need to be identified. Appendix C outlines the life-cycles of significant weed species in the SMP.

To prevent weed transport during development by vehicles, personnel, wind and water, all personnel and contractors on Western Precinct should:

- Avoid working in or travelling through flowering or seeding infestations, such as African Love Grass, where possible. Seeds can disperse in the wind but can also spread in mud sticking to boots and machinery[14]. Machinery, equipment and footwear should be cleaned down before leaving the Western Precinct during clearing and earthworks;

- Stay on formed tracks wherever possible. During clearing and earthworks when this is not feasible, machinery, equipment and footwear should be cleaned down before leaving the Western Precinct;

- Where appropriate, establish a fixed clean down site and clean down all vehicles at regular intervals after coming in contact with weeds, and all vehicles that arrive from known weed-infested areas, with high pressure hoses or compressed air;

- Contain the water and materials from the clean down site and regularly inspect for weeds species;

- Maintain buffers to the Regional Park boundaries and along roads and tracks as per the St Marys Fire Management Plan[16];

- Work from the clean to infested areas when spraying or slashing and start weed control from the outer edges of infestations working inwards. This is important for weeds such as Blackberry. When slashing African Love Grass ensure that the tractor and slasher are cleaned down to reduce the spread of seed.

To prevent weeds from infesting disturbed ground during and after development (which will help protect the adjacent Regional Park from weed invasion):

- Always re-establish vegetation as soon as possible and where practicable after construction earthworks in accordance with the *Water, Soils and Infrastructure Plan* and *Landscape and Open Space Masterplan* which will be prepared as part of the Western Precinct Plan;

- Monitor disturbed areas and all sediment and erosion control structures to ensure that they are functioning correctly and prescribe follow-up weed spraying to ensure that any germinating weed does not set seed;

- Weeds in the development area should be removed before any land is filled; and

- Any topsoil brought onto the site is to be certified as being free of weeds for use. This land should still be subject to assessment and where necessary weed management to ensure it has not contained weed seeds or weeds have not since established in these areas.

These weed prevention strategies comply with the objectives of the St Marys EPS.

### *4.2.2 Weed Suppression*

Suppression of significant weeds involves reducing the overall density of weed species and preventing their spread by preventing seed set. This can involve the use of biological controls, minimisation of earth disturbance and encouragement of beneficial species such as native colonising plants that may aid the suppression of weed germination.

Both during and after construction, weed suppression and weed control by the developer or relevant authorities should concentrate on the edges of the Regional Park, including the edges of perimeter roads and any fire trails in Asset Protection Zones to prevent the spread of weeds into the Regional Park[16].

Recommendations for the suppression of weeds include:

- Minimise soil disturbance and ensure that all disturbed areas that are not built upon immediately are revegetated as quickly as possible in accordance with *Water, Soils and Infrastructure Plans;*

- Opportunistically undertake follow-up control after disturbances such as fire or floods, because these can trigger major weed germination events; and

- Use weed-free fully composted mulch and topsoil when carrying out revegetation or landscaping and earth works to prevent competition from weeds species and reduce weed invasion of restoration areas. All topsoil to be brought onsite is to be certified weed free.

### *4.2.3 Control and Management*

Total eradication of all the weeds in the Western Precinct is not feasible because of the tendency of weed re-colonisation, existing degree of soil disturbance and the possibility of recolonisation from other areas. It is more realistic to manage these weeds by lowering their densities, which will reduce their impact on adjacent native vegetation, flora and fauna habitats and help contain their spread. Significant weed species are the main target of this WMP, however, when it is not feasible to control all of the weeds with the same amount of effort. Priority species can be determined using the variables of weed threat and feasibility of control as seen in Table 4.1.

**Table 4.1 DETERMINING WEED PRIORITIES**

| | | **Weed Threat** | |
|---|---|---|---|
| | | Low | High |
| **Feasibility of Control** | Hard | Lowest priority | 2nd priority |
| | Easy | 3rd priority | 1st priority |

Weeds control and management can be undertaken both during and after development. In the Western Precinct, this can be achieved using a combination of methods such as herbicide application and the general measures outlined above. Weed control measures need to be carried out during and after development, and routinely in the long term, to ensure that the soil stored weed seed bank is reduced and to suppress weeds that may spread into the Western Precinct from adjacent land.

A combination of methods can be used to manage weeds in the short and long-term. Weed management methods and their optimal timing for each of the significant weed species on the SMP are shown in the weed species profiles in Appendix C. Regeneration

and establishment of native species in some areas will assist in weed control. Weed control of adjacent properties (ie the Regional Park Plan of Management) will also greatly assist weed control, because this will limit the number of propagules that may enter and establish from outside the Western Precinct.

This five year weed control plan will be implemented by Maryland Development Company (MDC). After five years MDC would look to hand over relevant weed control measures (ie. on public land) to council.

### *4.2.4 Guidelines and Education*

*i. Design*

The design of the development will help minimise the spread and establishment of weeds in the Western Precinct, and the chances of weeds spreading into the Regional Park. Development will occur in the adjacent land to the Regional Park boundary. This will give users of the precinct a sense of ownership of the natural assets of the Regional Park so discouraging rubbish dumping and apathy regarding weed prevention practices.

*ii. Guidelines*

Landscaping plans should be prepared by MDC for both construction of infrastructure and buildings in the residential and employment zones should recommend the use of local native species where possible in landscaping and comply with the *Landscape and Open Space Handover and Maintenance Plan*..

It would also provide guidelines on preventing the spread of weeds and controlling weeds during construction.

*iii. Education*

As part of the overall weed management strategy, MDC will educate future residents of the potential impacts of weeds and their responsibilities to minimise these impacts. Information kits will be provided to all new residents.

## 4.3 Species Specific Control Measures

### *4.3.1 Introduction*

Control of significant weeds in the Western Precinct requires application of species-specific measures to prevent spread and establishment of weeds in addition to the general weed control measures outlined above.

Control of weeds would be facilitated by development of the Western Precinct, as land clearing for the development will removed areas of weed infestation. Clearing and revegetation or development of the land will reduce the abundance of disturbed sites for weeds to colonise. However, weeds that do re-establish in these areas still need to be managed along with weeds occurring outside of the development footprint.

General suppression or control measures for each species are detailed in the weed profiles in Appendix C. Each species requires particular suppression or control measures such as spot spraying of herbicide at particular times, manual removal, cut stump application of herbicide and native plant regeneration. Weed management methods and their optimal timing for each of the significant weed species in the Western Precinct and the wider SMP are detailed in Appendix C. Not all weed management strategies for each significant species can be implemented across the Western Precinct at the same time. It is therefore necessary to have a rotation scheme to ensure that each weed is targeted in an appropriate season in relation to its life cycle.

When restoring areas of native vegetation infested with weeds, the rate of weed removal should be dictated by native plant regeneration or revegetation establishment[17]. A high amount of disturbance, such as constant manual control, does not create optimal conditions for native vegetation establishment. Once areas for weeding controls are defined, implementation of these strategies should be on a rotational basis, for example, where one area is targeted in the first month, and another targeted the next month, so as not to constantly disturb one area. Each area defined for weeding strategies will need to be revisited a few times each year, depending on follow-up methods and timing.

