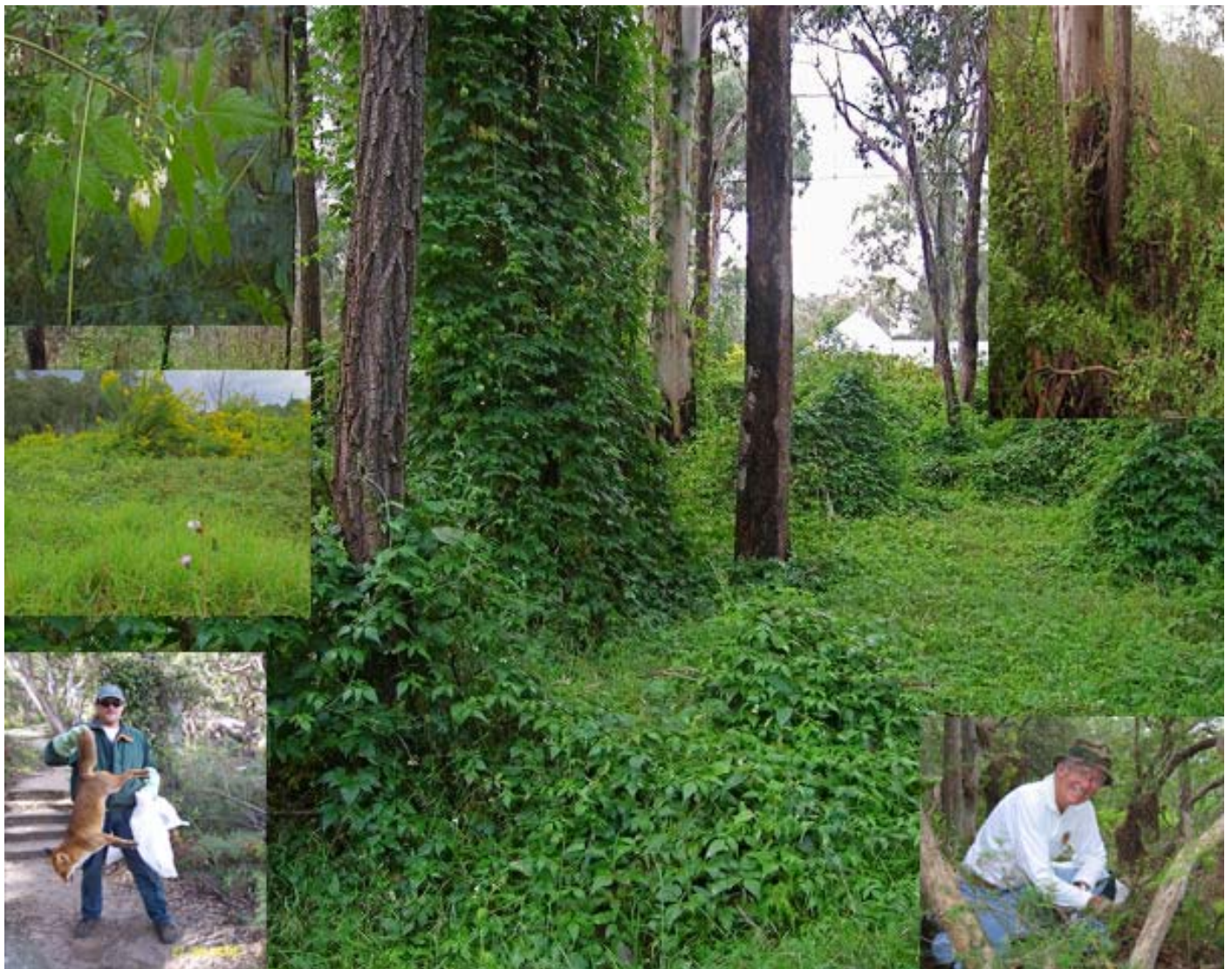




NSW National Parks
and Wildlife Service

Sydney Region Pest Management Strategy

2008-2011



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The New South Wales National Parks and Wildlife Service (NPWS) is now part of the Department of Environment and Climate Change (DECC). Throughout this strategy, references to “NPWS” should be taken to mean the NPWS carrying out functions on behalf of the Director General and the Minister of DECC.

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1.0 Introduction

Pest species are animals (including invertebrates) and plants that have negative environmental, economic and social impacts. In this document they are collectively referred to as pests. Pests are most commonly introduced species, though native species can become pests. In parks, pests may have impacts across the range of park values, including impacts on biodiversity, cultural heritage, catchment and scenic values.

Pests are among the greatest threats to biodiversity throughout Australia. In New South Wales, they have been identified as a threat to 657 of 945 (70%) species, populations and communities listed under the *NSW Threatened Species Conservation (TSC) Act 1995*; more than any other process except the destruction and disturbance of native vegetation. Minimising the impacts of pests on biodiversity is thus the main objective of NPWS pest management.

Pests can also have significant impacts on economic values of neighbouring lands. The National Parks and Wildlife Service (NPWS) seeks to address these impacts when setting management priorities and significant resources are committed towards landscape wide pest programs, including Wild Dogs.

The control of pests outside of parks is the responsibility of private landholders and other agencies such as rural lands protection boards, local councils, the Department of Primary Industries and the Department of Lands. The NSW Invasive Species Plan provides the framework for the coordinated management of weeds and pests that occur over varying land tenure. NPWS is a committed partner to the implementation of this plan.

Many pests are distributed widely across Australia and eradication is not possible in the foreseeable future. They occur in most environments and across all land tenures. Pests often spread quickly and have high reproductive rates, allowing them to re-establish rapidly following control. In recognising that eradication of widespread pests across large areas is an unrealistic goal, NPWS prioritises control effort to focus on areas where impacts are greatest. Resources can then be directed to ensure that the resultant control programs are effective in reducing these impacts. It is the responsibility of all land managers to work together to control pests where significant impacts have been identified.

In New South Wales, the main pest management priorities for the conservation of biodiversity are focussed on threatened species and endangered ecological communities, and are identified in the Threatened Species Priorities Action Statement (PAS), individual threat abatement plans (TAPs) and reserve plans of management. Pest programs are also integrated with other park management programs such as fire management.

2.0 Purpose of the Strategy

The development of Regional Pest Management Strategies (RPMS) provides NPWS with a strategic approach to pest management across NSW. The Strategy developed for each region provides a tool to broadly identify pest distribution and their associated impacts across the park system. It details priorities for each Region, including actions listed in the PAS and TAPs as well as other actions such as Wild Dog and Feral Pig control to protect neighbouring properties and site-based weed control and allows resources to be allocated to high priority programs. The RPMS also identifies the requirement for other plans or strategies, such as Wild Dog Plans or Bush Regeneration Plans, that provide a more detailed approach.

New pest species continue to establish in the environment either through the importation of new species into Australia or the escape of domestic plants and animals. Prevention and early detection followed by eradication is the most cost-effective way to minimise the impacts of new pests.

The NPWS works with other agencies to prevent the introduction of new pests into the wild and to respond rapidly when new incursions occur. The response of NSW government agencies to new pests will be coordinated through the NSW Invasive Species Plan.

In this strategy, the generic term "parks" is used to refer to any lands managed by NPWS including national park, nature reserve, aboriginal area, historic site, state conservation area and regional park amongst others. This strategy has a four year life span. In the final year of the strategy, it is intended that the strategy will be reviewed and updated.

3.0 Legislation and Policy

The NPWS has a number of statutory responsibilities in relation to pest management.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) vests the care, control and management of national parks, nature reserves, historic sites and Aboriginal areas with the Director-General of the NPWS. Key management objectives include conservation, provision of appropriate scientific and educational opportunities, and management of fire and pest species. These are achieved through the preparation and implementation of plans of management for each reserve, which identify pest species present, control strategies and priorities for that reserve.

Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) lists threatened species, endangered populations and endangered ecological communities. The TSC Act also lists *Key Threatening Processes* (KTPs), which are identified as having significant impacts on the conservation of native flora and fauna. As of December 2008, 19 pests have been listed as KTPs (see Appendix 3) e.g. *Predation by the Red Fox*, *Invasion of Native Plant Communities by Bitou Bush and Boneseed*. The NSW Threatened Species Priorities Action Statement (PAS) outlines the strategies for ameliorating threats listed under the TSC Act including the preparation of threat abatement plans. For each of these strategies the PAS lists one or more detailed actions which aim to protect threatened species by reducing the impact of listed threats.

Rural Lands Protection Act 1998

The pest animal provisions of the *Rural Lands Protection Act 1998* (RLP Act) outline the conditions under which animals, birds and insects are "declared" pests and provides for the control of such pest species. Gazettal of pest species occurs through Pest Control Orders that allow the Minister for Primary Industries to specify pest species on a state wide or local basis and the conditions or factors that apply to the control of each pest. Rabbits, Wild Dogs and Feral Pigs have been declared pest animals throughout NSW.

The RLP Act binds the Crown for the control of pest animals declared under the Act. Public land managers such as the NPWS are required to eradicate (continuously suppress and destroy) pest animals "...to the extent necessary to minimise the risk of the pest causing damage to any land" using any lawful method or, if the Order specifies a method to be used, by the method specified.

An approach to balance the conservation of Dingoes with the need for Wild Dog control has been incorporated into the RLP Act through the Pest Control Order for Wild Dogs. This order allows for the general destruction obligation for lands listed in Schedule 2 of the order to be satisfied through Wild Dog management plans with both control and conservation objectives.

Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* provides for the identification, classification and control of noxious weeds in New South Wales. The Act aims to identify noxious weeds and their respective control measures, as well as the roles and responsibilities for their control for both public and private land managers/owners.

Amendments to the *Noxious Weeds Act* in 2005 repealed the *NSW Seeds Act 1982* and introduced a new classification system of weed control classes based on the degree of threat and the distribution of the introduced plant within the state. These new control classes are:

Control Class 1 – State Prohibited Weeds

Control Class 2 – Regionally Prohibited Weeds

Control Class 3 – Regionally Controlled Weeds

Control Class 4 – Locally Controlled Weeds

Control Class 5 – Restricted Plants.

Under this new classification system, Control Classes 1, 2 and 5 noxious weeds are referred to as notifiable weeds.

Pesticides Act 1999

The *Pesticides Act 1999* and the Pesticides Regulation 1995, regulate the use of all pesticides in NSW, after point of sale, and includes specific provisions for record keeping, training and notification of use.

Specific requirements have been included under the Pesticides Regulation in relation the following.

Pesticide Record Keeping: Records must be kept by all people who use pesticides for commercial or occupational purposes such as on farm or as part of their occupation or business. There are also specific record keeping provisions for persons who aurally apply pesticides under both the Act and regulations.

Pesticides Training: People who use pesticides in their business or as part of their occupation must be trained how to use these pesticides. Any person employed or engaged by NPWS to use pesticides must also be trained.

Pesticide Notification: Notification requirements apply to pesticide applications by public authorities in public places (including NPWS managed park lands). The NPWS Pesticide Use Notification Plan sets out how the Department will notify the community about pesticide applications it makes to public places. (The plan can be located on the NPWS web site).

Pesticide Control Orders are orders that: prohibit or control the use of a pesticide or a class of pesticide, or authorise the use or possession of a restricted pesticide e.g. 1080.

Use of a pesticide must be in accordance with the Control Order where such exists. Current Control Orders can be found at:

www.environment.nsw.gov.au/pesticides/pco.htm.

Game and Feral Animal Control (Game) Act 2002

The major aim of the *Game and Feral Animal Control Act 2002* (Game Act) is to promote responsible and orderly hunting of game animals and certain pest animals. The public lands that are covered by this Act do not include any national park estate land.

Other Relevant Legislation

- *Environment Protection and Biodiversity Conservation Act 2000* (Commonwealth)
- *Agricultural and Veterinary Chemicals Code Act 1994*
- *Environmental Planning and Assessment Act 1979*
- *Firearms Act 1996*
- *Heritage Act 1977*
- *Prevention of Cruelty to Animals Act 1979*
- *Occupational Health and Safety Act 2000*
- *Wilderness Act 1987*
- *Protection of the Environment Operations Act 1997*

Park Management Program and policies

The Park Management Program is a series of guides which are being developed to define the values and objectives for park management and to integrate park policy, planning, operations, monitoring, evaluation and reporting. The aims of the guides are to improve the way we go about park management by:

- providing clear and consistent management objectives and operational procedures, and
- introducing a system to achieve consistent standards in park management and reporting on performance.

The Park Management Program comprises a Policy Guide, a Planning Guide, an Operating Procedures Guide and a Monitoring and Evaluation Guide.

The Policy Guide describes the goals and objectives for park management and the key principles which are applied to guide the achievement of these objectives.

Some specific policies relating to the management of weeds and pest animals are mentioned below.

Policy 2.6 Wild Dogs acknowledges the complexities inherent in the need to conserve native Dingoes (and their hybrids) together with the need to control Wild Dogs.

The NPWS Firearms Management Manual brings together the policy, procedural and technical information required for staff regarding the safety, security and legal procedures for keeping and using firearms. The manual replaced the *NPWS Firearms Policy* and provides policy and procedures for all aspects of firearms use and management including:

- possession and use of firearms by NPWS staff and other approved users,
- firearms administration and record keeping,
- location and storage of firearms,
- planning and risk management for firearms operations,
- maintenance and modification of firearms,
- animal welfare issues related to shooting pest animals and euthanasing native animals, and
- firearms training.

A state-wide policy directive requires conservation risk assessments for the application of pesticides on park to ensure that an appropriate level of environmental assessment is carried out prior to application.

Other plans

Other plans that help direct pest management may include Catchment Action Plans for each of the Catchment Management Authorities, regional weed plans, state and national strategies, and reserve Plans of Management. Plans specific to Sydney Region which help direct pest management include:

Harbour North and South Areas

Sydney Harbour Plan of Management

NPWS Fortifications Strategic Plan

Weed Management Strategy for Sydney Harbour NP and Botany Bay NP

Harbour North Area

Quarantine Station Conservation Management Plan

Quarantine Station Predator and Pest Plan

Feral Rabbit Management Plan (Sydney Harbour National Park)

Sydney Harbour National Park Field *Phytophthora* Protocols

Harbour South Area

Botany Bay Plan of Management

Wolli Creek Regional Park Bushland Regeneration Operations Plan

Cumberland North Area

Scheyville and Pitt Town Plan of Management

Castlereagh, Agnes Banks and Windsor Downs Plan of Management

Cattai Plan of Management

Wianamatta Regional Park Draft Plan of Management

Cumberland South Area

Deer Management Plan for Gulguer Nature Reserve

Kemps Creek NR Pest Strategy

Bents Basin SCA Pest Strategy

Mulgoa NR Plan of Management

Draft Prospect NR Plan of Management

Draft Kemps Creek NR Plan of Management

4.0 Regional Overview

The Sydney Region covers an area of approximately 200,650 hectares between the local government boundaries of Manly, Mosman and North Sydney to the north-east, Hawkesbury and Penrith to the north-west, Camden and Liverpool to the south-west, and Randwick, Hurstville, Rockdale and Botany to the south-east (see Map 1). Sydney Region covers 47 State Electorates and 39 Local Government Areas. The region falls within the bounds of two catchment authorities: the Sydney Metropolitan and the Hawkesbury-Nepean.

The region is geographically divided into four management units. These are Harbour North, Harbour South, Cumberland North and Cumberland South Areas. Sydney Region contains four National Parks, nine Nature Reserves, eight Regional Parks and one State Conservation Area. Currently Newington Nature Reserve, Western Sydney, Parramatta River, and Penrith Lakes Regional Parks are being managed by, or are in the process of being transferred to, other agencies, and are not included in this strategy. The total area of reserves managed by DECC in the Sydney Region is

4204 ha. Additions to the reserve system within Sydney Region are likely within the next few years, and the strategy may need amending accordingly.

The reserves of Sydney Region are highly diverse, ranging from islands within Sydney harbour, and harbour headlands on sandstones, to remnant vegetation on the shale derived Cumberland Plain as well as larger areas of bushland on the shale/sandstone transition from the Cumberland Plain to more elevated areas in the west and the north. Sydney Harbour National Park regularly plays an active role in festivals that are based around the harbour, and attracts over 2 million local and overseas visitors each year, while the parks in western Sydney provide important recreational opportunities to some of the state's most important growth centres. In Sydney Region, Prospect NR is unique in that it lies within a "Drinking Water Special Area", and is jointly managed with Sydney Catchment Authority. The catchment encompassed by the reserve is an integral component of Sydney's water supply and as such, requires special consideration of the potential impacts of pests and pest control activities on water quality.

Many of the reserves in the Sydney Region are remnant islands of vegetation surrounded by urban development or rural residential development, and because of this, they are continually exposed to conditions conducive to weed invasion such as increased nutrient flows from storm water runoff, illegal dumping of garden wastes and escapes of invasive garden plants from adjoining properties. Most of the reserves contain remnants of Endangered Ecological Communities (EECs) and they represent island-like refuges for at least 47 threatened fauna and 19 threatened plant species as well as two endangered fauna populations and one endangered plant population (see Appendix 1). Fourteen EECs are conserved within Sydney Region reserves (see Appendix 2) and these constitute around 71% of the vegetation within reserves, which makes prioritisation of weed control even more challenging. Several reserves also contain significant wetland areas which are important for migrating bird species. A number of *Key Threatening Processes* that impact upon these EECs and threatened species have been identified across the region (see Appendix 3). The management of pest species that are known to impact on threatened species, populations and communities is identified as a critical priority for DECC.

Sydney Region includes most of the first areas in NSW cleared for agricultural purposes and therefore a wide variety of plants and animals have been introduced. Disturbance from past land-use such as agriculture, grazing of many reserves and historical plantings has also left a legacy of numerous pest species.

The number of regional pest control programs has increased over the past few years and targets a range of pest species. The involvement of community bush regeneration groups and corporate volunteer programs assists in tackling weed invasions while also playing a role in community education and increasing community involvement in parks. Sydney Region also works co-operatively with a number of local governments, four Regional Weed Committees and two urban animal action groups to implement regional weed management plans and pest management across multiple land tenures. A number of research programs are also being undertaken in coordination with various universities and the Weeds and Invasive Animals Cooperative Research Centres to trial various weed control methods which may be more cost-effective across the broader landscape.

Map 1: Sydney Region Reserves.



5.0 Pest Distribution Tables

The following pest distribution tables give an overview of priority pest species for each reserve within the Region. The data has been derived from a combination of systematic surveys, consultation with staff and other agencies and through planning processes. The tables are not comprehensive lists of all pest species within the Region, but represent the most significant pests.