The following section outlines species-specific control measures for species or for groups of related species in the Western Precinct. A five-year program for weed control actions can be seen in Appendix E.

### *4.3.2 Specific Control Measures*

Control measures for each species need to focus on different aspects of control. This can be related to the habitat of the weed, such as in gullies, native vegetation or cleared pastureland, as well the life-cycle and method of spread that is most likely on the Western Precinct.

All the measures and guidelines outlined in this chapter will be followed in relation to restricting the spread of species and seeds while undertaking control measures. Herbicide guidelines should be followed, and any spraying should occur in appropriate wind conditions so that spray drift does not occur.

Herbicides registered in New South Wales for each species can be obtained by contacting NSW Agriculture or from the following website:

http://www.dpi.nsw.gov.au/agriculture

*i. Perennial Grasses*

**Species**: Pampas Grass, African Love Grass

**Control Priority:** *High* – due to threats to adjacent native vegetation and the potential for high future costs of control.

**Chemical Control**: Use of registered appropriate chemicals to control African Love Grass. Take particular care in spot-spraying African Love Grass to avoid impact on threatened non–target species i.e. *Grevillea juniperina* subsp*. juniperina*.

**Mechanical Control**: Cut flower heads of Pampas Grass.

**Biological Control:** None available.

**Oversowing**: Regenerate or oversow areas that have been temporarily disturbed for development, or where chemicals have been applied, with native grasses.

**Quarantine:** None.

*ii. Herbaceous Weeds*

**Species**: Prickly Pear, Bridal Creeper, Crofton Weed.

**Control Priority:** *Medium* – species can be highly invasive but threats minor at present due to low level of infestations.

**Chemical Control**: Chemical controls are not the most effective for Prickly Pear, however, spot-spraying has been used for the control of these species. Spot-spraying is an effective control for Bridal Creeper, providing follow-up treatment in consecutive years is conducted. Thoroughly spraying Crofton Weed during its peak growing period, during late summer or autumn, is an effective control measure for this weed[14].

**Mechanical Control**: Physically remove and dispose responsibly of Prickly Pear. Care must be taken to collect and destroy all dislodged segments and fruit. Care must be taken to remove the entire tuberous root system to minimise regeneration.

Ripping or ploughing an area of Crofton weed will control the weed if the area is suitable for this method[14].

**Biological Control:** Biological controls for Prickly Pear are present on the SMP. Some biological controls may have an effect on Bridal Creeper, these being a chalcid wasp, a moth larva and a rust fungus. The trypetid gall fly can be used to control Crofton Weed[14].

**Oversowing**: Regenerate or over sow areas with native grass seed such as *Microlaena* sp. or Kangaroo Grass (*Microlaena* sp for moist areas, Kangaroo Grass for dry areas). A high level of maintenance will be required to ensure that the native seed does not get out competed by weed germination. This method is best used in areas that have high levels of native resilience.

**Quarantine:** None.

*iii. Woody Perennials*

**Species**: Blackberry, Narrow-leaved Privet, Broad-leaved Privet, African Boxthorn, African Olive, Cotoneaster, Castor Oil Plant, Lantana.

**Control Priority:** *High* – for Blackberry due to threats to native vegetation and the potential for high future costs of control, and for African Olive due to widespread occurrence. Medium priority for other species due to low levels of infestations but high invasive/dispersal potential.

**Chemical Control**: Control all species (except Blackberry) by cut and paint with undiluted herbicide registered for this application or stem injection. Spot spray Blackberry, which occurs in dense infestations. Follow-up spray and cut stump applications to ensure that native species have a chance to grow in areas where these species have been removed.

**Mechanical Control**: Pull out small seedlings. Generally removal with tractors and machinery results in inappropriate disturbance level and will result in a high level weed germination and soil disturbance.

**Biological Control**: No biological controls are currently available.

**Oversowing**: None.

**Quarantine:** None.

Chapter 5

# Monitoring and Review

A vital component of a weed control strategy is follow-up work and monitoring.

The objective of monitoring is to measure the effectiveness of the proposed control measures in achieving the desired outcomes. Monitoring will also identify the rate and spread of weeds or the establishment of desirable vegetation, new threats to native vegetation, and factors that have arisen that will effect the site[17]. Monitoring will help to identify and address non-conformance and implement corrective actions within an appropriate time frame. It will also assist in determining cost effectiveness of weed control measures and allow for the refinement of weed control budgets.

Two types of monitoring for weeds will be undertaken; Short term 'follow-up' monitoring and long term monitoring.

## 5.1 Short Term Monitoring

Short term monitoring will be undertaken as a 'follow-up' after weed control operations to ensure that weeds present in targeted areas have actually been sprayed or removed, and to re-spray if necessary. Once weeds have been initially reduced in densities due to control activities they need to be regularly monitored, so that any outbreak or spread of weeds can be quickly suppressed. This will prevent weeds from re-establishing in the targeted area and ensure that the initial control effort is not wasted. Short term monitoring is also essential after areas that have been temporarily disturbed during construction are revegetated or landscaped.

This type of monitoring is essential for grassy weeds, which could remain hidden amongst the non-target vegetation during the initial control activities. Records should be kept detailing actions and dates of implementation of this WMP.

Times for follow-up monitoring are indicated within the implementation schedule (Appendix E).

## 5.2 Long Term Monitoring

The objective of the long-term monitoring program is to provide sufficient feedback on the success of the overall weed control strategies including suppression and prevention of

weed spread and establishment. It will also provide some information about the successful regeneration of native vegetation communities that contained weed species.

Long term monitoring involves a qualitative weed survey and mapping every year in the appropriate season for five years to coincide with the implementation schedule. Weed mapping will consist of a weed survey and subsequent compilation of weed maps that show the distribution and abundance of weeds using the same measures of abundance as used for this WMP. Comparison of annual maps will indicate whether the distribution and abundance of weeds has increased or decreased over the year, and allow future weed control measures to be tailored for specific objectives. This allows updating of the implementation schedule for the next year based on the significance of weed infestations and success of past control measures.

## 5.3 Review

An annual review of the WMP will be undertaken to assess its effectiveness during the first three years from the commencement of development. The reviews will be conducted in conjunction with Penrith City Council prior to handover of public space to local authorities. An additional two years of maintenance weed control will probably be required unless further active control and removal is required. At the time of handover a report detailing the results of annual mapping and comparisons of counts will be prepared. This report could also detail any necessary changes to weed control measures in order to maintain control of weeds in Western Precinct development area. It should also review the direction of the strategy and indicate if the actions proposed are having the desired effect in relation to weed control.

# References


1. Gunninah (1997) **ADI Site St Marys. Biological Assessment Report. Volume 1-3: Responses to Issues Raised by the Section 22 Committee** Gunninah Environmental Consultants, Sydney.

2. DUAP (2001) **Sydney Regional Environmental Plan No. 30: St Marys** Department of Urban Affairs and Planning, Sydney.

3. ERM (2003) **St Marys Eastern Precinct Plan: Biodiversity Assessment** Environmental Resources Management Australia, Sydney.

4. ERM (2003) **St Marys Eastern Precinct Plan: Weed Management Plan** Environmental Resources Management Australia, Sydney.

5. Cumberland Ecology (2005) **St Marys North and South Dunheved Precincts Plan: Biodiversity Assessment** Cumberland Ecology, Epping.

6. Cumberland Ecology (2005) **St Marys North and South Dunheved Precincts Plan: Weed Management Plan** Cumberland Ecology, Sydney.

7. Cumberland Ecology (2007) **Ropes Creek Precinct: Biodiversity Assessment** Report for Delfin Lend Lease Cumberland Ecology, Epping.

8. Cumberland Ecology (2007) **Ropes Creek Precinct: Weed Management Strategy** Report for Delfin Lend Lease Cumberland Ecology, Epping.

9. Gunninah (1991) **Australian Defence Industries (ADI) Site, St Marys, Fauna Survey** Gunninah Environmental Consultants, Sydney.

10. Gunninah (1994) **Australian Defence Industries St Marys Facility Western Sydney Environmental Review** Gunninah Environmental Consultants, Sydney.

11. Gunninah (1995) **Australian Defence Industries St Marys Planning Study: Flora and Fauna Issues** Gunninah Environmental Consultants, Sydney.

12. Gunninah (1996) **Australian Defence Industries St Marys Facility - Vegetation Communities** Gunninah Environmental Consultants, Sydney.

13. Cumberland Ecology (2004) **Stage 1 Subdivision, St Mary's Eastern Precinct: Part Lot 2 DP 1038166 Species Impact Statement** Cumberland Ecology, Sydney.

14. Parsons, W. T. and Cuthbertson, E. G. (2001) **Noxious Weeds of Australia** CSIRO Publishing, Collingwood.

15. Australian Weeds Committee (2006) **Australian Weeds Strategy: A national strategy for weed management in Australia** Natural Resource Management Ministerial Council

16. ERM (2002) **St Marys Property Fire Management Plan** Unpublished report prepared by Environmental Resources Management Australia Pty Ltd for Delfin Lendlease and Comland Environmental Resources Management Australia, Sydney.

17. Weeds CRC (2004) **Introductory Weed Management Manual** Natural Heritage Trust

18. Harden, G. J. (1991) **Flora of New South Wales Volume 2** New South Wales University Press, Kensington.

19. Weeds CRC (2003) **Weed Management Guide: Alligator Weed - Alternanthera philpxeroides** Natural Heritage Trust

20. Weeds CRC (2003) **Weed Management Guide: Bridal Creeper - Asparagus asparagoides** Natural Heritage Trust

21. Robinson, L. (1991) **Field Guide to the Native Plants of Sydney** Kangaroo Press, Roseville, Sydney.

22. Harden, G. J. (1992) **Flora of New South Wales Volume 3** New South Wales University Press, Kensington.

23. Lamp, C. and Collet, F. (1996) **Field Guide to Weeds in Australia** Inkata Press, Melbourne.

24. Victorian Department of Primary Industries (2007) **Landcare Notes: Erect Prickly Pear** Victorian Department of Primary Industries

*Appendix A*

# Weeds of National Significance

## Table A.1 WEEDS OF NATIONAL SIGNIFICANCE (WONS)

| Common Name | Scientific Name | Extent in Australia | Potential Distribution |
|---|---|---|---|
| Alligator Weed | *Alternanthera philoxeroides* | WA, NT, QLD, NSW, VIC, SA, TAS | Could further expand in current locations |
| Athel Pine | *Tamarix aphylla* | WA, NT, QLD, NSW, VIC, SA | Could further expand in current locations |
| Bitou bush / Boneseed | *Chrysanthemoides monilifera* | WA, QLD, NSW, VIC, SA, TAS | Could further expand in current locations |
| Blackberry | *Rubus fruticosus agg.* | WA, QLD, NSW, VIC, SA, TAS, ACT | Could further expand in current locations |
| Bridal Creeper | *Asparagus asparagoides* | WA, NSW, VIC, SA, TAS | Could further expand in current locations; plus QLD, ACT |
| Cabomba | *Cabomba caroliniana* | NT, QLD, NSW, VIC | Could further expand in current locations; plus WA, SA, TAS, ACT |
| Chilean Needle Grass | *Nassella neesiana* | NSW, VIC, SA, ACT | Could further expand in current locations; plus WA, QLD, TAS |
| Gorse | *Ulex europaeus* | WA, QLD, NSW, VIC, SA, TAS, ACT | Could further expand in current locations |
| Hymenachne | *Hymenachne amplexicaulis* | NT, QLD, SA | Could further expand in current locations; plus WA, NSW |
| Lantana | *Lantana camara* | WA, NT, QLD, NSW | Could further expand in current locations; plus VIC, SA, TAS |
| Mesquite | *Prosopis spp.* | WA, NT, QLD, NSW, VIC, SA | Could further expand in current locations |
| Mimosa | *Mimosa pigra* | NT | Could further expand in current locations; plus WA, QLD |
| Parkinsonia | *Parkinsonia aculeate* | WA, NT, QLD | Could further expand in current locations; plus NSW, VIC, SA |
| Parthenium weed | *Parthenium hysterophorus* | QLD, NSW, VIC | Could further expand in current locations; plus WA, NT, SA |

**Table A.1 WEEDS OF NATIONAL SIGNIFICANCE (WONS)**

| Common Name | Scientific Name | Extent in Australia | Potential Distribution |
|---|---|---|---|
| Pond Apple | *Annona glabra* | NT, QLD, NSW | Could further expand in current locations |
| Prickly Acacia | *Acacia nilotica ssp. indica* | QLD, NSW | Could further expand in current locations; plus WA, NT, SA |
| Rubber Vine | *Cryptostegia grandiflora* | WA, QLD | Could further expand in current locations; plus NT, NSW |
| Salvinia | *Salvinia molesta* | WA, NT, QLD, NSW, SA | Could further expand in current locations; plus VIC, TAS, ACT |
| Serrated Tussock | *Nassella trichotoma* | NSW, VIC, TAS, ACT | Could further expand in current locations; plus WA, QLD, SA |
| Willows except Weeping Willows, Pussy Willow and Sterile Pussy Willow | *Salix spp. except S. babylonica, S. X calodendron and S. X reichardtiji* | NSW, VIC, ACT | Could further expand in current locations; plus SA, TAS |

*Appendix B*

# Noxious Weeds for Hawkesbury River County Council Local Control Authority

**Table B.1 NOXIOUS WEEDS LISTED FOR THE HAWKESBURY RIVER COUNTY COUNCIL**

| Weed | Class | Legal requirements |
|---|---|---|
| African boxthorn [Lycium ferocissimum ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. |
| African feathergrass [Pennisetum macrourum ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| African turnipweed [Sisymbrium runcinatum ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| African turnipweed [Sisymbrium thellungii ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Alligator weed [Alternanthera philoxeroides ] | 3 | The plant must be fully and continuously suppressed and destroyed. |
| Anchored water hyacinth [Eichhornia azurea] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Annual ragweed [Ambrosia artemisiifolia ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Arrowhead [Sagittaria montevidensis ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Artichoke thistle [Cynara cardunculus ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Athel pine [Tamarix aphylla ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration |
| Bathurst/Noogoora/Californian/cockle burrs [Xanthium species ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. |
| Bear-skin fescue [Festuca gautieri] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with. |