- Denotes established widespread populations throughout a reserve
- Denotes scattered populations throughout a reserve
- ⊙ Denotes isolated populations restricted to a small geographic area of a reserve

	Fox	Rabbit	Deer	Cat	Black Rat
Harbour North					
Sydney Harbour National Park (Nth)	○	○		○	●
Harbour South					
Sydney Harbour National Park (Sth)	○	○		○	○
Botany Bay National Park (Nth)	○	○		○	○
Wolli Creek Regional Park	○	○		○	
Cumberland North					
Agnes Banks Nature Reserve	○	○		○	
Castlereagh Nature Reserve	○	○			
Cattai National Park	○	○	○	○	○
Pitt Town Nature Reserve	○	○		○	
Rouse Hill Regional Park	○	○			
Scheyville National Park	○	○		○	○
Wianamatta Regional Park	○	○			○
Windsor Downs Nature Reserve	○	○		○	
Cumberland South					
Bents Basin State Conservation Area	○	○	●	○	○
Gulguer Nature Reserve	○	○	●	○	
Kemps Creek Nature Reserve	○	○			
Mulgoa Nature Reserve	○	○	○	○	○
Leacock Regional Park	○	○		○	
Prospect Nature Reserve	○	○		○	
William Howe Regional Park	○	○		○	

- Denotes established widespread infestation throughout a reserve
- Denotes scattered infestation throughout a reserve
- ⊙ Denotes isolated infestation restricted to a small geographic area of a reserve (encompassing new weed incursions)

Targeted Noxious/Environmental Weeds (including garden escapes) that are treated singularly:

	African Boxthorn	African Olive	Alligator Weed	Bitou Bush/ Boneseed	Blackberry	Black Locust	Box Elder Maple	Cootamundra Wattle	Green Cestrum	Honey Locust	Lantana	Ludwigia	Privet (Large leaved)	Privet (Small leaved)	Salvinia	Tree of Heaven	Willows
Harbour North																	
Sydney Harbour National Park (Nth)		⊙	⊙	⊙	○			⊙			●		○	○			
Harbour South																	
Sydney Harbour National Park (Sth)		○			○												
Botany Bay National Park (Nth)				●	○						○	○					
Wolli Creek Regional Park		○			⊙						○	○	○				○
Cumberland North																	
Agnes Banks Nature Reserve					⊙	⊙					○					⊙	
Castlereagh Nature Reserve																	
Cattai National Park		○			●		⊙		○	○	●		○	●	⊙	○	○
Pitt Town Nature Reserve					○				●	●							
Scheyville National Park	○	○			●			○	⊙	⊙	●				○		○
Windsor Downs Nature Reserve								⊙			⊙				⊙		
Wianamatta Regional Park					○												
Rouse Hill Regional Park		●			⊙				○		○		○	○			
Cumberland South																	
Bents Basin State Conservation Area		●	⊙		○		●			●	●		●				⊙
Gulguer Nature Reserve			●				○				⊙		○				⊙
Kemps Creek Nature Reserve	○	○	●		○		⊙				⊙		○	○			
Mulgoa Nature Reserve		●			○						●		○		○	○	
Leacock Regional Park	○	●			○	○			○	⊙	●		○	○		⊙	
Prospect Nature Reserve		○			○				⊙		○		○	○			⊙
William Howe Regional Park	○	●									⊙						⊙

- Denotes established widespread infestation throughout a reserve
- Denotes scattered infestation throughout a reserve
- ⊙ Denotes isolated infestation restricted to a small geographic area of a reserve (encompassing new weed incursions)

Exotic Perennial Grasses

	African Lovegrass	Bamboo	Buffalo Grass	Chilean Needlegrass	Couch	<i>Ehrharta</i>	Kikuyu	Pampas Grass	Paspalum (Tussock)	Rhodes Grass	Whisky Grass
Harbour North											
Sydney Harbour National Park (Nth)	○	⊙	○		○	○	⊙	○	○	○	○
Harbour South											
Sydney Harbour National Park (Sth)	○	⊙	○		○	○	○	⊙		○	○
Botany Bay National Park (Nth)	○				○	○		⊙		○	○
Wolli Creek Regional Park	○				○	○	○	○		○	○
Cumberland North											
Agnes Banks Nature Reserve	○			Eradicated			⊙			⊙	
Castlereagh Nature Reserve							⊙			⊙	○
Cattai National Park	○				○		⊙			⊙	○
Pitt Town Nature Reserve											
Scheyville National Park	●						○			⊙	○
Windsor Downs Nature Reserve	○						○				○
Wianamatta Regional Park	⊙									⊙	
Rouse Hill Regional Park	○				○		○			○	
Cumberland South											
Bents Basin State Conservation Area	●				●		○				
Gulguer Nature Reserve					⊙						
Kemps Creek Nature Reserve	○				○		○			○	
Mulgoa Nature Reserve	○				⊙		○			○	
Leacock Regional Park	○				○	○	○	⊙		○	
Prospect Nature Reserve	○	⊙			⊙		○	⊙		⊙	
William Howe Regional Park	○				⊙		○	○		○	

- Denotes established widespread infestation throughout a reserve
- Denotes scattered infestation throughout a reserve
- ⊙ Denotes isolated infestation restricted to a small geographic area of a reserve (encompassing new weed incursions)

Exotic Vines and Scramblers:

	Asparagus Ferns (ground & climbing)	Balloon Vine	Bridal Creeper	Cape Ivy	Cats Claw Creeper	Dolichos Pea	Honeysuckle (Cape)	Honeysuckle (Japanese)	Madeira Vine	Moth Vine	Morning Glory	Pampas Lily-of-the-valley	Turkey Rhubarb	Trad
Harbour North														
Sydney Harbour National Park (Nth)	●			○		⊙	⊙	○	⊙	⊙	⊙	⊙	○	○
Harbour South														
Sydney Harbour National Park (Sth)	●											⊙	○	
Botany Bay National Park (Nth)	○			○									○	○
Wolli Creek Regional Park	○	○	○						○	○	○	⊙	○	○
Cumberland North														
Agnes Banks Nature Reserve	⊙													
Castlereagh Nature Reserve														
Cattai National Park	⊙	○		○	○			○		○				○
Pitt Town Nature Reserve		●	●							●				
Scheyville National Park		⊙	●						○	○				
Windsor Downs Nature Reserve														
Wianamatta Regional Park														
Rouse Hill Regional Park	○		○	○					○	○				○
Cumberland South														
Bents Basin State Conservation Area		●	○							○	○			○
Gulguer Nature Reserve				○										○
Kemps Creek Nature Reserve	⊙	○	●							○	⊙			○
Mulgoa Nature Reserve			○		●					●				○
Leacock Regional Park		○	○		○			○	⊙	○	○			○
Prospect Nature Reserve	⊙		○							○	⊙			
William Howe Regional Park			○							○				○

6.0 Pest Management Objectives

The overriding objective of NPWS pest management programs is to minimise the adverse impacts of pests on biodiversity and other park values whilst complying with legislative responsibilities.

Programs also aim to:

- manage pest populations to minimise their impact on neighbours,
- increase community understanding of the adverse impacts of pests on biodiversity and Aboriginal and historic cultural heritage, and
- support cooperative approaches and participation in pest management programs with the community and other agencies.

7.0 Pest Management Principles

Wherever possible, NPWS adopts an integrated approach to pest management, where more than one control technique is used across the landscape. Integrated pest management is likely to be more effective because it avoids selecting for herbicide resistant weed biotypes or bait-shy animals. Targeting more than one pest species is important as the control of one species may benefit another e.g. control of foxes may benefit rabbits, control of Bitou Bush often leads to an increase in other weeds. Also, control is usually undertaken at particular times of the year when pests are most vulnerable (e.g. translocation of herbicides to growing points is usually greater when weeds are flowering).

So that pest management undertaken by the NPWS is carried out effectively and efficiently, the following principles are generally applied.

- Pest control is targeted to species/locations where benefits will be greatest.
- Development of control priorities are set by clearly defining the problem to be addressed i.e. specific impacts are identified so that the purpose of control is clear.
- Where relevant, pest control is collaborative and across tenure, that is, undertaken on a landscape approach.
- Early detection of new incursions and rapid response is considered a high priority as this is the most cost-effective form of pest control.
- Priority is given to mitigating the impacts on biodiversity of a pest that has cultural significance, whilst minimising impacts on cultural values.
- The aim of most pest control programs is to minimise the adverse impacts of pests, as many exotic pests are already widespread (e.g. foxes, blackberries) and for these species eradication is not possible.
- The focus of control programs is directed towards the values to be protected, because killing pests, by itself, does not necessarily minimise their impacts due to the fact that ecological processes are complex and can be affected by a range of factors.
- Site specific risk assessments are undertaken prior to pest control, where required.
- Pest management strives to strike a balance between cost efficiency, target specificity and animal welfare.
- Where appropriate, pest control employs a combination of control methods and strategies (integrated pest management).

- Pest control programs take a holistic approach, given that the control of one pest may benefit other pests, in that they attempt to control all significant pest threats at a site.
- Pesticide use complies with relevant legislation and is employed in a manner that minimises impacts on the environment.
- Pest management programs are often integrated with other land management activities such as fire management and recreation management.
- Monitoring is being implemented, at varying levels, to demonstrate and improve the ongoing effectiveness of control programs.

8.0 Pest Program Priorities

NPWS prioritises its pest control programs to focus on those areas where the impacts of pests are likely to be greatest. Resources can then be directed to ensure that the resultant control programs are effective in reducing these impacts. The availability of suitable control techniques and resources (both financial and physical), as well as the practicality and cost effectiveness of control, also influence which programs can be implemented.

Where new pest incursions occur, early detection and eradication is the most cost-effective way to minimise the impacts. The NPWS will work with other agencies to prevent the introduction of new pests and to respond rapidly when new incursions occur.

The following key factors are considered when determining priorities for pest management within the Region.

Critical Priority

1. Programs targeting pests which are, or are likely to be, significantly impacting on biodiversity, as largely identified in the NSW Threatened Species Priorities Action Statement and the regional ranking of areas of critical conservation significance within EECs, e.g. undertake weed control for Bitou Bush and Boneseed at priority sites in accordance with the approved Threat Abatement Plan, Recovery Plan, Recovery Team and associated PAS actions;
2. Programs that target pests which impact significantly on human health or are part of a declared national emergency, e.g. outbreak of foot and mouth disease or control of Feral Pigs in the catchment area of a domestic water supply reservoir;
3. Programs targeting pests that impact significantly on agricultural production, e.g. Wild Dog control where there is potential for significant stock losses as identified in Wild Dog Management Plans; programs to control State Prohibited or Regionally Prohibited Noxious Weeds (Control Class 1 and 2 weeds);
4. Programs addressing new occurrences of highly invasive pest species with potential for significant impacts on park values (subject to risk/feasibility assessment), e.g. control of Serrated Tussock in an area previously free of the weed;

High Priority

5. Programs that target pests (other than those covered in priorities above) that impact significantly on World Heritage or international heritage values or on areas identified as having very high significance in the regional ranking of conservation

significance of EECs e.g. control of rabbits impacting on World Heritage values of Mungo NP; pest control in RAMSAR wetlands;

6. Programs targeting pests that impact significantly on important cultural heritage values' e.g. control of Feral Goats where they are inhabiting an area containing Aboriginal rock art; control of rabbits undermining an historic building;

Medium Priority

7. Programs that target pests (other than those covered in priorities above) that impact significantly on Wilderness, Wild Rivers, national heritage values or other important listed values, e.g. control of Willows along a declared Wild River or within a Wilderness area;
8. Programs that target pests that are significantly impacting on regionally scarce key habitat components or resources such as tree hollows (in areas other than those covered in the priorities above);
9. Programs that target pests that impact significantly on recreation, landscape or aesthetic values, e.g. control of Blackberry on the margins of camping areas; control of weeds in an area of natural beauty that is visited frequently;
10. Community or cooperative programs targeting pests that impact significantly on park values or agricultural production and that have ongoing, proven effectiveness and participation, e.g. control of Willows with the assistance of an established community group; control of Regionally Controlled Noxious Weeds (Control Class 3 weeds);
11. Community or cooperative programs that are implemented as part of an endorsed state or regional plan (and not covered above in higher priorities), e.g. control of Bitou Bush across boundaries as part of a regional control plan prepared by a regional weeds advisory committee and supported by NPWS.

Lower Priority

12. Community programs targeting pests that have localised impacts on natural ecosystems or agricultural lands and that promote community education and involvement with parks, e.g. participation in a new bush regeneration project with a local community group; control of Locally Controlled and Restricted Noxious Weeds (Control Class 4 and 5 weeds);
13. Previous programs targeting pests that have localised impacts on native species and ecosystems, and that can be efficiently implemented to maintain program benefits, e.g. the maintenance of areas treated previously for Serrated Tussock to keep them weed free.

In some circumstances, new programs may be introduced, or priority programs extended to target pests where a control "window of opportunity" is identified, e.g. where burnt areas become more accessible for ground control of weeds; where drought makes control of Feral Pigs and Feral Goats more efficient because they congregate in areas where water is available; or when a new biocontrol agent becomes available or when weed or location specific external funding opportunities arise.

Future priorities for pest control will need to reflect changes in the distribution, abundance or impacts of pests that may occur in response to environmental changes including climate change. NPWS is supporting research to understand the interaction between climate change, pests and biodiversity.

9.0 Pest Program Recording and Monitoring

Measuring the response of biodiversity (or other values) to pest control is necessary in order to:

- demonstrate the degree of impacts and hence justify priorities for management, and
- measure the effectiveness of ongoing control and direct resources to those programs with the greatest effect.

Measuring the response of biodiversity can be difficult because populations of native species can vary in space and time for many reasons, so that differentiating the effects of pest control from other sources of variation is often complex. Where populations cannot be counted directly, measurement is dependent on using indices of abundance. Rigorous attempts to measure population responses need to consider experimental design (e.g. treatment and non-treatment sites, replication, time scale for measurable responses to occur), sampling design (because the entire population can rarely be measured) and standardisation of population measures to allow data to be collated across NPWS (across sites, times and land tenure where appropriate). As a result, measuring the response to pest control is expensive and can be afforded for only a small sub-set of control programs.

Where native populations are rare, cryptic or dispersed, or where a suite of species is predicted to be affected, indicator species, or other indices of relative abundance, can be used to provide an indirect measure of effectiveness. For example, while fox control may benefit a broad range of ground dwelling mammals, monitoring may focus on a particular “indicator” species which may be easy to capture.

The monitoring of response of pest species distribution and abundance provides an interim measure of effectiveness which is essential:

- to aid comparison between control effort and biodiversity response;
- to provide useful data where biodiversity, other park values or agricultural responses are too difficult to measure or there is insufficient resources to make proper measurement;
- to provide an interim measure where native species may take some time to respond to pest control.

Where pest incursions have occurred recently, or where their distribution is otherwise limited, the objective of control is usually to eradicate the incursion completely or to contain its spread. In these situations, monitoring is required to confirm eradication or containment and should focus on the pest species rather than the response of native species to control. Such an approach may require methods that are capable of detecting populations at very low densities and prolonged monitoring will be required to ensure that containment or eradication has been achieved.

Where appropriate, monitoring programs should also include measures to verify the results of research being undertaken to gain a better understanding of the interaction between pests and climate change.

Systems and databases are being developed for the consistent and systematic collection, collation, storage and analysis of data as part of the Monitoring and Evaluation component of the Park Management Program.

10.0 Regional Coordination and Support of Pest Control Programs

Pest control programs in Sydney Region are implemented and co-ordinated at a local NPWS Area level with coordination and strategic planning and support at the Regional level in order to ensure that resources are utilised to achieve the best possible outcomes. Area and Regional assistance is also required to efficiently work with neighbours, community groups and other agencies. Education of staff and the broader community are essential requirements in integrated pest management and are also best achieved by centralised coordination.

In Sydney Region, Area staff manage projects and undertake on-ground control works with technical advice from the Regional OSCU. The Biodiversity Officer provides technical advice on biodiversity impacts and strategic priorities. Integrated cross-tenure pest management is facilitated in many ways. Area staff participate in two regional Urban Feral Animal Action Groups (UFAAG) and four Regional Weed Committees. The Regional Weed Committees have developed cross-tenure regional plans to which Sydney Region Parks and Wildlife Group is a party. These Regional Plans can be downloaded at www.sydneyweeds.org.au and include:

- African Olive Management Plan for the Sydney Region (2008-2013)
- Control of Aquatic Weeds in the Sydney West-Blue Mountains & Sydney North Regions (2006-2010)
- Aquatic Weed Management Plan for the South-west Sydney and Sydney Central Regions (2008-2010)
- Regional Asthma Weed Management Plan – Sydney Central (2003-2008)
- Sydney Wide Bitou Bush and Boneseed Regional Management Plan (2004-2009)
- Sydney Region Bridal Creeper Management Plan (2004-2009)
- Sydney Wide Green Cestrum Regional Management Plan (2006-2011)
- Sydney Wide Grasses Management Plan “the big four” (2006-2011)
- Sydney Wide Ludwigia Management Plan (2008-2013)
- Sydney Regional Privet Management Plan (2005-2010)

11.0 Pest Program Overviews

11.1 Vertebrate Pests

11.1.1 European Red Fox (*Vulpes vulpes*)

Distribution and abundance

Since their introduction into Australia in the 1870s, foxes have contributed to significant declines in the distribution and abundance of a suite of native fauna, particularly among medium-sized ground-dwelling and semi-arboreal mammals and ground-nesting birds. Foxes occur in most environments in Australia and have been recorded in almost all reserves in the Sydney Region, although many are only occasional visitors.

Foxes are now so abundant throughout Australia that removal of one animal from a reserve will likely lead to that animal being replaced by another. There are also complex interactions between pest species, for example, studies have shown that fox removal can lead to an increase in rabbit numbers; and interspecific competition between foxes and cats suggests that removing one species may lead to an increase in the other species, at least in some habitats (English and Chappel 2002).

Impacts

Fox predation is a recognised threat to native animal populations, in particular the threatened fauna populations that occur in Sydney Region, such as the endangered population of Long-nosed Bandicoots (*Perameles nasuta*) at North Head in Sydney Harbour NP, and the endangered population of Little Penguins (*Eudyptula minor*) at Manly. Foxes are also recognised as an agent of dispersal for Bitou Bush/Boneseed which threatens Eastern Suburbs Banksia Scrub EEC.

Predation by the European Red Fox was the first *Key Threatening Process* to be listed under the *NSW TSC Act 1995*. Sydney Region participates in a co-operative cross-tenure fox control program co-ordinated by the Urban Feral Animal Action Group (UFAAG) – Sydney North Fox Control Program which involves another NPWS region and 17 other land management agencies.

Priorities for control

Critical Priority

Control priorities are driven by the species and sites identified by the Fox Threat Abatement Plan (TAP) and North Head, Sydney Harbour NP is an identified site for the protection of the:

- the endangered population of Little Penguins at Manly; and
- the endangered population of Long-nosed Bandicoots at North Head.

The Priority Action Statement (PAS) for the vulnerable Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) requires control of foxes at important roosting sites. The Middle Head/Georges Head Fortifications are a significant over winter roosting sites for this species in Sydney.