**Table B.1 NOXIOUS WEEDS LISTED FOR THE HAWKESBURY RIVER COUNTY COUNCIL**

| Weed | Class | Legal requirements |
|---|---|---|
| | | This is an All of NSW declaration. |
| Black knapweed [Centaurea nigra] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Blackberry [Rubus fruticosus aggregate species ]<br>except cultivars Black satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smoothstem, Thornfree | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed.<br>This is an All of NSW declaration. |
| Bridal creeper [Asparagus asparagoides ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Broomrapes [Orobanche species]<br>Includes all Orobanche species except the native O. cernua variety australiana and O. minor | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Burr ragweed [Ambrosia confertiflora ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Cabomba [Cabomba caroliniana ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Cayenne snakeweed [Stachytarpheta cayennensis ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Chilean needle grass [Nassella neesiana ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed. |
| Chinese violet [Asystasia gangetica subspecies micrantha] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Clockweed [Gaura lindheimeri ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |

**Table B.1 NOXIOUS WEEDS LISTED FOR THE HAWKESBURY RIVER COUNTY COUNCIL**

| Weed | Class | Legal requirements |
|---|---|---|
| Clockweed [Gaura parviflora ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Cockle burrs [Xanthium species ] | | See Bathurst/Noogoora/Californian/cockle burrs. |
| Columbus grass [Sorghum x almum ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. |
| Corn sowthistle [Sonchus arvensis ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Crofton weed [Ageratina adenophora ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. |
| Dodder [Cuscuta species]<br>Includes All Cuscuta species except the native species C. australis, C. tasmanica and C. victoriana | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| East Indian hygrophila [Hygrophila polysperma] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Espartillo [Achnatherum brachychaetum ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Eurasian water milfoil [Myriophyllum spicatum] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Fine-bristled burr grass [Cenchrus brownii ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Fountain grass [Pennisetum setaceum ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Gallon's curse [Cenchrus biflorus ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |

**Table B.1 NOXIOUS WEEDS LISTED FOR THE HAWKESBURY RIVER COUNTY COUNCIL**

| Weed | Class | Legal requirements |
|---|---|---|
| Giant Parramatta grass [Sporobolus fertilis ] | 3 | The plant must be fully and continuously suppressed and destroyed. |
| Glaucous starthistle [Carthamus glaucus ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Golden dodder [Cuscuta campestris] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. |
| Golden thistle [Scolymus hispanicus ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Green cestrum [Cestrum parqui ] | 3 | The plant must be fully and continuously suppressed and destroyed. |
| Harrisia cactus [Harrisia species ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed.<br>This is an All of NSW declaration. |
| Hawkweed [Hieracium species] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Horsetail [Equisetum species] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Hygrophila [Hygrophila costata ] | 2 | The plant must be eradicated from the land and the land must be kept free of the plant. |
| Hymenachne [Hymenachne amplexicaulis] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Italian bugloss [Echium species ] | | See Paterson's curse, Vipers bugloss, Italian bugloss. |
| Johnson grass [Sorghum halepense ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. |

**Table B.1 NOXIOUS WEEDS LISTED FOR THE HAWKESBURY RIVER COUNTY COUNCIL**

| Weed | Class | Legal requirements |
|---|---|---|
| Karoo thorn [Acacia karroo] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Kochia [Bassia scoparia]<br>except Bassia scoparia subspecies trichophylla | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Lagarosiphon [Lagarosiphon major] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Lantana [Lantana species ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Long-leaf willow primrose [Ludwigia longifolia ] | 3 | The plant must be fully and continuously suppressed and destroyed. |
| Long-leaf willow primrose [Ludwigia longifolia ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Ludwigia [Ludwigia peruviana ] | 3 | The plant must be fully and continuously suppressed and destroyed. |
| Mexican feather grass [Nassella tenuissima ] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Mexican poppy [Argemone mexicana ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Miconia [Miconia species] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Mimosa [Mimosa pigra] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Mossman River grass [Cenchrus echinatus ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Mother-of-millions [Bryophyllum species and hybrids ] | 3 | The plant must be fully and continuously suppressed and destroyed and the plant may not |

**Table B.1 NOXIOUS WEEDS LISTED FOR THE HAWKESBURY RIVER COUNTY COUNCIL**

| Weed | Class | Legal requirements |
|---|---|---|
| | | be sold, propagated or knowingly distributed. |
| Onion grass [Romulea species]<br>Includes all Romulea species and varieties except R. rosea var. australis | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Oxalis [Oxalis species and varieties]<br>Includes all Oxalis species and varieties except the native species O. chnoodes, O. exilis, O. perennans, O. radicosa, O. rubens, and O. thompsoniae | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Pampas grass [Cortaderia species ] | 3 | The plant must be fully and continuously suppressed and destroyed. |
| Parthenium weed [Parthenium hysterophorus] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Paterson's curse, Vipers bugloss, Italian bugloss [Echium species ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. |
| Pellitory [Parietaria judaica ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. |
| Pond apple [Annona glabra] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Prickly acacia [Acacia nilotica] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Prickly pear [Cylindropuntia species ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed.<br>This is an All of NSW declaration. |
| Prickly pear [Opuntia species except O. ficus-indica ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, |

**Table B.1 NOXIOUS WEEDS LISTED FOR THE HAWKESBURY RIVER COUNTY COUNCIL**

| Weed | Class | Legal requirements |
|---|---|---|
| | | propagated or knowingly distributed.<br>This is an All of NSW declaration. |
| Privet (Broad-leaf) [Ligustrum lucidum ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed. |
| Privet (Narrow-leaf/Chinese) [Ligustrum sinense ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed. |
| Red rice [Oryza rufipogon ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Rhus tree [Toxicodendron succedaneum] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.<br>This is an All of NSW declaration. |
| Rubbervine [Cryptostegia grandiflora] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Sagittaria [Sagittaria platyphylla ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration |
| Salvinia [Salvinia molesta ] | 3 | The plant must be fully and continuously suppressed and destroyed |
| Sand oat [Avena strigosa ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Senegal tea plant [Gymnocoronis spilanthoides] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Serrated tussock [Nassella trichotoma ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, |

**Table B.1 NOXIOUS WEEDS LISTED FOR THE HAWKESBURY RIVER COUNTY COUNCIL**

| Weed | Class | Legal requirements |
|---|---|---|
| | | propagated or knowingly distributed. |
| Siam weed [Chromolaena odorata] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Smooth-stemmed turnip [Brassica barrelieri subspecies oxyrrhina] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Soldier thistle [Picnomon acarna ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Spiny burrgrass [Cenchrus incertus ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed. |
| Spiny burrgrass [Cenchrus longispinus ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed. |
| Spotted knapweed [Centaurea maculosa] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| St. John's wort [Hypericum perforatum ] | 4 | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. |
| Texas blueweed [Helianthus ciliaris ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.<br>This is an All of NSW declaration. |
| Water caltrop [Trapa species] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant.<br>This is an All of NSW declaration. |
| Water hyacinth [Eichhornia crassipes ] | 3 | The plant must be fully and continuously suppressed and destroyed. |
| Water lettuce [Pistia stratiotes] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant. |

**Table B.1 NOXIOUS WEEDS LISTED FOR THE HAWKESBURY RIVER COUNTY COUNCIL**

| Weed | Class | Legal requirements |
|---|---|---|
| | | This is an All of NSW declaration. |
| Water soldier [Stratiotes aloides] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant. |
| | | This is an All of NSW declaration. |
| Willows [Salix species] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with. |
| Includes all Salix species except S. babylonica, S. x reichardtii, S. x calodendron | | This is an All of NSW declaration. |
| Witchweed [Striga species] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant. |
| Includes all Striga species except native species and Striga parviflora | | This is an All of NSW declaration. |
| Yellow burrhead [Limnocharis flava] | 1 | The plant must be eradicated from the land and the land must be kept free of the plant. |
| | | This is an All of NSW declaration. |
| Yellow nutgrass [Cyperus esculentus ] | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with. |
| | | This is an All of NSW declaration. |

*Appendix C*

# Weed Species Profiles

## C.1 African Boxthorn (*Lycium ferocissimum*)


**General**[14]

African Boxthorn is native to the southern coast of Africa. It grows in most soil types in Australia, particularly lighter soils, for example, in dry creek beds.

**Description**[14]

Erect shrub to 5m high and 3m across.

*Stems*: Brown to grey, much-branched, with spines up to 15cm on main branches. Smaller spines occur on branchlets.

*Leaves*: Glabrous, fleshy, to 3.5cm long, 2cm wide, ovate to elliptical on short stalks, clustered at the end of nodes.

*Flowers*: White with purple markings in the throat, 1cm in diameter, occur singly or in pairs, 5 petals.

*Fruit*: Orange-red, globular or ovoid berry, 1cm in diameter, smooth, shiny and drooping.

*Seed*: Light brown or yellow, numerous, ovoid or irregular, flattened, 2.5mm long, 1.5mm wide, small raised dots on the surface.

*Root*: Extensive deep branched taproot, producing new growth when broken.

**Life Cycle and Dispersal**[14]

Seeds germinate any time of year. Flower after 2 years, mainly in summer, but also throughout the year. Fruit eaten by birds and foxes, and are dispersed in droppings.

**Control**[14]

*Mechanical Control*: Can be pulled out with a tractor and chain, or cut with a chainsaw at the ground and painted with a glyphosate based product.

*Chemical Control*: Exposed surfaces sprayed or painted with registered chemical.

## C.2 African Love Grass (*Eragrostis curvula*)


**General**[14]

African Love Grass originated in southern Africa. As a weed it is found in disturbed soils along roadsides, railway tracks, riverbanks and waste places.

**Description**[14]

A vigorous densely tufted perennial grass, 30 to 120 cm in height.

*Stems*: Slender or robust, sometimes bent at the lower nodes, 30 to 120 cm long.

*Leaves*: Vary from green to blue-green in colour, narrow blades, 25 to 35 cm long and 3 mm wide, narrowly tapered and often curled near tips, margins often folded or rolled inwards; between the leaf blade and the sheath is a conspicuous ring or beard of hairs.

*Inflorescence*: Variable compact or loose and spreading panicle 6 to 30cm long, branches ascending, lowest branches may be in whorls; spikelets solitary, grey-green, 4- to 13-flowered, 4 to 10mm long, 1 to 1.5mm wide.

*Seed*: Creamy to dark orange or almost brown, 0.3 to 0.7 mm long.

*Roots*: Fibrous, primarily in the upper 50 cm of soil.

**Life Cycle and Dispersal**[14]

Seeds reproduce without fertilisation. Seeds germinate in autumn or spring if sufficient moisture is available. Flowering begins in early summer, with ripe seeds present from January to March. Seed can be spread short distances by wind and is also dispersed by animals, machinery, vehicles and in hay. It is readily spread during road construction in contaminated soils.

**Control**

*Mechanical control*: Small to medium plants should be removed by either crowning or digging out with a mattock. This method should be used when working near native vegetation.

*Chemical control*: African Love Grass can be treated by spraying with a registered chemical. Oversowing with a native perennial grass after spraying is advised.

## C.3 African Olive (*Olea europea* subsp. *africana*)


Adelaide Plains Animal and Plant Control Board

**General**[18].

African Olives have been planted as ornamentals and for hedges. They have become a problem in some areas by becoming a naturalised and invasive weed species.

**Description**[18]

African Olives are much-branched evergreen trees or shrubs.

*Leaves:* Leaves are 6 to 10 cm in length and 1 to 2.5 cm wide, with a hooked apex. The underneath surface is a green/ yellowish brown colour.

*Flowers*: Flowers are bisexual and are coloured white.

*Fruit*: Fruit is a drupe.

*Roots*: Tap and lateral.

**Life Cycle and Dispersal**[18]

When the plant is disturbed, it coppices from the base. It is dispersed by birds, soil, and the nursery trade. The seeds are short lived.

**Control**

*Manual Control*: Small seedlings should be cut and painted with a registered herbicide. Hand pulling large amounts of seedlings causes undesirable amounts of soil disturbance.

*Chemical Control*: Larger and more mature plants should be cut and painted or scrape and painted with a registered herbicide.

## C.4 Alligator Weed (*Alternanthera philpxeroides*)


**General** [14]

Alligator weed is a native of South America. It thrives in shallow drainage ditches, canals, rivers, lakes, reservoirs, swamps, rice fields, and wet or occasionally inundated pastures.

**Description**[14]

An almost glabrous rhizomatous perennial herb, growing either as a terrestrial or rooted emergent, or occasionally as a free-floating aquatic plant. Reproduces from rhizomes and rarely, it at all, by seed.

*Stems*: Prostrate, semi-prostrate or ascending, simple or branched, hollow with pubescent grooves on opposite sides of the internodes, prostrate stems light green, yellow or brown; ascending stems dark green, 10 to 70cm long.

*Leaves*: Dark green; opposite, sessile, linear, 2 to 7 cm long, 5 to 40 mm wide, narrowing at apex, blade fleshy with waxy surface and conspicuous veins radiating from the midrib.

*Flowers*: Silvery-white, cylindrical or subglobular heads 1.2 to 1.4 cm diameter, borne on glabrous or slightly pubescent stalks 2 to 7cm long.

*Fruit*: Brownish, thin-skinned, bladder-like, flattened and indehiscent.

*Seed*: Ellipsoid, smooth.

*Root*: Short and filamentous in water, rising mainly from the nodes, longer and thicket in soil, often extending to below 50cm.

**Life Cycle and Dispersal**[14]

Reproduction in the field is entirely vegetative. Growth starts with development of node buds on old stems in early spring. Spread when pieces of cut stem are shifted away from the source.

**Control**

*Mechanical control*: On small infestations, removal by hand will give temporary relief. Must ensure all parts of the plant are removed, including the deep roots, and disposed of appropriately.

*Chemical control*: Repeated herbicide treatments can be used on terrestrial infestations[19].

*Biological control*: The aquatic alligator weed flea beetle (*Agasicles hygrophila*) has had some success in controlling aquatic alligator weed [19].

## C.5 Blackberry (*Rubus fruticosus*)


Keith Turnbull Research Institute

**General**[14]

Blackberry is native to Europe. It has been introduced to many countries around the world and is considered a noxious weed in most countries. It inhabits areas with more than 750 mm annual rainfall and occurs in gullies, along streams, roadsides and readily invades native bushland.

**Description**[14]

An erect shrub growing in thickets which can be several meters high.