Medium Priority

Maintain existing co-operative control program under Sydney North UFAAG at Bradleys Head, Chowder Bay and Clifton Gardens and Dobroyd Head, Sydney Harbour NP.

Participate in the development of co-operative control programs where interest exists in other areas and where foxes are known to be having a significant impact on threatened species. Development of any new programs should be in accordance with the Fox TAP and should have clearly articulated objectives.

Control

Strategic 1080 baiting programmes to be carried out twice annually as part of the Sydney North Regional Fox Control Program on a co-operative basis with neighbours. Opportunistic ground shooting where the distance from habitation permits.

Monitoring

- Existing monitoring of the endangered Long-nosed Bandicoot and Little Penguin populations to be continued, including the maintenance of mortality registers for these species as determined by the recovery team.
- Fox populations near infestations of Bitou Bush to be monitored.
- Monitoring of bait taken at bait stations to be carried out as part of the control program
- Fox activity to be monitored quarterly via track counts on sand pads at North Head. Data gathered is to be analysed by the Pest Management Unit and published periodically as part of the review of the Fox Threat Abatement Plan.

11.1.2 European Rabbit (*Oryctolagus cuniculus*)

Distribution and abundance

The European Rabbit was successfully introduced into Australia in 1858, it now occurs in most habitats on the continent. Rabbits occur in scattered populations throughout the Sydney Region, although their densities fluctuate. Their numbers fluctuate in response to conditions peaking in spring and summer and also to outbreaks of naturally occurring myxomatosis (usually annually in February – March). Calciivirus has affected rabbit populations in Sydney reserves in the past, mostly south of the M4, but appears to be least effective in coastal reserves. Major rabbit infestations occur in Sydney Harbour NP (especially the Quarantine Station), Cattai NP and Scheyville NP.

Impacts

Feral rabbits impact on native plant and animal species by various direct and indirect mechanisms including: increasing soil erosion by removal of vegetation, reduction of native plant regeneration by grazing on seedlings and young plants, competition with native fauna for habitat and food, modification of habitat making it unsuitable for other species, dispersal of weeds, disturbance of foundations of sites of historic significance, and decreasing recreational amenity of an area (e.g. public safety issue posed by extensive warren systems). Grazing by rabbits can also have effects on the structure and composition of Endangered Ecological Communities. Competition and land degradation by feral European Rabbits is listed as a *Key Threatening Process* under both the *Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and the *NSW TSC Act 1995*.

Within Sydney Region, monitoring of Eastern Suburbs Banksia Scrub EEC regeneration post-fire at North Head (with experimental enclosure plots) has demonstrated that rabbits may have a considerable impact through predation of seedlings.

Priorities for control

Critical Priority

Critical priorities are to control impacts on the following EECS:

- Eastern Suburbs Banksia Scrub (ESBS) EEC at North Head, Sydney Harbour NP; and Botany Bay NP;
- Western Sydney Dry Rainforest EEC – Cattai NP; and
- Shale/Sandstone Transition Forest EEC - Cattai NP.

Medium Priority

Maintain existing co-operative whole of headland rabbit control program with neighbouring landowners in accordance with the Feral Rabbit Management Plan for Sydney Harbour NP.

Control the impacts of rabbit populations on recreation at Cattai and Scheyville National Parks, and if possible develop co-operative programs with adjoining landowners.

If necessary, revitalise co-operative control programs with adjoining neighbours at Botany Bay NP.

Control

Rabbit control requires a combination of control techniques including: baiting with pindone, fumigation, trapping, warren ripping, shelter reduction where shelter

comprises weed species, biological control and opportunistic shooting. Management of feral rabbits at North Head, should be in accordance with the Feral Rabbit Management Plan – Sydney Harbour NP and the Quarantine Station Predator and Pest Animal Plan, 2008.

Monitoring

The numbers of rabbits in the vicinity of these EECs and their impacts should be monitored and used to determine the need for control programs. For example, currently rabbits are not impacting on the ESBS at Botany Bay or the Western Sydney Dry Rainforest at Cattai, so no control is currently necessary. Monitoring of rabbit numbers at North Head should be in accordance with the Feral Rabbit Management Plan – Sydney Harbour NP and the Quarantine Station Predator and Pest Animal Plan, 2008.

Continue implementation of the rabbit exclusion plot monitoring in ESBS at North Head. A record will be kept by Area Staff of positive and negative feedback from neighbours and visitors on rabbit numbers in areas mentioned above, particularly with regards to impacts on recreation and amenity.

11.1.3 Feral Deer (Fallow deer - *Dama dama* and Red Deer - *Cervus elaphus*)

Distribution and abundance

Deer were introduced into Australia by acclimatisation societies in the late 19th and early 20th centuries to enhance the local environment and provide sporting opportunities. Several of these populations survived and formed the basis of larger, well established wild deer populations. Deer were also introduced by farmers in the late 20th century through the release of animals during poor climatic and economic conditions and through their escape from poorly-maintained farms. In addition, hunters and hunting agencies have released deer into the wild in the late 20th century for trophy development. As a consequence several species of deer have formed wild populations in many habitats, ranging from arid woodland to rainforest.

A growing population of Fallow Deer is now established in and around Gulguer NR and Bents Basin SCA, and individuals of both the Fallow Deer and the Red Deer have been regularly sighted in Cattai NP and the population is believed to be growing. There have also been sporadic sightings close to (but not within) other Sydney Region reserves such as Agnes Banks NR, Castlereagh NR, Mulgoa NR and Scheyville NP. Given that there are larger deer populations to the west and south of Sydney, feral deer have the potential to become an emerging issue in other reserves.

Impacts

Deer are primarily grazers, but all species browse opportunistically on shrub, understorey and grass species. Deer may also strip bark from woody plants. Herbivory and environmental degradation caused by deer is listed as a *Key Threatening Process* under the *NSW TSC Act 1995*. Deer can impact upon endangered ecological communities including Freshwater Wetlands on Coastal Floodplains and River-flat Eucalypt Forest on Coastal Floodplains EECs (NSW Scientific Committee 2004), which suggests that they may also impact upon the river-flat forest habitat of the vulnerable Camden White Gum *Eucalyptus benthamii*. Littoral Rainforest is identified as an EEC at threat from deer (NSW Scientific Committee 2004) and it appears like that Western Sydney Dry Rainforest in Cattai NP may also be susceptible to deer impacts.

Grazing and trampling by feral deer may alter the composition and structure of habitats and may also dislodge rock slabs used for shelter by reptiles and amphibians. The threatened fauna within Sydney Region reserves most likely to be susceptible to these impacts include the Giant Burrowing Frog (*Heleioporus australiacus*) and the Red-crowned Toadlet (*Pseudophyrne australis*), both of which occur in Gulguer NR. De Jong (2006) suggests that all threatened fauna and flora within Bents Basin SCA and Gulguer NR may be at risk from the impacts of deer. In addition, agricultural impacts on market gardens adjacent to Bents Basin SCA and Gulguer NR are thought to be high, for example De Jong (2006) documented a 3% loss of a radicchio crop in a single week.

Priorities for control

Critical Priority

Deer control in Bents Basin SCA and Gulguer NR for the protection of River-flat Eucalypt Forest on Coastal Floodplains EEC, *Eucalyptus benthamii*; the Giant Burrowing Frog, and the Red-crowned Toadlet, and to minimise impacts on adjacent agriculture.

Development of a deer management plan and implementation of control in Cattai NP for the protection of the following EECs: River-flat Eucalypt Forest on Coastal Floodplains, Freshwater Wetlands on Coastal Floodplains and Western Sydney Dry Rainforest.

As deer are a potential emerging threat in Agnes Banks NR, Castlereagh NR, Mulgoa NR and Scheyville NP, monitoring the need for control action in these reserves is critical.

Control

A deer management plan has been prepared for Gulguer NR, and control should be in accordance with this plan. Control is through a ground shooting program in association with Moss Vale RLPB. The program allows for the implementation of complementary methods should the technology become available or social acceptance change. An equivalent deer management plan should be developed for Cattai NP and control should be in accordance with that plan.

Monitoring

Monitoring includes maintaining records of all operations and a tally of all animals removed from reserves. Cumberland North and South Area Offices will monitor reports of deer in that area, and ensure that sightings are followed up by appropriate actions.

11.1.4 Feral Cats (*Felis catus*)

Distribution and abundance

Feral Cats are widespread and occur in most habitats across Australia. Cats are known to occur in most reserves within the region, but in many areas most are actually not feral animals but domestic animals utilising the reserve on an occasional basis. However, unwanted cats and kittens are often dumped within Sydney Region reserves, and the potential for the establishment of Feral Cat populations is high.

Impacts

Feral Cats prey on a wide range of native fauna, and are known vectors of disease and parasites which can be transmitted to humans, native fauna and domestic stock. At particular risk of cat predation are small-sized mammals weighing less than 220g

and birds less than 200g (NPWS 2000a), however they can kill vertebrates up to 3kg. Reptiles, amphibians and invertebrates are also eaten. Cats may directly prey upon threatened species. Predation by Feral Cats is listed as a *Key Threatening Process* under both the *Commonwealth EPBC Act 1999* and the *NSW TSC Act 1995*. Control of cats at roosting sites is identified in the priority action statements for the Eastern Bentwing Bat. The fortifications at Middle/Georges Head are significant over-wintering sites for this species in Sydney. Predation by Feral Cats is listed as a threat for both the endangered Little Penguin population and the endangered Long-nosed Bandicoot population at North Head.

Priorities for control

Critical Priority

Locations of critical priority for control of cats are:

- North Head (Sydney Harbour NP) to protect both the Little Penguin and the Long-nosed Bandicoot populations;
- Middle and Georges Head (Sydney Harbour NP) to protect the vulnerable Eastern Bentwing Bat which roosts in the fortifications on these headlands; &
- Pitt Town NR to protect a suite of threatened water birds that periodically utilise the reserve.

When cats, signs or scats or evidence of cat predation occur in the above areas, reactive trapping will be implemented.

Medium Priority

Where feral, stray or domestic cats are impacting upon the amenity of areas, reactive trapping will be implemented. Areas where this had been an issue in the past include: Botany Bay NP; South Head, The Gap, and Green Point, Sydney Harbour NP; Scheyville NP and Cattai NP.

Control

Feral Cats are a difficult pest to control. There are no poisons licensed for use on cats. Other control methods include trapping and shooting, however most are relatively ineffective. Cat control in Sydney Region will be predominantly by cage trapping for problem cats. Captured cats will be taken to an animal shelter or vet, scanned for microchip identification and may either be returned to their owners, upon which a written warning or fine should ensue, or humanely euthanased by lethal injection by qualified personnel. Efforts will be made to increase community awareness of responsible cat ownership in conjunction with local government and Companion Animal Act regulations, to minimise impacts within reserves where necessary.

Monitoring

Monitoring of Feral Cat abundance is extremely difficult. Sand plots used to determine fox presence do not effectively determine Feral Cat abundance. However cat scats or prints noted during fox monitoring or other works can be utilised to determine cat presence in specific priority locations and thus to determine necessity for control at specific sites.

- Monitor areas identified as being of critical priority for signs of the arrival of problem cats.
- Investigate and record distribution/ sightings and keep records at Area Offices of all cat trapping and number of cats trapped.
- The mortality register kept for both Long-nosed Bandicoots and Little Penguins will be analysed annually to determine the number of deaths inflicted by cats.

11.1.5 Black Rats (*Rattus rattus*)

Distribution and abundance

First introduced with the First Fleet, the Black Rat is generally closely associated with human habitation, but has now been recorded in undisturbed bushland. Black Rats occur in every reserve within Sydney Region. Their abundance in most reserves is relatively low. However, Long-nosed Bandicoot population monitoring has consistently recorded them in high numbers at North Head.

Impacts

Black Rats have been linked with extinction and range reduction of a number of bird species on islands, although there is little evidence to suggest that this has occurred on mainland Australia. However, since many of the reserves in Sydney Region resemble islands surrounded by urban development, impacts on native fauna are likely. There is also recent evidence to suggest that Black Rats may competitively exclude native rats. Black Rats also carry and disperse disease. On North Head and in other Sydney Harbour Foreshore bushland areas, Black Rats appear to have replaced otherwise common native small mammals including the Bush Rat (*Rattus fuscipes*) and the brown Antechinus (*Antechinus stuartii*) (Rose 2004). In Sydney Harbour NP a number of precincts have food outlets which may attract increased numbers of Black Rats. Black Rats may also have impacts on the fabric of historic buildings. The significance of Black Rat seed predation is unknown in endangered ecological communities such as Eastern Suburbs Banksia Scrub, and investigation of these impacts where high density rat populations occur (particularly post-fire) are needed. Further investigation is also needed to determine whether predation by Black Rats on juvenile bandicoots in nests and of penguin eggs is having a significant impact on the two endangered populations at North Head.

Priorities for control

Critical Priority

Control rats around food outlets by lessees on North Head and other precincts to protect human health.

High Priority

Investigate impacts of rat predation on bandicoot and penguin populations and on seed in the Eastern Suburbs Banksia Scrub EEC on North Head.

Control

Lessees to establish trapping and poisoning programs near food outlets as needed.

Monitoring

Investigations into the impacts of rat predation on seeds in the Eastern Suburbs Banksia Scrub EEC should determine the need for rat control in this community. Leaseholders of food outlets are required by health regulations to report any rat intrusions and implement control where needed.

11.1.6 Other Vertebrate Pests

There are a number of other pest vertebrate species within Sydney Region, some of which are discussed in potential emerging issues in Appendix 4. The species of most concern is the Feral Pig (*Sus scrofa*). Although there are no established populations within Sydney Region reserves, in recent years there have been what appears to be intentional releases of small numbers of pigs in two Sydney Region reserves (Kemps

Creek NR and Scheyville NP) which were quickly eradicated. Given that pigs have a high reproductive potential (Choquenot *et al.* 1996), there is a need for vigilance in Sydney Region reserves.

Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa* is listed as a *Key Threatening Process* both under the *NSW TSC Act 1995* and the *Commonwealth EPBC Act 1999*. Feral Pigs present a significant threat to native species and ecological communities as a result of their behaviour and feeding habits. Feral Pigs have been implicated as potential vectors for the spread of *Phytophthora cinnamomi*, a root-rot fungus responsible for die-back in native vegetation (DEH 2003). Freshwater Wetland on Coastal Floodplains is the EEC most susceptible to habitat degradation, and Pitt Town NR, Scheyville NP, and Cattai NP all contain either regionally or nationally significant wetland habitats.

Although there is a wide range of introduced bird species within or on the edges of Sydney Region reserves, only two species are currently of concern within Sydney Region, and these are the Feral Pigeon (*Columba livia*) and the Common Starling (*Sturnus vulgaris*) due to the impact they are currently having on the fabric of cultural heritage buildings at Nielsen Park, Sydney Harbour NP.

Priorities for control

Critical Priority

If (when) new releases of Feral Pigs into Sydney Region reserves are detected prompt action should be taken to eradicate pigs from the reserve to protect significant Freshwater Wetland on Coastal Floodplains and Eucalypt River-flat Forest on Coastal Floodplains EECs.

High Priority

Control Feral Pigeons and Starlings roosting in or on buildings to prevent damage to cultural heritage buildings at Nielsen Park, Sydney Harbour NP.

Control

Pigs should be trapped using humane methods in conjunction with Moss Vale RLPB. Methods of control for feral birds including exclusion from perching and entrance points; poisoning and trapping should be investigated.

Monitoring

Monitoring will be primarily achieved through the detection of pig damage to vegetation and other sensitive areas during regular day to day operations. Anecdotal sightings of pigs and pig damage, and the outcomes of all control efforts, will be recorded and mapped by Area Offices. Control actions taken for feral birds will be documented and observational evidence of success (i.e. birds excluded) recorded.

11.2 Weed Pest Species

11.2.1 African Olive (*Olea europaea* subsp. *cuspidata*)

Distribution and abundance

African Olive occurs to some extent in almost all reserves in the Sydney Region. African Olive forms dense thickets throughout many of the reserves that contain Cumberland Plain Woodland EEC, particularly in Mulgoa NR and Leacock RP, and is also within other communities. Other reserves with infestations of African Olive include: Sydney Harbour NP (Nth and Sth), Botany Bay NP (Nth), Cattai NP, Scheyville NP, Bents Basin SCA, Gulguer NR, Kemps Creek NR and Prospect NR.

Impacts

Infestations of African Olive shade and crowd out ground-flora and over-storey plants, forming dense thickets over time that can prevent virtually all regeneration. Plants produce thousands of seeds which are consumed and spread by foxes and birds. The thickets also provide shelter for foxes, rabbits and native fauna. Infestations of African Olive are a serious threat to Cumberland Plain reserves, particularly those that conserve Cumberland Plain Woodland EEC, as it appears to prefer clay soils in these regions. A Sydney-wide African Olive Weed Management Plan (2008-2013) has been prepared by the four Regional Weed Committees. The Priority Action Statements for Cumberland Plain Woodland EEC includes the need for development and implementation of a co-ordinated program of African Olive removal across all land tenures. Weed invasion (including African Olive) is identified as a threat to *Acacia pubescens* (NPWS 2003a).

African Olives are an emerging issue in reserves where they are not currently present. Vigilance is required to eradicate this species as soon as it occurs in the reserves which are currently African Olive free.

Priorities for control

Critical Priority

Control of impacts and prevention of the expansion or establishment of African Olive in Cumberland Plain Woodland EEC in the following reserves: Bents Basin SCA, Kemps Creek NR, Leacock RP, Mulgoa NR, Prospect NR, Scheyville NP and Windsor Downs NR. The highest priority should be given to reserves where the infestation levels are currently low (e.g. Kemps Creek, and Prospect NR).

Control of impacts of African Olive on the threatened plant *Acacia pubescens* in Scheyville NP.

High Priority

Control African olive that are impacting on the following cultural heritage sites:

- middens at Milk Beach, Nielsen Park, Sydney Harbour NP; and
- historical vineyard terracing at Mulgoa NR.

Lower Priority

Control of African Olive that only has localised impact (with the aid of community groups) in William Howe RP.

Control

The 'African Olive Management Plan for the Sydney Region' should be used as a guide for the management of this species. Seedlings and small plants can be hand-pulled or dug out. Larger plants can be treated with herbicide using drill-frill, frilling or cut and paint methods. Follow-up weeding of new seedlings is always needed after application of herbicide to mature plants. Given the extensive distribution of African Olive in Cumberland Plain Woodland EEC, bush regeneration strategies need to be developed and implemented that target areas of highest conservation value as identified in the regional ranking of conservation significance of EECs, which also have the greatest potential for natural regeneration. Treatment of African Olive should occur as a part of bush regeneration programs.

Monitoring

For major infestations, photo points should be established to monitor success over time. Vigilance by area staff is required to treat new infestations as they occur.