*Stems*: Erect and arched or trailing, to 7 m long, green to reddish purple, smooth or finely hairy, round, ribbed or angled, with numerous curved or straight prickles 3 to 12 mm long. Flowering shoots emerge from the first year canes in summer and after fruiting the cane dies back.

*Leaves*: Dark green above, and lighter green, often with whitish hairs below. Alternate, consisting of 3 or 5 toothed oval and ovate leaflets, with short prickles on leaf stalks and the under side of veins. Leaves normally shed in winter.

*Flowers*: White or pink, 2 to 3 cm diameter, formed in clusters at ends of short branches, 5 petals.

*Fruit*: A berry which changes colour from green to red to black as it ripens, 1 to 3 cm diameter, consisting of an aggregate of fleshy segments or drupelets each containing 1 seed.

*Seed*: Light to dark brown, somewhat triangular, 2 to 3 mm long, deeply and irregularly pitted.

*Root*: Most roots occur in top 20 cm of soil but a few are to 1 m deep.

**Lifecycle and Dispersal**[14]

Seed germinates in spring, and occasionally at other times. After several years thickets are usually 1 to 2.5 m high. Flowering commences in late November and extends to January, and fruit is produced from January to March. Plants may be deciduous through winter. Blackberry seed is spread for some distances by creeks and rivers. More importantly it is spread by birds and foxes which eat the fruit and can distribute seeds over a wide area. Tip rooting allows blackberry to take over large areas in only a short time.

**Control**

*Mechanical Control*: Effective control of established plants is achieved by physically removing the crowns and much of the root system by mattocking or through cultivation, or, on a larger scale, by bulldozing and ripping roots. Slashing or burning is often used, but neither is of more than temporary value because of extensive regrowth occurring from crowns and lateral roots. [14]

*Chemical control*: Herbicide treatments are considered the most practical and cost effective, however must be repeated every three to four years. The preferred products for herbicide control of Blackberry are any registered herbicide used to control Blackberry. These products contain active ingredients that are registered for use in NSW. Only those herbicide products containing active ingredients that are registered for use in NSW should be used.

*Biological control:* A species of fungus, *Phragmidium violaceum*, the blackberry rust fungus, causes annual defoliation of blackberry plants during summer. It is specific to the genus *Rubus*. Although the fungus does not kill the plant is makes thickets less dense and allows other plants to invade land occupied by blackberry. The fungus was illegally introduced to Australia, and is now widespread. [14]

## C.6 Bridal Creeper (*Asparagus asparagoides*)

**General**[14].

Bridal Creeper is native to South Africa. It occurs in open woodlands, in warm temperate regions, on fertile soils that have a light texture and are well-drained. It has been grown as an ornamental plant and is now a weed, colonising disturbed areas.

**Description**[14].

Erect or climbing perennial herb, to 3m high.

*Stems*: Slender, branching, and twining, change direction each node, can be up to 3m long.

*Leaves*: Glossy green, broadly ovate, sharply pointed multi-nerved cladodes, and 1 to 4.5cm long and 5 to 16mm wide.

*Flowers*: Greenish-white, 8 to 9mm diameter, stalks bent near summit.

*Fruit*: Red sticky globose berry, 6 to 10 mm diameter.

*Seed*: Black, shiny, ovoid to globose, 3 to 4mm diameter.

*Root*: Short thick rhizome, tuberous roots.

**Life Cycle and Dispersal**[14].

Germination in autumn to early winter, flowering commences in August or September. Plants become dormant in November, new growth begins in February or March. Fruit may remain on the plants for some time. Seeds usually fall close to the parent plant but the fruit can be eaten by birds. The plant spreads locally from tubers and severed rhizomes.

**Control**

*Manual control*: Dig out individual plants carefully, removing underground tuber, before they flower [14]. Physical removal is not effective unless all the rhizomes are dug up and destroyed [20].

*Chemical control*: Spot-spray for three consecutive years [14].

*Biological control*: Three natural enemies of Bridal Creeper have been introduced into Australia. These are: the bridal creeper leafhopper (*Zygina* sp.), rust fungus (*Puccinia myrsiphylli*) and leaf beetle (*Crioceris* sp.). The leafhopper feed on the leaves which eventually leads to less vigorous growth and reduced new tuber production. The rust fungus

attacks the leaves and stems. The grubs of the beetle strips shoots and leaves that enable the plant to climb [20].

## C.7 Broad-leaved Privet (*Ligustrum lucidum*)


**General**[21].

Large-leaved Privet was introduced to Australia as a garden shrub from China and Japan. The species replaces mid canopy trees in forest and may completely dominate an area of forest or forest fragment in time if unhindered.

**Description**[21].

Small to medium sized evergreen tree, to 10m high, sometimes a dense shrub.

*Stems*: Bark is thin, smooth and grey.

*Leaves*: Oval, glossy, 5-13cm long, 3-6cm wide, down-curving at the tip.

*Flowers*: Long panicles of small, cream-coloured fragrant flowers.

*Fruit and seeds*: Fruit up to 5-6mm diameter, bluish or purplish-black.

*Roots*: Has a tenacious woody root system.

**Life cycle and dispersal**

Flowers in spring and summer[22]. Fruit matures in July/August and is spread widely by birds and water.

**Control**

*Manual Control*: Can be removed by hand if small.

*Chemical Control*: Cut and paint plants below 50mm in diameter and drill and inject plants or scrape and paint above that and leave plants in-situ.

## C.8 Crofton Weed (*Ageratina adenophora*)


**General**[14]

Crofton weed is a native to South America. Occurs in humid subtropics, usually in creek beds and clearings in forests. It is found as a weed along roadsides, in abandoned cultivations areas and overgrazed pastures.

**Description**[14]

A many-stemmed perennial herb that grows to 2m high, reproducing from seed and vegetatively from a short rootstock.

*Stems*: Purplish, numerous, erect, smooth, cylindrical, shortly-branched, glandular and hairy at first but become woody with age, may root at nodes if damaged.

*Leaves*: Dark green, opposite, trowel-shaped, 5 to 8cm long, 3 to 7.5cm wide, tapering towards the apex, 3-nerved, glabrous or slightly pubescent, toothed margins.

*Flowers*: White tubular florets grouped in heads 5 to 6mm diameter, heads occurring in clusters, to 10cm across, at ends of branches.

*Seeds:* Dark brown-black, slender, angular, 1.5 to 2mm long, pappus of 5-10 fine white hairs 4mm long.

*Roots*: Short, thick pale yellow root with numerous secondary roots extending laterally to a radius of 1m and downwards to 40cm.

**Life Cycle and Dispersal** [14]

Germination occurs between December and September, especially February-March. In mature plants, growth occurs in summer rains, usually January. Flowering occurs during September. Seeds are shed October-January. Seeds are dispersed by wind and water.

**Control**[14].

*Mechanical control*: Crofton weed can be ripped, slashed or ploughed, followed by oversowing the area with grasses.

*Chemical control*: Can be sprayed when growing actively. Use a registered chemical as per label instructions.

*Biological control*: the Trypetid Gall Fly has been introduced to control Crofton Weed but its success is dependent on parasitism by native insects. Other organisms also can harm the plants but need to be used in combination to successfully control the weed.