11.2.2 Aquatic Weeds

Distribution and abundance

The main aquatic weeds that impact upon biodiversity in Sydney Region reserves are Salvinia (*Salvinia molesta*) and Alligator Weed (*Alternanthera philoxeroides*). Alligator Weed and Salvinia are both listed as Weeds of National Significance, which means that they have been recognised as presenting a major threat to ecosystems in Australia.

There is currently a major Salvinia infestation in Longneck Lagoon, Scheyville NP and minor infestations in Windsor Downs NR and Cattai NP. Major infestations of Alligator Weed occur in the gorge in Gulguer NR and in Kemps Creek NR, with minor infestations at Bents Basin SCA, and North Head Sydney Harbour NP.

Impacts

Noxious aquatic weed species can cause major deterioration to creeks, rivers and wetlands, completely covering the water surface which can cut available oxygen and sunlight to aquatic species. These weeds also impact upon other species such as water birds, tortoises, and bats which rely on freshwater bodies to drink.

Alligator Weed can grow on land or as floating mats that invade waterways, wetlands, floodplains and irrigation channels. Once established, it is extremely difficult to control and eradication is normally only possible when infestations are detected early. Alligator Weed easily spreads to new areas as plant fragments in extracted gravel, earth-moving equipment and other machinery. Salvinia is a free-floating fern choking many waterways throughout Australia. This weed forms dense floating mats that deplete oxygen levels, reduce fish stocks and prevent birds and other wildlife from using the water. Salvinia is mostly spread through its popularity as a fishpond or farm dam plant, and by the movement of plant fragments via flooding, fishing and boating activities. It is a rapidly growing plant that can double in size in less than a week.

Sydney Region reserves contain two wetlands of national significance: Longneck Lagoon – Scheyville NP, and Pitt Town NR as well as other regionally significant wetlands. The impact of these weeds is most significant in these habitats which are classified as Freshwater Wetland on Coastal Floodplain EEC.

Priorities for control

Salvinia:

Critical Priority

Protection of Freshwater Wetland EEC in Longneck Lagoon, Scheyville NP and Reedy Swamp Cattai NP.

Medium Priority

Control Salvinia in accordance with the Regional Weed Committee Aquatic Weed Management Plan in Windsor Downs NR.

Alligator Weed:

Critical Priority

Control dryland Alligator Weed impacting on EECs in Kemps Creek NR (e.g. in Castlereagh Swamp Woodland EEC).

Medium Priority

Control Alligator Weed in accordance with the Regional Weed Committee Aquatic Weed Management Plan in:

- Little Congwong/Happy Valley – La Perouse, Botany Bay NP;
- Wolli Creek RP;
- creekline infestations at Kemps Creek NR;
- the gorge, Gulguer NR; and
- Collins Flat, North Head, Sydney Harbour NP.

Control

There are two Regional Plans for Aquatic Weeds in the Sydney Region: Control of Aquatic Weeds in the Sydney West - Blue Mountains and Sydney North Regions (2006-1010) and Aquatic Weed Management for the South West Sydney and Sydney Central Regions (2008-2013). Control methods are described in these plans and control should be carried out in accordance with these plans and the Alligator Weed and Salvinia Control Manuals (DPI 2006, Van Oosterhout 2007).

Numerous methods of control are used for the control of these aquatic weeds, including chemical control, mechanical removal of the weed mass and biological controls. Recent releases of the Salvinia weevil in Longneck Lagoon has been relatively effective, and weir modifications are also likely to improve management.

Monitoring

Regular monitoring by Area staff while conducting their daily duties to detect outbreaks is necessary in all reserves that contain wetland habitats. Photo points shall be established where major control works are undertaken to monitor success.

11.2.3 Bitou Bush – (*Chrysanthemoides monilifera* ssp. *rotundata*) and Boneseed (*C. monilifera* ssp. *monilifera*)

Distribution and abundance

Bitou Bush and Boneseed are common weeds along the east coast of Australia. Within Sydney Region reserves infestations of Bitou Bush occur throughout Botany Bay NP, and Boneseed occurs in Sydney Harbour NP (both north and south of the harbour).

Control programs have been implemented since the mid-1970s. Control programs have included helicopter spraying of herbicides and hand removal and release of biological control agents (e.g. tip-moth, *Tortrix* and Bitou Seed Fly).

Impacts

Bitou Bush and Boneseed are both highly competitive and invasive weeds that can displace native vegetation in coastal environments. Bitou Bush and Boneseed are both listed as “Weeds of National Significance” meaning they have been recognised as posing a severe threat to ecosystems in Australia and *Invasion of native plant communities by Bitou Bush/Boneseed* has been listed as a *Key Threatening Process* under the *NSW TSC Act 1995*. Dense stands of these plants can eliminate most indigenous ground flora and prevent virtually all over-storey regeneration and often

eventuate in dense monocultures. Seeds can remain viable in the soil seed bank for 4 – 10 years. It is also a source of food for foxes and some native fauna which aid the dispersion of seeds. It also provides shelter for foxes and rabbits and some native fauna.

The Bitou Bush/Boneseed TAP recognises the following EECs within Sydney Region reserves as being at most risk from Bitou Bush/Boneseed invasion: Eastern Suburbs Banksia Scrub; *Themeda* Grasslands on Seacliffs and Coastal Headlands and Littoral Rainforest.

Priorities for control

Critical Priority

Control of impacts and prevention of expansion or establishment of Bitou Bush/Boneseed in the following EECs:

- Eastern Suburbs Banksia Scrub at North Head, Sydney Harbour NP and Botany Bay NP;
- *Themeda* Grasslands at Botany Bay NP; and
- Littoral Rainforest at North Head, Sydney Harbour NP.

Control of impacts on the following threatened plant species:

- *Acacia terminalis* subsp *terminalis* at Botany Bay NP, and Nielsen Park and South Head, Sydney Harbour NP;
- *Allocasuarina portuensis* at Nielsen Park and South Head, Sydney Harbour NP; and
- *Syzygium paniculatum* at Dobroyd Head, Sydney Harbour NP.

High Priority

Control infestations that are impacting on cultural heritage sites and fortifications at Botany Bay NP.

Medium Priority

Control of Bitou Bush/Boneseed outside EECs in Sydney Harbour NP and Botany Bay NP as per the Regional Weed Committee Bitou/Boneseed Management Plan.

Control

Weed Management Guidelines have been prepared for both Bitou Bush (CRC for Weed Management 2003a; Brougham *et al.* 2006) and Boneseed (CRC for Weed Management 2003b) and control methods should be in accordance with the guidelines. Past control has included using herbicide applications of low concentration Glyphosate (helicopter aerial, cut and paint hand application and hand and pump spraying). Follow-up of these areas has involved hand removal and spraying of seedlings. A number of biological control agents have been released in the area, but many have not established well. Pile burns have been used in some areas to promote regeneration of indigenous species.

Monitoring

Establish monitoring programs in accordance with the guidelines established in the Bitou TAP.

11.2.4 Blackberry (*Rubus fruticosus*)

Distribution and abundance

Minor Blackberry infestations occur in most reserves within Sydney Region. Larger infestations occur in Cattai NP, and Scheyville NP.

Impacts

Blackberry invades disturbed areas, particularly along tracks, power easements and creeklines and has the potential to move into less disturbed bushland. Blackberry is listed as a 'Weed of National Significance'. Blackberry is spread by birds and animals eating the fruit and dropping seed. Dense stands of Blackberry provide habitat for rabbits and foxes, and small birds and mammals. Care must be taken as to timing of weed removal to not impact on nesting native bird species. Dense infestations can impede the movement of some native animals and can have impacts on the recreational and scenic amenity of reserves.

Priorities for control

Critical Priority

Control of currently minor infestations to prevent expansion into EECs in the following reserves: Agnes Banks NR, Kemps Creek NR, Prospect NR, Rouse Hill RP and Wianamatta RP.

Control of impacts of Blackberry on the following threatened species:

- *Acacia pubescens* at Scheyville NP; and
- Eastern Bentwing Bat through the removal of Blackberry from entrances to fortifications and flyways at Middle and Georges Heads, Sydney Harbour NP.

High Priority

Control Blackberry infestations that are impacting on the following cultural heritage sites:

- the mill and associated ruins at Cattai NP; and
- the cultural landscape at Scheyville NP.

Medium Priority

Control Blackberry outside the areas identified above in all other reserves to minimise impacts on recreation and scenic amenity.

Control

Control should be consistent with the 'Weed Management Guide for Weeds of National Significance' (CRC for Weed Management 2003c). Herbicide application is the most efficient and cost effective method to control Blackberry. Small infestations can be treated with the cut-paint method. Plants can also be sprayed with selective and non-selective herbicides. Small plants and seedlings can be dug out. Fire can also be used to control Blackberry. In most reserves control should be conducted in conjunction with bush regeneration programs.

Monitoring

Distribution has been mapped in Scheyville NP. Area staff will continue to map infestations and report treatment areas. Monitoring programs will be observational only, except where there are major infestations which will have photo points established.

11.2.5 Lantana (*Lantana camara*)

Distribution and abundance

Lantana infestations occur within most Sydney Region Reserves, with major infestations in Sydney Harbour NP, Cattai NP, Scheyville NP, Bents Basin SCA, Mulgoa NR, and Leacock RP.

Impacts

Lantana has been listed as a 'Weed of National Significance' meaning that it has been recognised as posing a severe threat to ecosystems in Australia. Invasion, establishment and spread of *Lantana camara* has been listed as a *Key Threatening Process* under the *NSW TSC Act 1995*. Sydney Region has a number of EECs and threatened species that have been identified as being at threat from Lantana. These form the basis for critical priorities.

Lantana plants physically crowd or shade out indigenous vegetation and prevent most regeneration occurring. They also alter soil chemistry and nutrient cycles. Dense stands of Lantana provides cover for rabbits, birds and foxes and may be a source of food for both native and exotic fauna. Control should be timed so as to not impact on native nesting bird species, and if large areas are to be treated this control should be undertaken in planned stages.

Priorities for control

Critical Priority

Control of impacts and prevention of expansion or establishment of Lantana in Endangered Ecological Communities identified as most at threat in the Lantana TAP:

- Eastern Suburbs Banksia Scrub EEC– North Head, Sydney Harbour NP and Botany Bay NP;
- Littoral Rainforest EEC– North and Dobroyd Heads, Sydney Harbour NP;
- Western Sydney Dry Rainforest EEC– Cattai NP; and
- River-flat Eucalypt Forest on Coastal Floodplains EEC – Campbell's Ford in Gulguer NR, Bents Basin SCA, Cattai NP, Scheyville NP, Kemps Creek NR, Leacock RP, and Mulgoa NR. The highest priorities for control are those areas identified as being of most critical conservation significance and those areas which have the highest resilience.

Control of impacts from Lantana on the following threatened species:

- *Pimelea curviflora* – Cattai NP ;
- *Allocasuarina portuensis* at Nielsen Park and South Head, Sydney Harbour NP;
- *Acacia terminalis* at South Head, Sydney Harbour NP;
- *Syzygium paniculatum* – Dobroyd Head, Sydney Harbour NP;
- Eastern Bentwing Bat – removal from entrances to fortifications and flyways at Middle and Georges Heads, Sydney Harbour NP; and
- Speckled Warbler (*Pyrrholaemus sagittatus*) habitat – Scheyville NP.

High Priority

Control Lantana infestations that are impacting on cultural heritage sites such as the gun emplacements at South Head, Sydney Harbour NP.

Medium

Control Lantana in all reserves, outside areas identified above to minimise impacts on recreation and scenic amenity.

Control

Control should be consistent with the Weeds of National Significance Control Manual for Lantana (Van Oosterhout 2004). Cut and paint application or herbicide spraying. A range of herbicides are registered for use on Lantana. Physical removal of smaller plants or where plants are shallow rooted. Biological control agents are also available but have achieved mixed results in Sydney Region.

Monitoring

Records should be kept by Area staff of all areas treated. For major Lantana control programs, photo points will be established at a minimum. Opportunistic surveying of areas should be undertaken by staff whilst undertaking other routine duties to monitor for new infestations.

11.2.6 Exotic Perennial Grasses

Distribution and abundance

Exotic grasses are widespread throughout NSW and have been introduced in the past for either pasture or soil stabilisation.

Sydney Region reserves contain a diverse range of exotic perennial grasses, although many are just on reserve boundaries or road edges. The most widespread grasses are probably African Lovegrass (*Eragrostis curvula*), Whisky Grass (*Andropogon virginicus*), and Rhodes Grass (*Chloris gayana*). However other grasses such as Pampas grasses (*Cortaderia* spp.), Panic Veldgrass (*Ehrharta erecta*), Kikuyu (*Pennisetum clandestinum*), Couch (*Cynodon dactylon*), Paspalum (*Paspalum* spp.), and bamboos are either locally common within a number of reserves or significantly impacting on biodiversity. Four species of grass are included in the Sydney-wide Grasses Management Plan: Chilean Needle Grass (*Nassella neesiana*), Tussock Paspalum (*Paspalum quadrifarium*), Serrated Tussock Grass (*Nassella trichotoma*) and Coolatai Grass (*Hyparrhenia* spp.), but only the first two species have been recorded within a reserve.

Impacts

Invasion of native plant communities by exotic perennial grasses has been identified and listed as a *Key Threatening Process* under the *NSW TSC Act 1995*, and is an identified threat to Cumberland Plain Woodland.

The characteristics of vigorous growth, prolific seed production and effective seed dispersal have allowed exotic perennial grasses to compete strongly with, and in some areas displace native vegetation. In some areas, native species have been completely replaced by a monoculture of exotic grasses. These impacts are most strongly felt in communities that naturally have a grass and herbaceous understorey such as the Cumberland Plain Woodland or *Themeda* grasslands on Seacliffs and Coastal Headlands EECs, although impacts can be severe in other communities.

Many exotic grasses invade after an area has been disturbed which is why boundaries and tracks are sites of significant infestations. Many areas within Sydney Region reserves have had past disturbance from grazing or clearing for agricultural or military purposes, and/or continue to have disturbances from fire, dumping and visitor impacts which provide ideal opportunities for exotic grass invasions. Grass seed is also easily transferred from area to area on vehicles, shoes and clothing, as well as animal fur. Invasion of exotic grasses, in particular African Lovegrass, has been identified as a threat to Aboriginal engraving sites in Cattai National Park.

Priorities for control

Critical Priority

Control of impacts and prevention of expansion or establishment of exotic perennial grasses in the following EECs:

- Eastern Suburbs Banksia Scrub EEC at North Head, Sydney Harbour NP and Botany Bay NP (particularly African Lovegrass, Whisky Grass, Kikuyu, Couch, and Buffalo Grass (and Pampas on the edge of community));
- *Themeda* Grasslands on Seacliffs and Coastal Headlands - Botany Bay NP (particularly Kikuyu, Couch and Buffalo Grasses);
- Agnes Banks Woodland (prevent expansion of African Lovegrass into woodland, particularly post-fire, and be alert for re-invasion of Chilean Needle Grass which has now been eradicated from the reserve) – Agnes Banks NR;
- Cumberland Plain Woodland EEC – all reserves as part of bush regeneration programs identified in section 11.2.8.

Control of exotic grass impacts on the habitat of the following threatened species:

- *Allocasuarina portuensis*, Sydney Harbour NP (particularly *Ehrharta* and Couch);
- *Acacia terminalis* subsp. *terminalis* in Sydney Harbour NP (particularly *Ehrharta* and Couch).
- *Grevillea juniperina* subsp. *juniperina* – Wianamatta RP and Castlereagh NR (particularly African Lovegrass and Whisky Grass);
- Speckled Warbler – prevent expansion of exotic grasses that form dense monocultures within the open woodland habitat of this species in Scheyville NP, Castlereagh NR, Kemps Creek NR and Wianamatta RP.

High Priority

Control exotic grass impacts (particularly African Lovegrass) on Aboriginal engraving sites in Cattai NP.

Medium Priority

Eradicate (non-culturally significant plantings) of bamboo at Hermitage Point, Sydney Harbour NP and Prospect NR to protect scenic/aesthetic values.

Control

Control is best when the target grass is actively growing and ideally should be undertaken before seed is set. Control can be extremely difficult when some species can set seed very rapidly (every 6 weeks for *Ehrharta*) and in Sydney many species are able to grow and set seed year round. In general, physical removal is very effective at eradicating small and isolated clumps before they seed or when working in areas where native grasses or herbs dominate. Herbicide spot spraying is generally effective but care must be taken to avoid non-target native grasses, and follow up control or other measures (e.g. mulching, planting) are required as grasses will readily recolonise bare ground. Cumberland North Area is currently engaged in co-operative research with several universities into alternative more cost-effective methods of treating broad-scale areas.

Mowing, slashing or burning is often advantageous prior to spraying to remove dead foliage that may prevent herbicide from contacting new growth. Soil, seed and vegetative matter should be removed from people, vehicles and plant when moving out of infected areas by washing, brushing or blowing (with compressed air) to prevent further spread.

Monitoring

Opportunistic surveys of tracks and trails should be undertaken by staff whilst undertaking other routine duties to detect new infestations. All reserves should be monitored post fire to detect new incursions. Records should be kept of areas where extensive infestations have been treated by Area staff and photo points established to monitor success.

11.2.7 Exotic Vines and Scramblers

Distribution and abundance

Exotic vines and scramblers are widespread throughout NSW, with many being introduced as garden varieties. The predominant vines and scramblers present within Sydney Region reserves include Balloon Vine (*Cardiospermum grandiflorum*), Bridal Creeper (*Asparagus asparagoides*), Cape Honeysuckle (*Techomaria capensis*), Cape Ivy (*Delaria odorata*), Cat's Claw Creeper (*Macfadyena unguis-cati*), Climbing Asparagus Fern (*Asparagus africanus*), Coastal Morning Glory (*Ipomoea cairica*), English Ivy (*Hedera helix*), Ground Asparagus Fern (*Asparagus aethiopicus*), Japanese Honeysuckle (*Lonicera japonica*), Madeira Vine (*Anredera cordifolia*), Morning Glory (*Ipomoea indica*), Moth Vine (*Araujia sericifera*), Pampas Lily of the Valley (*Salpichroa organifolia*), Turkey Rhubarb (*Acetosa sagittata*) and Trad (*Tradescantia fluminensis*), although this list is not exhaustive.

Vines and scramblers occur throughout the Sydney region particularly on disturbed edges and in riparian zones, but some like Bridal Creeper have invaded otherwise good bush. Many have the potential to increase their distribution and abundance and some species not yet naturalised in the region have the potential to become established.

Impacts

Invasion and establishment of exotic vines and scramblers has been listed as a *Key Threatening Process* under the *NSW TSC Act 1995* and many of the species listed here have been declared noxious at the state or local level. Vines and scramblers impact seriously upon a number of endangered ecological communities and the habitat of numerous threatened species in the region. Exotic vines and scramblers can smother native vegetation, in the ground, shrub and canopy layers and if uncontrolled can dominate and significantly alter the health and composition of native plant communities. Vines and scramblers can form dense blankets which suppress native plant vigour, growth and seed germination.

The weight of exotic vines in a canopy can cause branches to break and in severe situations result in total canopy collapse. They can alter light levels, and promote a more humid microclimate, affecting soil biota and plant dwelling invertebrates, altering soil moisture and nutrient levels, and compete with native plant species for water and nutrients. As most vines and scramblers have a mesic effect they can alter fire behaviour and fire regimes especially in sclerophyll communities.

Exotic vines and scramblers can affect fauna including threatened species by restricting movement, damaging or restricting access to habitat trees and providing favourable habitat for others. They can also overrun, damage or restrict access to cultural heritage sites or infrastructure. Species particularly impacted by vines and scramblers include the endangered Cumberland Plain Land Snail (*Meridolum corneovirens*), as well as threatened owl and bird and bat species (through loss of hollows). Destruction of hollow-bearing trees is of particular significance in Sydney Region reserves as recent tree hollow density mapping in Cumberland Plain reserves

has estimated that there are less than 3-5 hollows per hectare in most reserves, making tree hollows an extremely scarce resource.

Some vines and scramblers not yet present in the Sydney region, can be considered a potential emerging threat. One of these is the Kudzu Vine (*Pueraria lobata*) which if uncontrolled can form a dense monoculture totally covering existing vegetation and building structures.

Priorities for control

Critical Priority

Control of vines and scramblers that are impacting on the following EECs:

- Eastern Suburbs Banksia Scrub EEC at North Head, Sydney Harbour NP and Botany Bay NP (particularly Cape Ivy and Turkey Rhubarb);
- Western Sydney Dry Rainforest EEC – Cattai NP (particularly Cape Ivy, Balloon Vine, Moth Vine, Cat's Claw Creeper, Bridal Creeper and Trad);
- Shale/Sandstone Transition Forest EEC – Cattai NP (particularly Bridal Creeper, Moth Vine and Trad), Rouse Hill RP (particularly Bridal Creeper, Moth Vine, Trad, Cape Ivy and Madeira Vine); Scheyville NP (particularly Bridal Creeper and Balloon Vine);
- Cumberland Plain Woodland EEC – in relatively weed free areas of Kemps Creek NR and Prospect NR; areas around Longneck Lagoon - Scheyville NP identified as being of critical conservation significance; Rouse Hill RP and Leacock RP (particularly Bridal Creeper, Moth Vine and Balloon Vine);
- River-flat Eucalypt Forest on Coastal Flood Plains EEC – Bents Basin SCA and Campbell's Ford, Gulguer NR; areas identified as being of critical conservation significance in Cattai NP (particularly Cape Ivy, Balloon Vine, Moth Vine, Cat's Claw Creeper, Bridal Creeper and Trad); and Mulgoa NR (particularly Cat's Claw Creeper).

Control of vines and scramblers that are impacting in the habitats of the following threatened plant species:

- *Allocasuarina portuensis* – Sydney Harbour NP (particularly Asparagus Fern and Turkey Rhubarb)
- *Acacia terminalis* – Sydney Harbour NP and Botany Bay NP (particularly Asparagus Fern, Cape Ivy and Turkey Rhubarb);
- *Pimelea curviflora*- Cattai NP (as per Western Sydney Dry Rainforest above);
- *Acacia pubescens* – Scheyville NP (particularly Bridal Creeper and Moth Vine); and
- *E. benthamii* habitat – Bents Basin SCA and Gulguer NR.

High Priority

Control vines and scramblers that are impacting on the following cultural heritage sites:

- Aboriginal engraving and shelter sites in Mitchell Park precinct, Cattai NP; and
- European cultural heritage sites, Scheyville NP.

Medium Priority

Control vines and scramblers to protect regionally scarce, large, old, hollow bearing trees outside areas identified above to provide habitats for threatened marsupials, owls and bats which have been recorded in the following reserves: Bents Basin SCA; Cattai NP; Goat Island, North and Dobroyd Heads, Sydney Harbour NP; Gulguer NR;

Kemps Creek NR; Leacock RP; Mulgoa NR; Prospect NR; Scheyville NP; Rouse Hill RP; Wianamatta RP; William Howe RP; and Wolli Creek RP.

Control

Coordinated, consistent and timely control is needed in order to effectively control exotic vines and scramblers. Methodology is dependent on species and situation. Hand removal of seedlings or crowning (Asparagus Fern) is acceptable for control of small, scattered infestations, or in sensitive areas. The removal (bag and dispose of) of propagules, e.g. berries, pods, aerial tubers can be undertaken in association with other methods or as a means to slow spread if full treatment of the plant is not achievable at that time. A management plan for Bridal Creeper has been prepared (the "Sydney Regional Bridal Creeper Management Plan") and is current for 2004-2009. This plan to be referred to when planning Bridal Creeper control.

Where vines occur in the canopy they are best treated by cutting and painting or scraping with herbicide, care should be taken not to pull vines from trees as this can cause canopy damage or disturb fauna. Rather, vines should be left to die in situ. Foliar application of herbicides is useful to control mass seedlings, regrowth or as primary control especially on ground layer species.

Several herbicides are registered for use on a number of species. Timing is important, i.e. application during active growth is best practice. Staff will be kept informed of new herbicides and methodologies by participation in industry events and committees. Bridal Creeper rust fungus (*Puccinia myrsiphylli*) is available, as is a species of hopper that feeds on Bridal Creeper. This has been released at Wolli Creek RP and Scheyville NP.

Prevention by community education and awareness raising by participation in Weed Buster events and targeted events like 'Asparagus Out' community weeding days and by reporting noxious weeds on land adjacent parks to the relevant control/enforcement agency is encouraged.

Monitoring

Monitoring to be by mapping location and density of infestations of specific species or suite of species. Photo points will also be utilised to demonstrate response to control at some treatment sites. Bushcare groups will be encouraged to keep records of control efforts and map or document site condition. Not all species or sites will be subject to formal monitoring.

11.2.8 Other Noxious and Environmental Weeds and Garden Escapes

Distribution and abundance

There are at least 1,386 naturalised alien plants in New South Wales, which constitute 21% of the total number of plant species in the state (Coutts-Smith and Downey 2006). In a spatial analysis (by Catchment Management Authority Area) Coutts-Smith and Downey found that over half of these (758) occur within the bounds of the Sydney Metropolitan CMA. Predictive modelling suggests that some weed species may decrease but many are expected to increase in distribution and abundance with climate change (most have that potential regardless of global warming).

Weeds are widespread across NPWS estate in the Sydney Region. They are generally associated with urban development and infrastructure and are therefore more abundant in disturbed areas and edges, including road and trail verges, in

bushland adjoining residential or rural properties or in areas of high nutrient levels such as riparian zones.

Whilst many weed species are associated with disturbance, many can and have invaded otherwise undisturbed bushland in the region. Preceding sections have dealt with major weeds targeted across the landscape in singular weed control programs or suites of weeds of similar life form, e.g. aquatic weeds, exotic vines and scramblers, and perennial grasses, but most reserves in Sydney Region are infested with a suite of weeds, and targeting individual weed species singularly is not always the most productive management approach. The weed control approach generally taken within most reserves in Sydney Region is that of multi-species integrated weed control treating individual areas within the reserve rather than individual species. This is often achieved through a bush regeneration approach. The following section details priority areas within reserves for multi-species integrated weed control or bush regeneration, and in some cases identifies individual significant target species.

The recent weed mapping completed for most western Sydney Region reserves and parts of Sydney Harbour and Botany Bay National Parks (Epacris 2008) identifies significant weeds in each reserve, and average weed density by management areas or precincts within reserves, and has been produced as a GIS layer which will help inform management decisions within each reserve. The distributions of significant weeds, additional to those identified in section 5, are shown in Appendix 8.

Impacts

Weeds in Australia cost an estimated \$4 billion per year to manage. This estimate is based on economic impact to Agriculture and does not include the environmental impacts of weeds (DEC 2006), so the real figure is much greater. The agricultural impacts of weeds whilst significant and well documented Australia wide are limited in the Sydney Region, although weeds do cause nuisance to park neighbours on most of the park/rural interface (including hobby farms and lifestyle properties) in the region.

Weeds pose a major threat to biodiversity as they out compete and displace native plant species, and place threatened species and endangered ecological communities under increased pressure. In many cases they have replaced entire components (e.g. ground layers) of EEC's and decreased the ecological integrity of these communities. Many weed species have the potential to form monocultures if left uncontrolled. Weeds cause habitat degradation by altering shelter and food availability (positively and negatively) for fauna including invertebrates. Weeds can reduce the aesthetic appeal and scenic value of reserves and restrict recreational opportunities. Weeds readily invade disturbed or built areas and can cause significant damage to cultural heritage sites. Weeds alter fuel loads and effect fire behaviour and long term fire regimes. Some weeds such as Asthma Weed can cause severe allergic reactions in some people and can be considered a real health risk.

Priorities for control

Critical Priority

Privets (both small and large-leaf- *Ligustrum* spp.) and Green

Cestrum (Cestrum parqui): Control to prevent further impacts on the following endangered ecological communities and threatened species:

- Littoral Rainforest EEC - North Head and Dobroyd Head, Sydney Harbour National Park;
- River-Flat Eucalypt Forest on Coastal Flood Plains – Cattai NP (as well as other EECs within the reserve ranked as having critical conservation

- significance); Campbell's Ford- Gulguer NR; Bents Basin SCA; Woodland adjacent to Long-neck Lagoon, Scheyville NP; Mulgoa NR
- Western Sydney Dry Rainforest – Cattai NP; and
- the vulnerable Magenta Lilly Pilly (*Syzygium paniculatum*) at Dobroyd Head, Sydney Harbour NP.

Willows (*Salix* spp.), Honey Locust (*Gleditsia triacanthos*), and Box Elder Maple (*Acer negundo*): Control to prevent further impacts on River-flat Eucalypt Forest on Coastal Flood Plains EEC in the following areas:

- Adjacent to Longneck Lagoon, Scheyville NP;
- Campbell's Ford, Gulguer NR; and
- Bents Basin SCA.

Cootamundra Wattle (*Acacia baileyana*) : Eradicate in areas where it has potential to interbreed with the threatened plant *Acacia pubescens* in Scheyville NP and Windsor Downs NR.

African Box Thorn (*Lycium ferocissimum*) : Control to prevent further impacts Cumberland Plain Woodland EEC: - in areas identified as critical conservation significance in Scheyville NP.

Critical priorities for **general bush regeneration** programs targeting a suite of weeds are those that minimise weed impacts on EECs and endangered animal populations in the following precincts or reserves:

- Eastern Suburbs Banksia Scrub EEC – North Head, Sydney Harbour NP and Botany Bay NP;
- Littoral Rainforest EEC – North and Dobroyd Heads, Sydney Harbour NP (prior to undertaking work here stormwater and other drainage issues need to be resolved);
- *Themeda* Grasslands on Seacliffs and Coastal Headlands EEC – Botany Bay NP;
- Agnes Banks Woodland EEC – prevent expansion of environmental and noxious weeds and garden escapes from the NW corner of the reserve;
- Freshwater Wetlands on Coastal Floodplains EEC – prevent expansion of weeds at margin of wetland – Pitt Town NR and Scheyville NP;
- Shale/Gravel Transition Forest EEC – prevent expansion of weeds into relatively weed free areas – Kemps Creek NR and Scheyville NP;
- Shale/Sandstone Transition Forest EEC – prevent expansion of weeds into relatively weed free areas – Gulguer NR and Scheyville NP;
- Cumberland Plain Woodland EEC – prevent expansion of weeds into relatively weed free areas - Kemps Creek NR, Prospect NR and Scheyville NP;
- Western Sydney Dry Rainforest EEC – Cattai NP;
- River-flat Eucalypt Forest on Coastal Flood Plains EEC – in areas identified as critical conservation significance - Cattai NP;
- Endangered Long-nosed Bandicoot population habitat – North Head, Sydney Harbour NP – ensure that known habitat does not become too densely weed infested for animals to move through;
- Endangered Little Penguin population and declared critical habitat – Collins Beach/North Head, Sydney Harbour NP (any bush regeneration or weed control activities will require the preparation of a species impact statement and should be developed in close consultation with the Threatened Species Recovery Team as some weed control may actually constitute a threat- see Recovery Plan - NPWS 2000c);

Critical priorities for **general bush regeneration** programs are those that target weeds currently known to be impacting on the following threatened plant and animal species:

- *Allocasuarina portuensis* – Nielsen Park, Hermitage Foreshore and South Head, Sydney Harbour NP – as identified in PAS;
- *Acacia terminalis* subsp. *terminalis* – Nielsen Park, Hermitage Foreshore, Bottle and Glass Pt, South Head, North, Middle, Georges and Bradleys Heads, Sydney Harbour NP;
- *Eucalyptus camfieldii* – North Head, Sydney Harbour NP;
- *Eucalyptus benthamii* – Bents Basin SCA and Gulguer NR;
- *Pimelea curviflora* var. *curviflora* – Cattai NP;
- Eastern Bentwing Bat – maintain clear entrances and flyways to roosting sites in fortifications at Middle and Georges Head, Sydney Harbour NP.

Preparation of **site management plans** to identify the need for bush regeneration and individual weed species management is needed for the following threatened plant species:

- *Acacia bynoeana* – Agnes Banks NR;
- *Persoonia nutans* – Agnes Banks NR, Wianamatta RP;
- *Micromyrtus minutifolia* – Agnes Banks NR;
- *Dillwynia tenuifolia* – Agnes Banks NR, Kemps Creek NR, Scheyville NP, Wianamatta RP;
- *Pultenaea parviflora* – Agnes Banks NR, Scheyville NP, Wianamatta RP;
- *Persoonia hirsuta* – North Head, Sydney Harbour NP; and
- *Syzygium paniculatum* – Dobroyd Head.

High Priority

Tree of Heaven (*Ailanthus altissima*): Control to prevent further expansion of impacts on River-flat Eucalypt Forest on Coastal Flood Plains EEC in identified areas of identified very high conservation significance, in Mulgoa NR.

High priority **bush regeneration programs** target weeds that impact on significant cultural heritage assets at:

- listed Aboriginal heritage places (including middens, burials, and rock engravings, shelters) at North Head, Reef Beach and Tania Park, Sydney Harbour NP and Cattai NP;
- fortifications and gun emplacements at Middle, Georges and Bradleys Head, and South Head/The Gap, Sydney Harbour NP (especially where woody weeds are impacting on the integrity of structures and as informed by the Fortifications Strategic Plan);
- the mill site - Cattai NP (keep site free of weeds);
- other significant European cultural heritage sites at Cattai NP and Scheyville NP;
- Regentville homestead ruins and the vineyard terracing, Mulgoa NR (particularly targeting Mt Morgan wattle and lemon-scented gum); and
- on the cultural viewscape from the historic house above Leacock RP.

Medium Priority

Privets (both small and large leafed) and Green Cestrum: On-going control as part of the co-operative Regional Weed Committee Plans for Privet and Green Cestrum – all reserves where relevant.

Ludwigia spp.: Control Ludwigia in accordance with the Regional Weed Committee Ludwigia Management Plan in:

- the Coastal Cemetery and Little Congwong Beach, La Perouse, Botany Bay NP; and

- Wolli Creek RP.

Bush regeneration programs that target weeds that impact scenic/aesthetic or recreation values in the following areas:

- Collins Beach/Flat, Dobroyd Head (particularly near Manly scenic walkway), Reef /Forty Baskets Beach, Crater Cover, Middle, Georges and Bradleys Heads, Goat and Shark Islands, Nielsen Park, Hermitage Foreshore (in areas not identified above) within Sydney Harbour NP (many of these are currently being conducted by corporate volunteers, CVA or other bushcare groups);
- Wolli Creek RP (most of the work here is conducted by volunteer groups organised by Wolli Creek Preservation Society);
- Caley's Lookout and the camp ground at Bents Basin SCA;
- Around the camp ground at Cattai NP;
- Weeds associated with sewage line overflow – Windsor Downs NR (this area requires resolution of sewerage issues first); and
- Rouse Hill RP picnic grounds and woodland walk.

Bush regeneration programs (including those by volunteer groups) that target weeds that are significantly impacting on the following EECs identified as high conservation significance in the regional conservation significance ranking of EECs:

- River-flat Eucalypt Forest on Coastal Flood Plains EEC – Mulgoa NR (currently much of the work conducted by Mulgoa Landcare Group) and Leacock RP; and
- Cumberland Plain Woodland – parts of Scheyville NP.

Lower Priority

There are a number of volunteer programs currently occurring that have localised impacts on natural ecosystems but promote community education and involvement with parks. These include:

- the joint program with Liverpool Council for the weaving gardens project – Leacock RP; and
- the glider club bush regeneration group - William Howe RP.

Control

Control techniques vary depending on species and situation, and in general integration of several techniques is best practice. Environmental weeds are often a symptom of a problem and not the cause, and thus control methods must take into consideration measures to mitigate underlying causes.

Correct species identification, an understanding of ecology, interrelationships and plant succession is also essential for long term effectiveness. Control should be undertaken subject to a site plan, risk assessment and an assessment of the feasibility of success. Prevention of new infestations by the implementation of good hygiene (by staff, contractors, volunteers and visitors) when moving people, equipment/plant or vehicles out of infected areas is essential.

Control techniques include hand removal, physical removal using plant and equipment, chemical treatments with a range of herbicides as per label or permit including by cut/scrape and paint, hand held or vehicle mounted or aerial spray application. Biological controls are also available for some weed species.

Monitoring

Where specific noxious or environmental weeds are impacting upon threatened species or communities, site plans should be prepared that identify specific aims, outcomes and milestones. Monitoring of weed invasions in EECs could be monitored

through the selection of sites to use as photo points, from where photographs can be taken on a regular basis. This method shows changes over time, and if control is being successful.

12.0 Phytophthora

Phytophthora cinnamomi is a microscopic soilborne organism, invisible to the naked eye, which causes root rot of a wide variety of plant species including many native and introduced plants. Infection often results in the death of the plant, with early symptoms including wilting, yellowing and retention of dried foliage and darkening of young feeder roots and occasionally the larger roots. *Phytophthora* requires moist soil conditions and warm temperatures to be active, but damage is most evident in summer when plants are also prone to drought stress.

There is no way of visually telling if the pathogen is present in the soil at any one site, however laboratory analysis of soil can determine if the organism is present. A plant infected by *Phytophthora* suffers destruction of root tissue which renders the plant unable to absorb water and nutrients, and the plant may subsequently die. The spores are easily transported in stormwater, drainage water, contaminated soil and on tools, footwear and vehicles. *Phytophthora* is able to survive in dead plant tissue and in the soil for extended periods.

Currently there is no single method for controlling *Phytophthora cinnamomi*. A combination of hygiene protocols, good horticultural management, selective use of some fungicides and the addition of organic matter to soils can be used to retard the activity of *Phytophthora*. Hygiene protocols should be implemented in every reserve to prevent the spread of *Phytophthora*, even if the organism has not been identified in a reserve. The protocols developed by Harbour North Area (Appendix 9) should be adhered to by all staff, bush regeneration contractors and volunteers in all Areas, not just Harbour North.