## C.9 Lantana (*Lantana camara*)

**General**[14].

Lantana is a plant native to the warmer regions of the world thriving in both dry and humid climates. It exists as a weed along roadsides, creekbanks, fence lines, and in waste places. It is a common component of weedy pastures, parklands and arable fields.

**Description**[14].

Much branched, forming thicket-forming shrubs up to 3 m high with prickly stems. It has odorous leaves and bright multicoloured flowers.

*Stems*: Branched, woody, brittle, arching sprawling or scrambling, to 5 m long. Diameter ranges from 2-4 mm when young to 5 cm when mature. Coloured grey to brown with small prickles.

*Leaves:* Yellow-green to dark green, opposite, normally shortly and roughly hairy, ovate, 2 to 10 cm long and 2 to 7 cm wide, bluntly pointed apex, variably toothed. It has a strong odour when crushed.

*Flowers*: White, cream, yellow, orange, pink purple or a mixture of these colours, flat topped slightly rounded head, 2 to 3 cm across on stiff, finely hairy stalks.

*Fruit:* Green at first but ripening to a glossy purple-black, a 1-seeded berry (drupe) 5 to 8 mm, grouped in clusters of 1 to 20.

*Seed:* Pale straw-coloured, hard and stony, ovoid, 2 to 4 mm long.

*Root:* A robust, woody stockroot with numerous shallow laterals which sucker if damaged or broken.

**Lifecycle and Dispersal**[14].

Seeds may germinate at any time of year. When branches intertwine with branches of others thickets begin to form. Flowering occurs in early summer through to March or April from the second growth season. Lantana is spread by birds eating the fruit and also through the nursery trade. It increases the size and density of existing thickets by suckering and seedling growth within and along the edges.

**Control**[14].

*Mechanical Control*: Plants should be removed with a tractor and chain, and burnt before flowering, especially removing lateral roots. Slashing or burning without follow up only results in an increase in weed density. Regrowth after clearing should be spot sprayed.

*Chemical control*: Spot spraying regrowth with herbicides is effective. Cut and paint and scrape and paint with herbicides.

## C.10 Narrow-leaved Privet (*Ligustrum sinense*)


**General**[22]

The Narrow-leaved Privet is a native of China and a member of the olive family (Oleaceae). It is often cultivated as a hedge and has become a problem in some areas as a naturalised invasive woody weed on rainforest edges and fence lines of cleared areas.

**Description**[22].

Shrub up to 3 metres in height.

*Stems*: Young branches and new growth have hairs.

*Leaves*: Leaves are elliptic to ovate, 2.5 cm long, 1.5-2.5cm wide

*Fruit*: Berries are black and round in shape.

*Flowers*: White, small fragrant, white

**Life Cycle and Dispersal**[22].

Flowers in late winter to spring. Fruit are spread widely by birds and water

**Control**

*Manual Control*: Can be removed by hand if small.

*Chemical Control*: Cut and paint plants below 50mm in diameter and drill and inject plants or scrape and paint above that and leave plants in-situ.

## C.11 Noogoora Burr (*Xanthium* sp.)

**General**[14]

Noogoora Burr originated from North America. Occurs as weeds of cultivation, grazing land and undeveloped areas subject to summer rainfall, flooding or irrigation.

**Description**[14]

Erect annual herb to 2.5m high.

*Stems*: Blotched or streaked with purple, somewhat zig-zagged, covered with short coarse upwards pointing hairs.

*Leaves*: Darker green on upper; lower leaves opposite, upper alternate, to 15cm diameter, dissected into 3 or 5 large lobes, coarsely toothed; rough textured with minute bristles.

*Flowers*: Inconspicuous, clusters of both male and female flowers.

*Fruit*: Brown hard woody ellipsoid burr, numerous hooked spines, in clusters of 2 to 13.

*Seed*: Brown or black, 2 in each burr, 6 to 10mm long, one larger than the other.

*Root*: Stout taproot and extensive lateral roots.

**Life Cycle and Dispersal**[14].

Germinate after spring and summer rains. Plants die in autumn but most remain standing, bearing mature burrs for months. Burrs have hooked spines while attach to wool, skin and tails of other animals and other fibrous material.

**Control**

*Manual control*: If infestations are small, hand pulling and hoeing before flowering is effective

## C.12 Pampas Grass (*Cortaderia selloana*)


**General**[14]

This species is a native of the South American Pampas, the prairie areas of this continent. In Australia it occurs in subhumid and semi-arid tropical regions in open sunny places that receive added moisture. It is found in damp places, along streams, depressions, margins of mangrove swamps and in disturbed areas associated with roads, pipeline cuts, and walking trails in bushland and in wasteland.

**Description**[14]

Pampas Grass is a large tussock-forming grass and grows to about 6 metres. Leaves develop from the base and grow to about 2 metres. Individual plants are either female or bisexual, reproducing by seed and vegetatively.

*Stems:* Grey-green to yellow-green, erect, 2 to 6 m high, to 3 cm diameter, hollow

*Leaves*: Bluish-green above, dark green below, leaf sheath smooth or slightly hairy, without a waxy covering or distinct midrib, hanging down in a spiral from when dead; 2 m long and 3.5cm wide, tapering to a fine point. Margins are finely serrated and the upper part recurved through 180 degrees but not touching the ground.

*Flowers:* White, pink or mauve plume-like terminal panicle, 30 to 90 cm long, spikelets 2 to 5-flowered.

*Seeds:* Pale straw-coloured, narrowly elliptical 2 mm long, 0.6 mm wide, enclosed within flowering glumes.

*Root:* Fibrous, rising from short robust rhizomes but extending to 4m radially and to 3.5m deep.

**Lifecycle and Dispersal** [14]

Seeds germinate in spring. The inflorescence grows in spring but flowers do not emerge till late summer, the bisexual head a week or two before the female heads. Flowering begins in March and continues till May.

The seed-bearing florets of the female plant are particularly hairy and readily dispersed by wind, often being carried for up to 25 km. The almost hairless florets of the bisexual plant

tend to fall close to the parent plant. Seeding regeneration is rare and vegetative spread is common. Grubbed crowns that are dumped in tips and waste places can re-establish if moisture is available. Major dispersal has always been by humans in the course of trade.

**Control**[14]

*Mechanical Control*: The prevention of seeding by cutting flower heads as soon as they appear is a preferred strategy. Plants can be cut at the base and poisoned. Grub and remove plants especially when they are young and immediately burn all plant material. Before grubbing, carefully cut and remove the aerial growth of larger plants, which can be quite abrasive. Remove all rhizomes and the crown by grubbing when the soil is moist.

*Chemical control*: Good control can be obtained using herbicides such as glyphosate and hexazinone. Only those herbicide products containing active ingredients that are registered for use in the relevant state should be used.

## C.13 Prickly Pear (*Opuntia stricta*)

**General**[14]

Prickly Pear originates from North America Central and tropical America. Before the advent of controls this plant was the most serious weed in Australia and capable of growing in most parts of the continent.

**Description** [14]

An erect succulent shrub, which can grow up to 2m in height, reproducing by seed and from branch segments.

*Stems*: Fleshy, leaf-like joints, which carry minute scarred leaves on their surfaces[23]. Often a dull or bluish green in colour, glabrous, consisting of a series of fleshy segments each up to 30 cm long, 15 cm wide and 1 to 2 cm thick; each areole contains tufts of short, very finely barbed bristles and occasionally 1 or 2 spines.