13.0 Further Ranking of Critical Priorities for Weed Control

The preceding sections identified around 135 critical priorities for weed control in Sydney Region reserves which were largely identified from the Priority Action Statements, Recovery Plans, Threat Abatement Plans, *Key Threatening Process* determinations, and identified threats in the listing of threatened species, communities and populations under the *NSW TSC Act 1995*. When multiple weed species are grouped by location of the threatened species, population or EEC that weed control aims to protect, 63 target locations are identified as being of critical priority. In an ideal world, Sydney Region would have the resources to implement appropriate control actions at these 63 sites, but given past funding allocations, and potential new funding streams, it still seems unlikely that Sydney Region will be able to address all 63 of these sites within the life of this plan. This of course, will lead to further decline of the condition of EECs, and threatened species and populations within Sydney Region reserves.

To minimise the significance of further declines, and to further guide allocation of limited resources the 63 sites have been subjected to an additional ranking process (see Appendix 10 for more detailed information). Ranking was achieved by assigning numerical scores to five factors, which were felt to be important criteria for further refining critical weed control priorities. These factors were: 1) the value of the site to the survival of species, population or EEC; 2) the overall conservation significance of the site; 3) the overall condition of the bushland at the site; 4) a risk assessment of the impacts of no control; and 5) an assessment of the difficulty/feasibility of control.

The first factor (value of the site) gave the highest score to species/populations or EEC that were recorded in two or less reserves (or in the case Sydney Harbour NP-precincts). The rationale behind this being that the loss of poorly represented species/populations/communities is likely to be more significant, since they are virtually irreplaceable within the reserve system. Sites that represent the largest or best example of the species or EEC within Sydney Region reserves were also scored highly (see Appendix 10 for a full explanation of numerical scores).

The second factor (overall conservation significance) is based on considerations in addition to the specific threatened species, population or EEC at risk. For western Sydney reserves this was based on the conservation significance ranking of EECs from data obtained in systematic fauna and habitat surveys. This overall conservation significance ranking takes into account species diversity, habitat attributes such as tree hollow density, connectivity, uniqueness and representation in other reserves and was based on 25 factors. This level of detailed information is not available for Sydney Harbour NP, Botany Bay NP, or Wollie Creek RP as equivalent systematic surveys have not been conducted in these reserves. For these parks, the overall conservation significance ranking is a more subjective assignment of values, which is heavily influenced by the threatened species or EEC at risk.

The third factor (bushland condition) is based on the recent weed mapping (Epacris 2008) which classified vegetation condition in the ground layer, middle layer (shrubs and small trees), and the upper layer. The bushland condition score is based on an average of scores for these three layers. The weed mapping did not cover some parts of Sydney Harbour and Botany Bay National Parks, and where this encompasses critical priority target areas, an averaged bushland condition score is assigned based on local knowledge of the area.

The fourth factor (risk assessment of impacts if no control) acknowledges that “doing nothing” will result in further decline of values for all of the target sites, but attempts to scale these impacts based on three somewhat simplistic assumptions: 1) that maintaining areas that are currently weed free or preventing expansion of weeds into these relatively weed free areas is of the highest priority; 2) that no weed control in sites that only have a moderate level of weed infestation but also have high conservation significance may lead to a net decline in key values; and 3) that lack of weed controls in areas which are already heavily weed infested or have lower conservation significance values, will result in no major changes to key values at that location.

The score of the fifth factor (difficulty/ feasibility of control) was subtracted from the overall site score, and was based on the assumption that the easiest weed infestations to control are those that are smallest in area and which do not have potentially on-going disturbance (e.g. flooding of creek lines or stormwater flows). It also assumes that other weed invasion pathways such as seed dispersal by birds are equivalent across all sites, and that the most heavily weed infested areas have the greatest soil-based seed bank, which may not always be the case.

The scores for all of these factors were summed and the ranking scores of all the critical priority weed control target sites and the Total Ranking Scores are listed in descending order in Appendix 10. Although this should be used as a guideline for the allocation of resources, it is also possible that funding or resourcing opportunities may arise (e.g. joint projects with councils or volunteer initiatives or funding sources that target a specific weed or threatened species or precinct), which result in weed control treatment sites with lower ranking scores being implemented before other sites with higher ranking scores.

14.0 Appendices

- Denotes recorded < 25yrs old
- Denotes record >25 yrs
- p Denotes planted
- p? Denotes probably planted

Appendix 1: Endangered Populations and Threatened Species

Common Name	Scientific name	Status	Harbour Sth Area			Cumberland Nth Area							Cumberland Sth Area							
			Sydney Harbour NP (Nth)	Sydney Harbour NP (Sth)	Botany Bay NP (Nthn only)	Wolli Creek RP	Agnes Banks NR	Castlereagh NR	Cattai NP	Pitt Town NR	Rouse Hill RP	Scheyville NP	Wianamatta RP	Windsor Downs NR	Bents Basin SCA	Gulguer NR	Kemps Creek NR	Leacock NR	Mulgoa NR	Prospect NR
Endangered Populations																				
Little Penguin Population Manly	<i>Eudyptula minor</i>	EP	●																	
Long-nosed Bandicoot Population North Head	<i>Perameles nasuta</i>	EP	●																	
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> population	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	EP										●								●
Threatened Plants																				
Bynoe's Wattle	<i>Acacia bynoeana</i>	E						●	●				●							
Downy Wattle	<i>Acacia pubescens</i>	E										●	●							●

Appendix 1 Continued: Endangered Populations and Threatened Species

Common Name	Scientific name	Status	Sydney Harbour NP (Nth)	Sydney Harbour NP (Sth)	Botany Bay NP (Nthn only)	Wolli Creek RP	Agnes Banks NR	Castlereagh NR	Cattai NP	Pitt Town NR	Rouse Hill RP	Scheyville NP	Wianamatta RP	Windsor Downs NR	Bents Basin SCA	Gulguer NR	Kemps Creek NR	Leacock NR	Mulgoa NR	Prospect NR	William Howe RP	
Sunshine Wattle	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	E	•	•	•																	
	<i>Allocasuarina glareicola</i>	E						•														
Nielsen Park She-oak	<i>Allocasuarina portuensis</i>	E		•																		
	<i>Dillwynia tenuifolia</i>	V					•	•				•	•	•			•		•			
Camfield's Stringybark	<i>Eucalyptus camfieldii</i>	V	•																			
Camden White Gum	<i>Eucalyptus benthamii</i>	V													•	•						
Juniper-leaved Grevillea	<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V						•					•	•?								
	<i>Micromyrtus minutiflora</i>	E					•	•					•								•	
Hairy Geebung	<i>Persoonia hirsuta</i> subsp. <i>hirsuta</i>	E	•																			
Nodding Geebung	<i>Persoonia nutans</i>	E					•	•					•	•								
	<i>Pimelea curviflora</i> var. <i>curviflora</i>	V	•p?						•				•									

Appendix 1 Continued: Endangered Populations and Threatened Species

Common Name	Scientific name	Status																			
			Sydney Harbour NP (Nth)	Sydney Harbour NP (Sth)	Botany Bay NP (Nthn only)	Wolli Creek RP	Agnes Banks NR	Castlereagh NR	Cattai NP	Pitt Town NR	Rouse Hill RP	Scheyville NP	Wianamatta RP	Windsor Downs NR	Bents Basin SCA	Gulguer NR	Kemps Creek NR	Leacock NR	Mulgoa NR	Prospect NR	William Howe RP
Spiked Rice Flower	<i>Pimelea spicata</i>	E											•							•	
	<i>Pultenaea parviflora</i>	E						•	•				•	•	•					•	
Magenta Lilly Pilly	<i>Syzygium paniculatum</i>	V	•				•p														
	<i>Tetradlea glandulosa</i>	V								•											
<u>Threatened Fauna</u>																					
Cumberland Plain Land Snail	<i>Meridolum corneovirens</i>	E						•	•	•			•	•	•	○		•	•	•	•
Wallum Froglet	<i>Crinia tinnula</i>	V				•															
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	V																•			
Red-crowned Toadlet	<i>Pseudophryne australis</i>	V	•															•			
Green and Golden Bell Frog	<i>Litoria aurea</i>	E				○												•		○	
Freckled Duck	<i>Stictonetta naevosa</i>	V									•										
Black Bittern	<i>Ixobrychus flavicollis</i>	V								•			•	•							
Australasian Bittern	<i>Botaurus poiciloptilus</i>	V									•									•	

Appendix 1 Continued: Endangered Populations and Threatened Species

Common Name	Scientific name	Status		Sydney Harbour NP (Nth)		Sydney Harbour NP (Sth)	Botany Bay NP (Nthn only)		Wolli Creek RP		Agnes Banks NR	Castlereagh NR	Cattai NP	Pitt Town NR	Rouse Hill RP	Scheyville NP	Wianamatta RP	Windsor Downs NR		Bents Basin SCA	Gulguer NR	Kemps Creek NR	Leacock NR	Mulgoa NR	Prospect NR	William Howe RP
Speckled Warbler	<i>Pyrrholaemus sagittatus</i>	V										•				•	•	•				•				
Regent Honeyeater	<i>Xanthomyza phrygia</i>	E		○							•	•	○			•										
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	V										•	•			•					•					
Painted Honeyeater	<i>Grantiella picta</i>	V										•														
Hooded Robin	<i>Melanodryas cucullata</i>	V														•					•					
Olive Whistler	<i>Pachycephala olivacea</i>	V																			•					
Diamond Firetail	<i>Stagonopleura guttata</i>	V				○										•	•				•					
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V				○							•													
Koala	<i>Phascolarctos cinereus</i>	V											•				•?									
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	V		○?																						
Yellow-bellied Glider	<i>Petaurus australis</i>	V											•					•								
Squirrel Glider	<i>Petaurus norfolcensis</i>	V											•													

Appendix 1 Continued: Endangered Populations and Threatened Species

Common Name	Scientific name	Status	Sydney Harbour NP	Sydney Harbour NP	Botany Bay NP (Nthn only)	Wolli Creek RP	Agnes Banks NR	Castlereagh NR	Cattai NP	Pitt Town NR	Rouse Hill RP	Scheyville NP	Wianamatta RP	Windsor Downs NR	Bents Basin SCA	Gulguer NR	Kemps Creek NR	Leacock NR	Mulgoa NR	Prospect NR	William Howe RP	
			(Nth)	(Sth)																		
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	•		•	•	•	•	•			•	•			•	•	•	•	•	•	•
Yellow-bellied Sheathtail Bat	<i>Saccolaimus flaviventris</i>	V									•		•									
Eastern Freetail Bat	<i>Mormopterus norfolkensis</i>	V	•				•	•	•			•	•	•	•	•		•	•	•	•	•
Little Bentwing Bat	<i>Miniopterus australis</i>	V											•									
Eastern Bentwing Bat	<i>Miniopterus schreibersii oceanensis</i>	V	•		•	•	•		•	•		•	•		•	•			•	•		
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V										•			•	•			•			
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V	•																	•		
Large-footed Myotis	<i>Myotis adversus</i>	V	•					•			•	•	•			•	•	•	•	•		
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V					•	•	•		•	•	•	•			•	•	•			

Appendix 2: Endangered Ecological Communities

	Eastern Suburbs Banksia Scrub	Littoral Rainforest	<i>Themeda</i> Grasslands on Seaciffs and Coastal Headlands	Agnes Banks Woodland	Castlereagh Ironbark Forest	Castlereagh Swamp Woodland	Cumberland Plain Woodland	Freshwater Wetlands on Coastal Floodplains	Moist Shale Woodland	River-flat Eucalypt Forest on Coastal Floodplain	Shale/Gravel Transition Forest	Shale/Sandstone Transition Forest	Western Sydney Dry Rainforest
Harbour North													
Sydney Harbour National Park (Nth)	●	●											
Harbour South													
Sydney Harbour National Park (Sth)													
Botany Bay National Park (Nth)	●		●										
Wolli Creek Regional Park													
Cumberland North													
Agnes Banks Nature Reserve				●	●	●					●		
Castlereagh Nature Reserve					●	●					●		
Cattai National Park							●	●		●		●	●
Pitt Town Nature Reserve								●					
Rouse Hill Regional Park							●			●		●	
Scheyville National Park					●		●	●		●	●		
Windsor Downs Nature Reserve					●	●	●				●		
Wianamatta Regional Park (gazetted)						●	●				●		
Cumberland South													
Bents Basin SCA							●			●		●	
Gulguer Nature Reserve										●		●	
Kemps Creek Nature Reserve						●	●			●	●		
Mulgoa Nature Reserve							●		●	●		●	
Leacock Regional Park							●			●			
Prospect Nature Reserve							●			●			
William Howe Regional Park							●						

NOTE: ● Occurs within the reserve.

Appendix 3: Summary of Pest Related Key Threatening Process in NSW

Name	Determination	Gazette date
Anthropogenic Climate Change	Final	17/11/00
Competition and grazing by the feral European Rabbit	Final	10/05/02
Competition and habitat degradation by Feral Goats	Final	12/11/04
Competition from Feral Honeybees <i>Apis mellifera</i>	Final	29/11/02
Establishment of escaped exotic garden plants	Preliminary	24/10/08
Herbivory and environmental degradation caused by Feral Deer	Final	17/12/04
Importation of red imported Fire Ants into NSW	Final	23/08/02
Infection of native plants by <i>Phytophthora cinnamomi</i>	Final	13/12/02
Introduction of Large Earth Bumblebee, <i>Bombus terrestris</i> (L)	Final	13/02/04
Invasion and establishment of exotic vines and scramblers	Final	21/04/06
Invasion and establishment of Scotch Broom <i>Cytisus scoparius</i>	Final	9/11/07
Invasion and establishment of the Cane Toad <i>Bufo marinus</i>	Final	21/04/06
Invasion, establishment and spread of Lantana <i>Lantana camara</i>	Final	08/09/06
Invasion of native plant communities by Bitou Bush and Boneseed <i>Chrysanthemoides monilifera</i>	Final	12/03/99
Invasion of native plant communities by exotic perennial grasses	Final	12/09/03
Invasion of the Yellow Crazy Ant, <i>Anoplolepis gracilipes</i> into NSW	Final	19/08/05
Predation and hybridation by Feral Dogs	Preliminary	29/9/08
Predation by <i>Gambusia holbrooki</i> Plague Minnow	Final	29/01/99
Predation by the European Red Fox	Final	20/03/98
Predation by the Feral Cat	Final	24/03/00
Predation, habitat degradation, competition and disease transmission by Feral Pigs <i>Sus scrofa</i>	Final	27/08/04

Appendix 4: Emerging and Potential Pest Issues

These may change over the life of this strategy and do not include pest or weed species already known in some reserves but not others.

Vertebrate Pests

Pest Species	Issue
Cane Toads <i>Bufo marinus</i>	Individuals have been recorded in Sydney, and can be imported via the transport of goods especially landscape supplies and fruit. Sydney's climate means that cane toads have the potential to establish populations in the region. Action: Reports of Cane Toads should be followed up in accordance with the NPWS Cane Toad Management Policy and Procedures (2007). Report to NPWS Wildlife Atlas.
Red-eared slider turtle <i>Trachemys scripta elegans</i>	Red-eared sliders have been reported from Wolli Creek outside of the reserve and the Parramatta River. The red-eared slider is an aggressive species that has established feral populations elsewhere in Australia and other countries. Action: Remove from area and report to Biodiversity Officer for further investigation and report to NPWS Atlas.
American corn snake <i>Elaphe guttata</i>	Individuals have reportedly been seen in Hawkesbury Area. The American corn snake has established feral populations in other countries. Action: Remove from area and report to Biodiversity Officer for further investigation and report to NPWS Atlas.

Weeds

Water hyacinth <i>Eichhornia crassipes</i>	An aquatic weed, a Class 2 notifiable weed. Not currently known on NPWS estate in the region. Action: Report to relevant regional weed committee and DPI. Should be given a critical priority for control. Immediate action will produce positive results.
Horsetail, Equisetum <i>Equisetum spp.</i> <i>E arvense</i> <i>E hymale</i>	A herb, a Class 1 notifiable weed. Although not known on NPWS estate, it has been reported but not confirmed in Ku-ring-gai Council (adjacent Dalrymple Hay NR) and confirmed in Warringah and Pittwater LGAs. Action: Report to relevant regional weed committee and DPI. Should be given a critical priority for control. Immediate action will produce positive results.
Senegal Tea <i>Gymnocornis spilanthoides</i>	A highly invasive aquatic weed occurring in scattered infestations around the country. It is a Class 1 notifiable weed. Although not recorded in Sydney Region reserves Senegal Tea is known in the vicinity of Cattai NP. Action: Notify relevant regional weed committee and DPI. Should be given critical priority for control.

Appendix 4 continued: Emerging and Potential Pest Issues

<p>Hygrophila <i>Hygrophila costata</i></p>	<p>An aquatic weed, a Class 2 notifiable Weed. Found in Centennial Park, but not currently known on NPWS estate in the Sydney Region. Action: Notify relevant regional weed committee& DPI. Should be given critical priority for control. Immediate action will produce positive results.</p>
<p>Chilean Needle Grass <i>Nasella neesiana</i></p>	<p>An invasive grass that is listed as a Weed of National Significance, and is a Class 3 weed in most LGAs. There has been a single infestation in Agnes Banks NR after a wildfire (possibly introduced by fire vehicles) which has now been eradicated. Vigilance is necessary for further outbreaks. Action: Should be given a critical priority if detected and eradicated from the reserve.</p>
<p>Kudzu Vine <i>Pueraria lobata</i></p>	<p>A fast growing prolific vine. A Class 3 weed on the north coast of NSW. It has recently been found in western Sydney and has the potential to occur in the Sydney Region reserves. Action: Should be given a critical priority for control if detected.</p>

Appendix 5: Noxious Weeds by Local Government Area.

(Note only LGAs which contain reserves within Sydney Region shown.)

Noxious Weed	Scientific name												
		<u>Baulkham Hills</u>	<u>Blacktown</u>	<u>Camden</u>	<u>Canterbury</u>	<u>Hawkesbury</u>	<u>Liverpool</u>	<u>Manly</u>	<u>Mosman</u>	<u>Penrith</u>	<u>Randwick</u>	<u>Woolahra</u>	<u>Wollondilly</u>
Karoo Thorn	<i>Acacia karroo</i>	1	1	1	1	1	1	1	1	1	1	1	1
Prickly Acacia	<i>Acacia nilotica</i>	1	1	1	1	1	1	1	1	1	1	1	1
Espartillo	<i>Achnatherum brachychaetum</i>	5	5	5	5	5	5	5	5	5	5	5	5
Crofton Weed	<i>Ageratina adenophora</i>	4	4			4		4		4			
Alligator Weed	<i>Alteranthera philoxeroides</i>	3	3	3	3	3	3	3	3	3	3	3	3
Annual Ragweed	<i>Ambrosia artemesiifolia</i>	5	5	5	5	5	5	5	5	5	5	5	5
Burr Ragweed	<i>Ambrosia confertiflora</i>	5	5	5	5	5	5	5	5	5	5	5	5
Pond Apple	<i>Annona glabra</i>	1	1	1	1	1	1	1	1	1	1	1	1
Madeira Vine	<i>Anredera cordifolia</i>							4	4				
Mexican Poppy	<i>Argemone mexicana</i>	5	5	5	5	5	5	5	5	5	5	5	5
Giant Reed/ Elephant Grass	<i>Arundo donax</i>							4	4				
Asparagus Fern	<i>Asparagus aethiopicus</i>							4	4				
Bridal Creeper	<i>Asparagus asparagoides</i>	5	5	5	5	5	5	5	5	5	5	5	5
Climbing Asparagus Fern	<i>Asparagus plumosus</i>							4	4				
Chinese Violet	<i>Asystasia gangeta subsp. micrantha</i>	1	1	1	1	1	1	1	1	1	1	1	1
Sand Oat	<i>Avena strigosa</i>	5	5	5	5	5	5	5	5	5	5	5	5
Mother of Millions	<i>Bryophyllum sp.</i>	3	3			3				3			
Kochia	<i>Bassia scoparia</i>	1	1	1	1	1	1	1	1	1	1	1	1
Smooth- stemmed Turnip	<i>Brassica barleri subsp. oxyrrhina</i>	5	5	5	5	5	5	5	5	5	5	5	5
Cabomba	<i>Cabomba caroliniana</i>	5	5	5	5	5	5	5	5	5	5	5	5
Balloon Vine	<i>Cardiospermum grandiflorum</i>							4	4				
Glaucous starthistle	<i>Carthamus glaucus</i>	5	5	5	5	5	5	5	5	5	5	5	5
Fine-bristled Burr Grass	<i>Cenchrus brownii</i>	5	5	5	5	5	5	5	5	5	5	5	5
Gallon's Curse	<i>Cenchrus biflorus</i>	5	5	5	5	5	5	5	5	5	5	5	5
Mossman River Grass	<i>Cenchrus echinatus</i>	5	5	5	5	5	5	5	5	5	5	5	5
Spiny Burrgrass	<i>Cenchrus incertus</i>	4	4	4		4				4			4
Spiny Burrgrass	<i>Cenchrus longispinus</i>	4	4	4		4				4			4
Spotted Knapweed	<i>Centaurea maculosa</i>	1	1	1	1	1	1	1	1	1	1	1	1
Black Knapweed	<i>Centaurea nigra</i>	1	1	1	1	1	1	1	1	1	1	1	1
Green Cestrum	<i>Cestrum parqui</i>	3	3	3	3	3	3	3	3	3	3	3	3
Siam Weed	<i>Chromolaena odorata</i>	1	1	1	1	1	1	1	1	1	1	1	1
Bitou Bush	<i>Chrysanthemoides monilifera subsp. monilifera</i>				3		3	3	3		3	3	
Boneseed	<i>Chrysanthemoides monilifera subsp. rotunda</i>				3		3	3	3		3	3	

Appendix 5 Continued: Noxious Weeds – Sydney Region

Noxious Weed	Scientific name	Baulkham	Blacktown	Camden	Canterbury	Hawkesbury	Liverpool	Manly	Mosman	Penrith	Randwick	Woollahra	Wollondilly
		Hills											
Pampas Grass	<i>Cortaderia</i> spp.	3	3	3	3	3	3	3	3	3	3	3	3
Rubbervine	<i>Cryptostegia grandiflora</i>	1	1	1	1	1	1	1	1	1	1	1	1
Dodder	<i>Cuscuta campestris</i>	5	5	5	5	5	5	5	5	5	5	5	5
Prickly Pear	<i>Cylindropuntia</i> sp.	4	4	4	4	4	4	4	4	4	4	4	4
Artichoke thistle	<i>Cynara cardunculus</i>	5	5	5	5	5	5	5	5	5	5	5	5
Yellow Nutgrass	<i>Cyperus esculentus</i>	5	5	5	5	5	5	5	5	5	5	5	5
Cape Ivy	<i>Delairea odorata</i>							4	4				
Paterson's Curse, Vipers /Italian Bugloss	<i>Echium</i> spp	4	4	4		4				4			4
Leafy elodea	<i>Egeria densa</i>	5	5	5	5	5	5	5	5	5	5	5	5
Water Hyacinth	<i>Eichhornia crassipes</i>	3	3	2	2	3	2	2	2	3	2	2	3
Anchored Water Hyacinth	<i>Eichomia azurea</i>	1	1	1	1	1	1	1	1	1	1	1	1
Horsetail	<i>Equisetum</i> spp	1	1	1	1	1	1	1	1	1	1	1	1
Cockspur Coral Tree	<i>Erythrina crista-galli</i>							4					
Bear skin Fescue	<i>Festuca gautieri</i>	5	5	5	5	5	5	5	5	5	5	5	5
Clockweed	<i>Gaura lindheimeri</i>	5	5	5	5	5	5	5	5	5	5	5	5
Clockweed	<i>Gaura parviflora</i>	5	5	5	5	5	5	5	5	5	5	5	5
Cape Broom	<i>Genista monspessulana</i>							3					
Senegal Tea Plant	<i>Gymnocoronis spilanthoides</i>	1	1	1	1	1	1	1	1	1	1	1	1
Harrisia Cactus	<i>Harrisia</i> spp	4	4	4	4	4	4	4	4	4	4	4	4
Texas Blueweed	<i>Helianthus ciliaris</i>	5	5	5	5	5	5	5	5	5	5	5	5
Hawkweed	<i>Heiracium</i> spp	1	1	1	1	1	1	1	1	1	1	1	1
Hygrophila	<i>Hygrophila costata</i>	2	2	2	2	2	2	2	2	2	2	2	2
East Indian Hygrophila	<i>Hygrophila polysperma</i>	1	1	1	1	1	1	1	1	1	1	1	1
Hymenachne	<i>Hymenachne amplexicaulis</i>	1	1	1	1	1	1	1	1	1	1	1	1
St John's Wort	<i>Hypericum perforatum</i>	4	4	4	4	4	4	4	4	4	4	4	4
Morning Glory	<i>Ipomea cairica</i>							4	4				
Morning Glory	<i>Ipomea indica</i>							4	4				
Lagarosiphon	<i>Lagarosiphon major</i>	1	1	1	1	1	1	1	1	1	1	1	1
Lantana	<i>Lantana camara</i>	5	5	5	4/5	5	4/5	4/5	4/5	5	4/5	4/5	5
Broadleaf Privet	<i>Ligustrum lucidum</i>	4	4	4	4	4		4	4	4	4	?	
Small leaf Privet	<i>Ligustrum sinense</i>	4	4	4	4	4		4	4	4	4	?	
Yellow Burrhead	<i>Limnocharis flava</i>	1	1	1	1	1	1	1	1	1	1	1	1
Ludwigia	<i>Ludwigia longiflora</i>	3/5	3/5	3/5	3/5	3/5	3/5	3/5	3/5	3/5	3/5	3/5	3/5
Ludwigia	<i>Ludwigia peruviana</i>	3	3		3	3	3	3	3	3	3	3	
African Boxthorn	<i>Lycium ferocissimum</i>	4	4	4		4				4			4
Cat's Claw Creeper	<i>Macfadyena unguis-cati</i>							4	4				
Miconia	<i>Miconia</i> spp.	1	1	1	1	1	1	1	1	1	1	1	1

Appendix 5 Continued: Noxious Weeds – Sydney Region

Noxious Weed	Scientific name	Sydney Region											
		Baulkham Hills	Blacktown	Camden	Canterbury	Hawkesbury	Liverpool	Manly	Mosman	Penrith	Randwick	Woollahra	Wollondilly
Mimosa	<i>Mimosa pigra</i>	1	1	1	1	1	1	1	1	1	1	1	1
Eurasian water Milfoil	<i>Myriophyllum spicatum</i>	1	1	1	1	1	1	1	1	1	1	1	1
Chilean Needle Grass	<i>Nassella neesiana</i>	4	4	4	4	4	4	4	4	4	4	4	4
Mexican Feather Grass	<i>Nassella tenuissima</i>	1	1	1	1	1	1	1	1	1	1	1	1
Serrated Tussock	<i>Nassella trichotoma</i>	4	4	4	4	4	4	4	4	4	4	4	4
Ochna	<i>Ochna serrulata</i>							4					
Prickly Pear	<i>Opuntia</i> spp.	4	4	4	4	4	4	4	4	4	4	4	4
Broomrape	<i>Orobanche</i> spp.	1	1	1	1	1	1	1	1	1	1	1	1
Red Rice	<i>Oryza rufipogon</i>	5	5	5	5	5	5	5	5	5	5	5	5
Oxalis	<i>Oxalis</i> sp	5	5	5	5	5	5	5	5	5	5	5	5
Pellitory	<i>Parietaria judaica</i>	4	4		4	4	4	4	4	4	4	4	
Parthenium Weed	<i>Parthenium hysterophorus</i>	1	1	1	1	1	1	1	1	1	1	1	1
Tussock paspalum	<i>Paspalum quadrifarium</i>							3	3				
African Feather Grass	<i>Pennisetum macrourum</i>	5	5	5	5	5	5	5	5	5	5	5	5
Fountain Grass	<i>Pennisetum setaceum</i>	5	5	5	5	5	5	5	5	5	5	5	5
Long-style Feather Grass	<i>Pennisetum villosum</i>			4									4
Rhizomatous Bamboo	<i>Phyllostachys</i> spp.							4	4				
Soldier Thistle	<i>Picnomon acarna</i>	5	5	5	5	5	5	5	5	5	5	5	5
Water Lettuce	<i>Pistia stratiotes</i>	1	1	1	1	1	1	1	1	1	1	1	1
Castor Oil Plant	<i>Ricinus communis</i>				4		4	4	4		4	4	
Onion Grass	<i>Romulea</i> sp.	5	5	5	5	5	5	5	5	5	5	5	5
Sweet Briar	<i>Rosa rubiginosa</i>			4									4
Blackberry	<i>Rubus fruticosus</i>	4	4	4	4	4	4	4	4	4	4	4	4
Arrowhead	<i>Sagittaria montevidensis</i>	5	5	5	5	5	5	5	5	5	5	5	5
Sagittaria	<i>Sagittaria platyphylla</i>	5	5	5	5	5	5	5	5	5	5	5	5
Willows	<i>Salix</i> spp.	5	5	5	5	5	5	5	5	5	5	5	5
Salvinia	<i>Salvinia molesta</i>	3	3	3	2	3	2	2	2	3	2	2	3
Golden Thistle	<i>Scolymus hispanicus</i>	5	5	5	5	5	5	5	5	5	5	5	5
Senna	<i>Senna pendula</i>							4					
African turnipweed	<i>Sisymbrium runcinatum</i>	5	5	5	5	5	5	5	5	5	5	5	5
African turnipweed	<i>Sisymbrium thellungi</i>	5	5	5	5	5	5	5	5	5	5	5	5
Corn Sowthistle	<i>Sonchus arvensis</i>	5	5	5	5	5	5	5	5	5	5	5	5
Johnson Grass	<i>Sorghum halepense</i>	4	4	4		4				4			4
Columbus Grass	<i>Sorghum x almum</i>	4	4	4		4				4			4

Appendix 5 Continued: Noxious Weeds – Sydney Region

LGAS

Noxious Weed	Scientific name	LGAS											
		Baulkham Hills	Blacktown	Camden	Canterbury	Hawkesbury	Liverpool	Manly	Mosman	Penrith	Randwick	Woollahra	Wollondilly
Giant Parramatta Grass	<i>Sporobolus fertilis</i>	3	3	3		3				3			3
Cayenne Snakeweed	<i>Stachytarpheta cayennensis</i>	5	5	5	5	5	5	5	5	5	5	5	5
Water Soldier	<i>Stratiotes aloides</i>	1	1	1	1	1	1	1	1	1	1	1	1
Witchweed	<i>Striga sp.</i>	1	1	1	1	1	1	1	1	1	1	1	1
Athel Pine	<i>Tamarix aphylla</i>	5	5	5	5	5	5	5	5	5	5	5	5
Rhus Tree	<i>Toxicodendron succedaneum</i>	4	4	4	4	4	4	4	4	4	4	4	4
Trad	<i>Tradescantia fluminensis</i>							4					
Water Caltrope	<i>Trapa sp.</i>	1	1	1	1	1	1	1	1	1	1	1	1
Gorse	<i>Ulex europaeus</i>			3									3
Bathurst/ Noogoora Burrs Cockle Burrs	<i>Xanthium spp.</i>	4	4	4		4				4			4

NOTES:

- 1 = Class 1: State Prohibited Weeds** - 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.
- 2 = Class 2: Regionally Prohibited Weeds** - The plant must be eradicated from the land and the land must be kept free of the plant.
- 3 = Class 3: Regionally Controlled Weeds** -The plant must be fully and continuously suppressed and destroyed.
- 4 = Class 4: Locally Controlled Weeds** -The growth and spread of the plant must be controlled according to measures specified in a management plan.
- 5 = Class 5: Restricted Plants** - The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with. This is an All of NSW declaration. Class 1, 2 and 5 are notifiable weeds.

The LGA in which each reserve is found is shown below:

Baulkham Hills LGA: Part of Cattai NP

Blacktown: Prospect NR, Rouse Hill RP, and Wianamatta RP

Camden: William Howe RP

Canterbury: Wolli Ck RP

Hawkesbury: Part of Cattai NP, Scheyville NP, Windsor Downs NR, Pitt Town NR

Liverpool: Kemps Ck NR, Part of Bents Basin SCA, Part of Gulguer NR, and Leacock RP

Manly: Part of Sydney Harbour NP

Mosman: Part of Sydney Harbour NP

Penrith: Agnes Banks NR, Castlereagh NR and Mulgoa NR

Randwick: Botany Bay NP (Nthn part)

Woollahra: Part of Sydney Harbour NP

Wollondilly: Part of Bents Basin SCA and part of Gulguer NR

Appendix 6. Weeds of National Significance

Scientific Name	Common Name
<i>Acacia nilotica</i>	Prickly Acacia
<i>Alternanthera philoxeroides</i>	Alligator Weed
<i>Annona glabra</i>	Pond Apple
<i>Asparagus asparagoides</i>	Bridal Creeper
<i>Cabomba caroliniana</i>	Cabomba
<i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i> and subsp. <i>rotunda</i>	Boneseed and Bitou Bush
<i>Cryptostegia grandiflora</i>	Rubber Vine
<i>Hymenachne amplexicaullis</i>	Hymenachne
<i>Lantana camara</i>	Lantana
<i>Mimosa pigra</i>	Mimosa
<i>Nassella neesiana</i>	Chilean Needlegrass
<i>Nassella trichotoma</i>	Serrated Tussock
<i>Parkinsonia aculeata</i>	Parkinsonia
<i>Parthenium hysterophorus</i>	Parthenium Weed
<i>Prosopis</i> spp.	Mesquite
<i>Rubus fruticosus</i> agg.	Blackberry
<i>Salix</i> spp. except <i>S. babylonica</i> , <i>S.x reichardtjii</i>	Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow.
<i>Salvinia molesta</i>	Salvinia
<i>Tamarix aphylla</i>	Athel Pine
<i>Ulex europaeus</i>	Gorse

Appendix 7: Timing of Herbicide Spraying Programs

It is essential for effective chemical control to treat weeds at the correct time of year. The optimal time for chemical application is dependant on the chemical used, the chemicals mode of action and the growth stage of the plant. The labels on most herbicides indicate the best time for spraying. The Table below outlines the best time for spraying herbicides. Application of herbicides by means other than spraying (e.g. cut and paint etc) can generally be applied throughout the year, as can other control methods. The table below can be used as a guide when planning annual spraying works programs.

Key weed species of Sydney Region and appropriate months for spraying herbicides

Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Bitou/Boneseed												
Salvinia												
Willows												
Lantana												
Ludwigia												
Blackberry												
Honey Locust												
Turkey Rhubarb												
Privets												
Bridal Creeper												
Pampas Grass												
African Lovegrass												

NOTE:

 Shading indicates most appropriate month for spraying

Appendix 8: Significant Weeds (additional to section 5) recorded during weed mapping by Epacris (2008). Significant weeds are defined as weeds that area likely to impact on biodiversity, or declared noxious weeds. NOTE: Wianamatta RP and Sydney Harbour NP (Sth) were not mapped and only limited areas were mapped in Botany Bay NP and Sydney Harbour NP (Nth). Cattai NP, Kemps Creek NR and Bents Basin SCA were mapped by others. This list is not an exhaustive list, but reflects the most significant species by density and distribution.

Common Name	Scientific Name	Sydney Harbour NP (Nth)	Sydney Harbour NP (Sth)	Botany Bay NP (Nthn only)	Wolli Creek RP	Agnes Banks NR	Castlereagh NR	Cattai NP	Pitt Town NR	Rouse Hill RP	Scheyville NP	Wianamatta RP	Windsor Downs NR	Bents Basin SCA	Gulguer NR	Kemps Creek NR	Leacock NR	Mulgoa NR	Prospect NR	William Howe RP
Crofton Weed	<i>Ageratina adenophora</i>	•																⊙	⊙	
Spanish Reed	<i>Arundo donax</i>										•									
Mother of Millions	<i>Bryophyllum delagoense</i>	•			•			•			•						•	•		
Camphor Laurel	<i>Cinnamomum camphora</i>	•				⊙														
Cotoneaster	<i>Cotoneaster</i> sp.	•									•									
Stone Crop	<i>Crassula</i> spp															•				
Hawthorn	<i>Crataegus monogyna</i>																	•		
Montbretia	<i>Crocossimia x crocosmiliflora</i>	•																		
Paterson's Curse	<i>Echium plantagineum</i>					⊙		•							⊙		•			•
Coral Trees	<i>Erythrina</i> spp	•			•															
Pennywort	<i>Hydrocotyle bonariensis</i>			•																
St John's Wort	<i>Hypericum perforatum</i>										•						•			•
Parrot's Feather	<i>Myriophyllum aquaticum</i>							•	•		•									

Appendix 8 Continued : Other Significant Weeds

Common Name	Scientific Name	Sydney Harbour NP (Nth)	Sydney Harbour NP (Sth)	Botany Bay NP (Nthn only)	Wolli Creek RP	Agnes Banks NR	Castlereagh NR	Cattai NP	Pitt Town NR	Rouse Hill RP	Scheyville NP	Wianamatta RP	Windsor Downs NR	Bents Basin SCA	Gulguer NR	Kemps Creek NR	Leacock NR	Mulgoa NR	Prospect NR	William Howe RP
Fishbone Fern	<i>Nephrolepis cordifolia</i>	•																		
Mickey Mouse Plant	<i>Ochna serrulata</i>	•																		
Prickly Pears	<i>Oppuntia</i> spp.													⊙	⊙	⊙		⊙		⊙
Radiata Pine	<i>Pinus radiata</i>					•					•									
Indian Hawthorn	<i>Raphiolepis indica</i>	•																		
Castor Oil	<i>Ricinus communis</i>	•						•			•				⊙					
Bulbil Watsonia	<i>Watsonia meriana</i>	•																		

Notes:

- Denotes established widespread infestation throughout a reserve
- ⊙ Denotes isolated infestation restricted to a small geographic area of a reserve (encompassing new weed incursions)

Appendix 9: Field Phytophthora Protocols – Harbour North Area

Adapted from 'Sydney Harbour' Dieback Working Group Protocols for Bush Regenerators to prevent the spread of *Phytophthora cinnamomi* and from Protocols developed by Brett Summerell of Royal Botanic Gardens, Sydney (Nov 2003).