*Leaves*: Small scale-like, produced beneath the areoles, only on young segments and are shed as the segments mature.

*Flowers*: Petaloids lemon yellow with greenish or pink markings on the back, 6 to 8cm diameter, sessile, possess a fleshy base, which becomes fruit.

*Fruit*: Skin reddish purple, flesh reddish, somewhat pear-shaped, 4 to 6cm long.

*Seed*: Yellow or pale brown, rounded, 5mm diameter, numerous.

*Roots*: Fibrous and shallow.

**Life Cycle and Dispersal** [14]

Germinate all year round. Local dispersal occurs around existing clumps, when segments or fruit drop to the ground and take root. Segments and fruit can also become attached and carried on wool and hides of animals, footwear and tyres of vehicles. Flood waters can also aid dispersal. However, the major method of dispersal is through human movement of plant parts. The droppings of birds and foxes can also contain viable seeds.

**Control** [14]

*Mechanical control*: Physical removal and burning of plants is effective, however, care must be taken to collect and destroy all segments and fruit. If mechanical control is

undertaken, as much of the root system should be removed as possible by grubbing or cultivation.

*Chemical*: Chemical control has not always been effective however a registered chemical could be used. For a small number of these plants, manual removal is recommended.

*Biological*: The most well known form of biological control is the Argentine Moth *(Cactoblastis cactorum*)[23]. This insect was introduced in 1925 and by 1932 the majority of prickly pear was killed in the worst affected areas.

Another insect that is also responsible for the demise of the prickly pear is the cochineal insect (*Dactylopius opuntiae).* These insects are specific to individual species of prickly pear or they attack only a limited number of prickly pear species. These species feed on the sap of the plant and inject a toxin. Another plant pathogen that attacks the prickly pear is the bacterial soft rot [24].

*Appendix D*

# Weed Species

## Table D.1 WEED SPECIES RECORDED IN THE WESTERN PRECINCT

| Scientific Name | Common Name | WONS | NSW Noxious Weeds Act for Hawkesbury River County Council | NSW Noxious Weed Act Class | Significant Weed in SMP |
|---|---|---|---|---|---|
| *Anagallis arvensis* | Scarlet Pimpernel | | | | |
| *Araujia sericifera* | Moth Vine | | | 4 | |
| *Asparagus aethiopicus* | Asparagus Fern | | | 4 | |
| *Asparagus plumosus* | Fern Asparagus | | | 4 | |
| *Aster subulatus* | Wild Aster | | | | |
| *Axonopus affinis* | Carpet Grass | | | | |
| *Briza subaristata* | | | | | |
| *Centaurium sp* | | | | | |
| *Ciclosperma leptophylla* | Slender Celery | | | | |
| *Cirsium vulgare* | Spear Thistle | | | | |
| *Conyza sp.* | a Fleabane | | | | |
| *Cynodon dactylon* | Couch | | | | |
| *Eragrostis curvula* | African Love-grass | | | 4 | ✓ |
| *Facelis retusa* | | | | | |
| *Gnaphalium sp* | a Cudweed | | | | |
| *Hypochaeris microcephala* | | | | | |
| *Hypochaeris radicata* | Flatweed | | | | |
| *Ligustrum sinense* | Narrow-leaved Privet | | ✓ | 4 | ✓ |
| *Linum monogynum* | | | | | |
| *Paspalum dilatatum* | Paspalum | | | | |
| *Plantago lanceolata* | Lambs Tongue | | | | |
| *Plantago myosuros* | | | | | |
| *Pyracantha sp* | Firethorn | | | | |
| *Richardia stellaria* | | | | | |
| *Romulea rosea* | Nut Grass | | | 5 | |
| *Rubus fruticosus* | Blackberry | ✓ | ✓ | 4 | ✓ |
| *Senecio madagascariensis* | Fireweed | | | 4 | |
| *Senecio pterophorus* | | | | | |

**Table D.1 WEED SPECIES RECORDED IN THE WESTERN PRECINCT**

| Scientific Name | Common Name | WONS | NSW Noxious Weeds Act for Hawkesbury River County Council | NSW Noxious Weed Act Class | Significant Weed in SMP |
|---|---|---|---|---|---|
| *Sida rhombifolia* | Paddys Lucerne | | | | |
| *Solanum pseudocapsicum* | Jerusalem Cherry | | | | |
| *Solvia sp* | Bindii | | | | |
| *Trifolium spp* | Clover | | | | |
| *Verbena bonariensis* | Purpletop | | | | |
| *Xanthium sp* | | | ✓ | 4 | ✓ |

*Appendix E*

# Implementation Schedule

# E.1 Year 1

## *E.1.1 Identify target species and areas*

*i.* Species of concern

- African Love Grass (*Eragrostis curvula*)
- Noogoora Burr (*Xanthium* sp.)
- Blackberry (*Rubus fruticosus*)
- Narrow-leaved Privet (*Ligustrum sinense*)

*ii*. Areas of concern

Areas mapped in Figure 3.1.

## *E.1.2 Objectives*

a) Prevent the spread of weeds resulting from construction activities

b) Contain and reduce current significant weed infestations

c) Prevent the spread of weeds into the Regional Park

d) Enhance areas marked for regional open space by removing weeds and establishing native species.

e) Community education.

## *E.1.3 Implementation*

The strategies for implementing objectives (a) to (e) above are found in the sections of this WMP as outlined in the corresponding points (a) to (e) below.

a) Implement strategies outlined in sections 4.2.1 and 4.2.2;

b) Implement strategies outlined in section 4.3.2 and the weed profiles;

c) Implement strategies outlined in sections 4.2.1, 4.2.2 and 4.3.2 and the weed profiles;

d) Implement strategies outlined in sections 4.2.1, 4.2.2 and 4.3.2 and the weed profiles; and

e) Develop information kits to be provided to new residents.

### *E.1.4 Monitoring and review*

- Short-term monitoring outlined in section 5.1
- Long-term monitoring outlined in section 5.2
- Review of the WMP outlined in section 5.3

## E.2 Year 2

### *E.2.1 Identify target species and areas*

*i.* Species of concern

As for year 1: Significant species not on this list that were detected during monitoring need to be added.

*ii*. Areas of concern

As for year 1: Any new areas of infestations detected during previous year.

### *E.2.2 Objectives*

As for year 1: Add or remove objectives based on previous year's end of year review.

### *E.2.3 Implementation*

As for year 1: Add or remove implementation strategies based on the current year's objectives.

### *E.2.4 Monitoring and review*

As for year 1.

## E.3 Year 3

### *E.3.1 Identify target species and areas*

*i.* Species of concern

As for year 1: Significant species not on this list that were detected during monitoring need to be added.

*ii*. Areas of concern

As for year 1: Any new areas of infestations detected during previous year.

### *E.3.2 Objectives*

Same as year 1. Add or remove objectives based on previous year's end of year review.

### *E.3.3 Implementation*

As for year 1: Add or remove implementation strategies based on the current year's objectives.

### *E.3.4 Monitoring and review*

As for year 1.

## E.4 Year 4

Ongoing maintenance unless active control is required (see years 1-3 for schedule).

## E.5 Year 5

Ongoing maintenance unless active control is required (see years 1-3 for schedule).