Phytophthora root rot is a disease of plant roots caused by a water mould that can cause widespread decline and plant death. Death is often associated with other stresses to native trees such as insect attack, changes to drainage, drought, weed growth and possibly lack of fire. Phytophthora is spread in contaminated soil and so is easily spread in soil adhering to footwear, tools and machinery. The following guidelines are designed to protect our native vegetation by preventing the spread of Phytophthora into areas where the disease does not occur.

Protocols required include:

- Always assume that the area you are working is free of Phytophthora. Conversely always assume that the activity you are about to undertake will have the potential to introduce the disease.
- **Clean equipment, machinery and footwear before entering a site.**
- Ensure that any adhering soil is removed as even the smallest amount of soil can contain Phytophthora spores.
- **Spray or soak all soles of shoes and tools** with one of the following disinfectants **before entering and leaving** a site:
 - **Household/Commercial Disinfectants – Use as per label**
 - Bleach (Sodium Hypochlorite, NaOCL) - 1% strength (NaOCL)
 - Methylated Spirits – 70% strength
 - **Allow a few minutes for the solution to soak into any soil** on the shoe / tool.
- Always work in areas known to be free of the pathogen before working in infected areas.
- **Never drive vehicles / trailers off-track** into bushland reserves, unless appropriate vehicle decontamination procedures are carried out.

All vehicles should be equipped with Phytophthora wash-down kits. These contain:

1. One rectangular bucket
2. One scrubbing brush
3. One bottle of disinfectant
4. One bottle of water (for diluting disinfectant)
5. One spray bottle (to contain pre-diluted disinfectant).

Protocols recommend that vehicles remain on the roads and are not driven off-track. Phytophthora-infected soil may adhere to vehicle tyres and undercarriages, and these must be disinfected before moving the vehicle to another site. If you must drive off-track, brush soil from tyres or undercarriages **BEFORE** leaving the current site and spray tyres/undercarriages with disinfectant as thoroughly as possible. Avoid driving off the pavement in wet or muddy conditions whenever possible, as this is when Phytophthora is most active.

If available, a vehicle wash-down bay provides for vehicles to be driven through a disinfectant wash prior to leaving and entering infected sites. Where possible, protocols should be established to address disinfecting large equipment (plant), such as chippers and bobcats. Always attempt to reduce soil contact as much as possible for all tools and equipment, and disinfect and remove soil whenever practical.

When possible, ensure that delivery trucks or visitors do not drive off the paved areas.

If you are leading a group or tour that will be walking through bushland, ensure that you explain the Phytophthora issue and that all members of the group follow protocols.

Any volunteers or researchers undertaking activities on Park are to be advised of and follow Phytophthora protocols.

Additional Phytophthora protocols:

- Follow Phytophthora protocols if you expect you will be moving from a potential Phytophthora infected area to a non-Phytophthora infected area. Potential Phytophthora infected areas include, drainage lines or areas where there is evidence of canopy dieback.
- Minimise soil disturbance on sites. Any activity that involves soil disturbance has the greatest potential for movement of the pathogen. In these situations it is essential that the soil not be moved from the site adjacent to the activity. By this we mean that soil dug is placed next to the excavation site – not dispersed across a larger area.
- Bag all weeds and soils that have been disturbed for removal off-site. It is essential that plants are not dragged through the bush with exposed roots and adhering soil. Ensure bags are strong enough to prevent damage when moving through vegetation and clean/disinfect bags thoroughly before reusing.
- Avoid working or minimise activities when the soil is very wet. The pathogen will be most active then, and the soil is more likely to adhere to foot wear and equipment.
- Only plant local plant stock that has come from suppliers who are accredited by the Nursery Industry Association. Never plant Phytophthora-susceptible plant species in areas where Phytophthora is present.
- Since specialised survival spores may survive for extended periods of time, Phytophthora can persist in dead plant tissue for a number of years. This has implications for leaving infected dead timber in reserves and sourcing suitable mulch. Mulch will need to be attained from accredited sources and should not be placed in bushland reserves but may be required along track edges. Avoid moving mulch between sites or between headlands.
- Disinfect fire equipment, such as hoses and drip torches, after each use. Bleach should not be used on hoses, however they can be sprayed with commercial disinfectant. Any equipment that comes into contact with the soil should be disinfected prior to leaving the site. If you do not have time to disinfect before leaving the site, ensure that items are promptly disinfected upon return to your home area.
- All waste disinfectant water should be disposed of in the sewer/stormwater system. Do not dump waste from disinfecting procedures in the bush or on turf, as it may damage some plants (including grass).

Appendix 10: Further Ranking of Critical Priorities

Definitions of each category within each of the five factors and the scores (in bold) are as follows:

1) Value of the site to the survival of the species, population or EEC within Sydney Region reserves:

Critical: Less than two locations for the species, population or EEC: **50**;

High: One of the largest or best examples of the species or EEC, habitat critical: **30**;

Medium: Smaller or larger populations or areas (for EECs) are known elsewhere, habitat important but not critical: **10**;

Lower: Site represents only a small population/area or few individuals at the site, with larger populations or better examples elsewhere: **0**.

2) Overall conservation significance ranking of the area: is based on the conservation significance ranking mapping of EECs in western Sydney reserves (from systematic survey, and is based on 25 factors which take into account values other than the threatened species or EECs). For eastern Sydney reserves (Botany Bay NP, Sydney Harbour NP, and Wolli Creek RP) this ranking is more subjective and is heavily influenced by threatened species and EECs.

Critical: **50**;

Very High: **30**;

High: **20**;

Medium: **10**;

Low or very low: **0**.

3) Bushland condition: For most reserves this is based on the vegetation condition assigned to areas during weed density mapping (Epacris 2008) in three strata: ground layer, middle layer (shrubs and small trees) and upper layer. There were four categories for each strata: Good, Fair, Poor, and Very Poor. The final score for overall bushland condition was an average of the scores for the three layers. If parts of the site were mapped with different conditions, the score was averaged for that layer. Parts of Botany Bay and Sydney Harbour National Parks were not mapped and where necessary the bushland condition was determined from local knowledge.

Good: Virtually weed-free; a healthy native community: **30**;

Fair: Minor infestations of weeds; natives dominate: **20**;

Poor: Severely weed-infested; regeneration of native species being suppressed OR few weeds but limited regrowth of only a few species for other reasons: **10**;

Very poor: Bushland replaced by exotic species OR only mature specimens of highest stratum remain; no seedlings/ saplings due to exotic-dominated understorey/ ground layer: **0**.

4) Risk assessment of the impacts of no weed control: Based on an assessment of the impacts of “no control works” or the “do nothing option” on the key values of the site as follows:

Very High Impact: Expansion of minor infestations into areas with significant conservation values that are currently relatively weed free is likely: **50**;

High Impact: Expansion of the area of weed infestations or an increase in weed densities is likely to result in a significant decline in key habitat or community values of sites with significant conservation values: **30**;

No major change: Area already heavily weed infested and values already compromised OR expansion of weeds not likely to impact further on significant key habitat or community values: **0**.

5) Difficulty/feasibility of control: Scores are subtracted and are based on the following criteria:

Relatively feasible: Infestation area is small, and there are no potentially on-going disturbances: **0**;

Relatively difficult: Infestation area is large or if small, there are also potentially on-going disturbances such as creek-line flooding or storm water drainage which make treating weed invasion pathways difficult: - **30**;

Very difficult: Infestation area is large and/or difficult to access AND there are on-going disturbances: - **50**.

Appendix 10 Continued: Further Ranking of Critical Priorities

(Note: Target weed species have been grouped and abbreviated. General bush regeneration targets a suite of species which includes noxious and environmental weeds and garden escapes – see main text for details.)

Bush regeneration or target weed species	Threatened species, population or EEC to be protected	Reserve	1) Value of the site	2) Conservation Significance Ranking	3) Bushland Condition	4) Risk assessment	5) Feasibility of Control	TOTAL RANKING SCORE
Exotic perennial grasses	Agnes Banks Woodland	Agnes Banks NR	50	50	26.7	50	0	176.7
General bush regeneration and Blackberry	Agnes Banks Woodland	Agnes Banks NR	50	50	11.6	50	0	161.6
General bush regeneration	Shale/Sandstone Transition Forest	Gulguer NR	30	50	30.0	50	0	160.0
General bush regeneration, Bitou, vines, grasses, and Lantana	Eastern Suburbs Banksia Scrub	Sydney Harbour NP (North Head)	50	50	25.0	30	0	155.0
General bush regeneration, Bitou, vines, grasses and Lantana	<i>Allocasuarina portuensis</i>	Sydney Harbour NP (Nielsen Park)	50	50	20.0	30	0	150.0
General bush regeneration, vines, and grasses	<i>Allocasuarina portuensis</i>	Sydney Harbour NP (Hermitage Foreshore)	50	50	20.0	30	0	150.0
General bush regeneration, Bitou, grasses, vines, and Lantana	Eastern Suburbs Banksia Scrub	Botany Bay NP	50	50	20.0	30	0	150.0
General bush regeneration, Bitou, grasses	<i>Themeda</i> Grasslands on Seacliffs and Coastal Headlands	Botany Bay NP	50	50	20.0	30	0	150.0
General bush regeneration, Bitou, vines, grasses and Lantana	<i>Allocasuarina portuensis</i>	Sydney Harbour NP (South Head)	50	50	13.3	30	0	143.3
General bush regeneration, vines, Blackberry, African Olive	Cumberland Plain Woodland	Prospect NR	30	20	25.0	50	0	125.0
General bush regeneration	<i>Eucalyptus camfieldii</i>	Sydney Harbour NP (North Head)	50	50	23.3	0	0	123.3
General bush regeneration	Endangered Long-nosed Bandicoot Population at North Head	Sydney Harbour NP (North Head)	50	50	23.3	0	0	123.3
General bush regeneration, vines, Lantana, Privet, Cestrum	Western Sydney Dry Rainforest	Cattai NP	50	50	16.7	30	-30	116.7
Exotic vines and scramblers	Shale/Sandstone Transition Forest	Cattai NP	10	50	26.7	30	0	116.7

Bush regeneration or target weed species	Threatened species, population or EEC to be protected	Reserve	1) Value of the site	2) Conservation Significance Ranking	3) Bushland Condition	4) Risk assessment	5) Feasibility of Control	TOTAL RANKING SCORE
Vines, Privets and Green Cestrum, Willows, Honey Locust, Box Elder Maple	River-flat Eucalypt Forest on Coastal Floodplains and Cumberland Plain Woodland	Scheyville NP (around Longneck lagoon)	0	50	25.0	30	0	105.0
General bush regeneration	Shale/Gravel Transition Forest	Kemps Creek NR	10	10	30.0	50	0	100.0
General bush regeneration, vines, Lantana	<i>Pimelea curviflora</i>	Cattai NP	30	50	16.7	0	0	96.7
Vines, Lantana, Privets, Green Cestrum, Willows, Honey Locust, Robinia, Box Maple Elder	River-flat Eucalypt Forest on Coastal Floodplains	Gulguer NR (Campbell's Ford)	30	50	16.7	30	-30	96.7
African Olive, Cootamundra Wattle, Blackberry, and grasses	<i>Acacia pubescens</i>	Scheyville NP	10	30	25.0	30	0	95.0
General bush regeneration and vines	<i>Eucalyptus benthamii</i>	Bents Basin SCA	50	30	10.0	30	-30	90.0
General bush regeneration and <i>Salvinia</i>	Freshwater Wetland on Coastal Flood Plains	Scheyville NP (Longneck Lagoon)	30	50	10.0	30	-30	90.0
General bush regeneration and vines	<i>Eucalyptus benthamii</i>	Gulguer NR	50	10	25.0	30	-30	85.0
General bush regeneration, vines, grasses	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Sydney Harbour NP (North Head)	30	30	23.3	0	0	83.3
African Olive	Cumberland Plain Woodland	Windsor Downs NR	0	10	20.0	50	0	80.0
General bush regeneration, African Olive, and African Boxthorn	Cumberland Plain Woodland	Scheyville NP	30	25	25.0	30	-30	80.0
Exotic perennial grasses and Lantana	Speckled Warbler	Scheyville NP	30	20	25.0	30	-30	75.0
Lantana	River-flat Eucalypt Forest on Coastal Floodplains	Scheyville NP	0	50	16.7	30	-30	66.7
General bush regeneration, vines, Lantana, Privets and Green Cestrum	River-flat Eucalypt Forest on Coastal Floodplains	Cattai NP	30	50	16.7	0	-30	66.7
General bush regeneration	Endangered Little Penguin Population and Declared Critical Habitat	Sydney Harbour NP (North Head - Collins Beach)	50	50	13.3	0	-50	63.3

Bush regeneration or target weed species	Threatened species, population or EEC to be protected	Reserve	1) Value of the site	2) Conservation Significance Ranking	3) Bushland Condition	4) Risk assessment	5) Feasibility of Control	TOTAL RANKING SCORE
General bush regeneration	Freshwater Wetland on Coastal Floodplains	Pitt Town NR	30	20	10.0	30	-30	60.0
Lantana	River-flat Eucalypt Forest on Coastal Floodplains	Kemps Creek NR	10	20	10.0	50	-30	60.0
Blackberry	Castlereagh Ironbark Forest, Cumberland Plain Woodland, Shale/Gravel Transition Forest	Wianamatta RP	0	10	16.7	30	0	56.7
Exotic perennial grasses	Speckled Warbler	Castlereagh NR	30	10	16.7	0	0	56.7
Bitou and vines	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Botany Bay NP	0	30	25.0	0	0	55.0
Blackberry	River-flat Eucalypt Forest on Coastal Floodplains, Castlereagh Swamp Woodland, Shale/Gravel Transition Forest	Kemps Creek NR	0	20	10.0	50	-30	50.0
General bush regeneration, Blackberry and Lantana	Eastern Bentwing Bat - <i>Miniopterus schreibersii oceanensis</i>	Sydney Harbour NP (Middle Head)	10	20	15.0	0	0	45.0
Blackberry and Lantana	Eastern Bentwing Bat - <i>Miniopterus schreibersii oceanensis</i>	Sydney Harbour NP (Georges Head)	10	20	15.0	0	0	45.0
<i>Salvinia</i>	Freshwater Wetland on Coastal Flood Plains	Cattai NP (Reedy Swamp)	10	20	15.0	30	-30	45.0
General bush regeneration, Lantana, Bitou, Privets, Green Cestrum	Littoral Rainforest	Sydney Harbour NP (North Head)	50	10	13.3	0	-30	43.3
African Olive	Cumberland Plain Woodland	Mulgoa NR	0	20	21.7	0	0	41.7
General bush regeneration, Bitou, vines, and grasses	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Sydney Harbour NP (Nielsen Park)	10	10	20.0	0	0	40.0
General bush regeneration, vines, and grasses	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Sydney Harbour NP (Hermitage Foreshore)	10	10	20.0	0	0	40.0
Exotic perennial grasses	Speckled Warbler	Kemps Creek NR	0	10	30.0	0	0	40.0
Exotic perennial grasses	<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Wianamatta RP	10	10	16.7	0	0	36.7
General bush regeneration, vines, and grasses	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Sydney Harbour NP (Middle Head)	10	10	15.0	0	0	35.0

Bush regeneration or target weed species	Threatened species, population or EEC to be protected	Reserve	1) Value of the site	2) Conservation Significance Ranking	3) Bushland Condition	4) Risk assessment	5) Feasibility of Control	TOTAL RANKING SCORE
General bush regeneration, vines, and grasses	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Sydney Harbour NP (Georges Head)	10	10	15.0	0	0	35.0
General bush regeneration, vines, and grasses	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Sydney Harbour NP (Bradleys Head)	10	10	13.3	0	0	33.3
General bush regeneration, Bitou, vines, grasses and Lantana	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Sydney Harbour NP (South Head)	10	10	13.3	0	0	33.3
General bush regeneration, vines and grasses	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	Sydney Harbour NP (Bottle and Glass Pt)	10	10	13.3	0	0	33.3
General bush regeneration, vines, and African Olive	Cumberland Plain Woodland	Kemps Creek NR	0	0	30.0	0	0	30.0
General bush regeneration, Lantana, Privets, Green Cestrum	Littoral Rainforest	Sydney Harbour NP (Dobroyd Head)	50	0	10.0	0	-30	30.0
Exotic perennial grasses	Speckled Warbler	Wianamatta RP	0	10	16.7	0	0	26.7
Vines and Blackberry	Cumberland Plain Woodland	Rouse Hill RP	0	10	13.3	0	0	23.3
General bush regeneration and vines	Shale/Gravel Transition Forest	Scheyville NP	0	10	13.3	0	0	23.3
Vines, Lantana, Privets, Green Cestrum	River-flat Eucalypt Forest on Coastal Floodplains	Mulgoa NR	10	30	3.3	0	-30	13.3
Alligator Weed	River-flat Eucalypt Forest on Coastal Floodplains, Castlereagh Swamp Woodland	Kemps Creek NR	0	20	10.0	30	-50	10.0
Bitou, Lantana, Privet, green cestrum	<i>Syzygium paniculatum</i>	Sydney Harbour NP (Dobroyd)	0	0	10.0	0	0	10.0
Exotic perennial grasses	<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Castlereagh NR	10	10	16.7	0	-30	6.7
Vines and Lantana	River-flat Eucalypt Forest on Coastal Floodplains	Leacock RP	0	20	10.0	0	-30	0.0
Vines, Lantana, Privets, Green Cestrum, Willows, Honey Locust, <i>Robinia</i> , Box Elder Maple	River-flat Eucalypt Forest on Coastal Floodplains	Bents Basin SCA	10	30	6.7	0	-50	-3.3
Vines and Blackberry	Shale/Sandstone Transition Forest	Rouse Hill RP	0	10	13.3	0	-30	-6.7
African Olive	Cumberland Plain Woodland	Bents Basin SCA	0	10	6.7	0	-30	-13.3
African Olive and vines	Cumberland Plain Woodland	Leacock RP	0	0	3.3	0	-30	-26.7

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