NSW GOVERNMENT
Environment, Climate Change & Water
National Parks & Wildlife Service

Wianamatta Regional Park

Plan of Management

WIANAMATTA REGIONAL PARK

PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

Part of the Department of Environment, Climate Change and Water

February 2011

This plan of management was adopted by the Minister for Climate Change and the Environment on 15th February 2011.

ACKNOWLEDGMENTS

This Plan of Management is based on a draft plan prepared by staff of the Cumberland North Area of the NSW National Parks and Wildlife Service (NPWS), with the assistance of the St Marys Community Reference Group.

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For additional information or enquiries about any aspect of the plan, contact the NPWS Cumberland North Area Office at Scheyville National Park by phone on (02) 4572 3100.

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FOREWORD

Wianamatta Regional Park was first established in January 2008 and is being gradually expanded as further land is acquired in accordance with the *St Marys Development Agreement* and other State Government initiatives. The Park is eventually expected to encompass all the land zoned as Regional Park under the *Sydney Regional Environmental Plan No. 30 – St Marys*, an area of approximately 900 hectares and is located 5 kilometres north-east of Penrith and 12 kilometres west of Blacktown in western Sydney. This plan of management will apply to those lands and other land once acquired under the *National Parks and Wildlife Act* for addition to the Park.

The New South Wales *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each reserve. A draft Plan of Management for the Wianamatta Regional Park was placed on public exhibition from 9 March 2007 until 1 July 2007. The submissions received were carefully considered before adopting this plan.

Wianamatta Regional Park lies within the Cumberland Plain and protects temperate eucalypt woodland, including vegetation communities that are listed under the *Threatened Species Conservation Act 1995*, as endangered ecological communities. The area also supports a number of threatened and regionally significant bird and reptile species, and the endangered Cumberland Land Snail. The Regional Park contains evidence of past use of the area by the Darug people, colonial settlement and farming activities, and the munitions factory and associated industry.

This Plan contains a number of actions to achieve the State Plan priority to "Protect our native vegetation, biodiversity, land, rivers and coastal waterways", including the restoration of disturbed areas, development and implementation of a pest management strategy, management of captive macrofauna, undertaking further fauna and flora surveys, preparing a reserve fire management strategy and providing opportunities for Aboriginal people to take part in the management of Country. The Plan also contains actions to help achieve the State Plan target of increasing the number of visits to parks, including the adoption of a master plan which will consider how to provide safe visitor access and appropriate recreation facilities to the reserve whilst also protecting the significant natural and cultural heritage values.

This Plan of Management establishes a prioritised scheme of operations for Wianamatta Regional Park. In accordance with section 73B of the *National Parks and Wildlife Act 1974*, this Plan of Management is hereby adopted.

Frank Sartor MP
Minister for Climate Change and the Environment

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1. INTRODUCTION

1.1 LOCATION, GAZETTAL AND REGIONAL SETTING

The former ADI site at St Marys in western Sydney, referred to in this Plan as the St Marys Property, has a total area of approximately 1,545 hectares. Technical investigations into the environmental values and development capability of this land were commenced in 1994. The *Sydney Regional Environmental Plan for St Marys* (SREP 30) was gazetted in January 2001 and zones the St Marys Property for a mixture of housing, employment, conservation, open space, drainage, road and road widening purposes.

The area zoned as Regional Park (the Park) covers approximately 900 hectares of the St Marys Property and is located 5 kilometres north-east of Penrith and 12 kilometres west of Blacktown (Map 1).

The establishment of Wianamatta Regional Park began with the gazettal of the first 63.5 hectares over Lot 1 DP 1105297 on 30th January 2008. Since then additional land has been added to the Park as it is acquired.

Llandilo and Shanes Park, which lie north of the Park, are rural in nature being mainly used for rural residential and agriculture. To the east, west and south, the Park is bounded by urban development in the suburbs of Willmot, Shalvey, Lethbridge Park, St Marys, Werrington County, Werrington Downs, Cambridge Gardens and Cranebrook. The Park will also be bounded by the new suburbs arising from the subdivision of the St Marys Property, including the suburb of Ropes Crossing.

Surrounding land uses also include the St Marys Sewerage Treatment Plant and Dunheved Industrial Estate to the south and market gardens and the international transmission station (Shanes Park Air Services site) to the north and north-east.

The Park is situated in the Sydney Basin Bioregion. Other reserves managed by the Department within this Bioregion, and which occur in close proximity to Wianamatta Regional Park, include Castlereagh, Windsor Downs, Agnes Banks and Mulgoa Nature Reserves.

Wianamatta Regional Park is located within the Penrith and Blacktown Local Government areas. The Park is within the traditional Darug Aboriginal country and the Deerubbin Local Aboriginal Land Council area.

The Development Agreement between the land developer and the State and Federal Governments delineated a Regional Park that was initially about 850 hectares in size. During the preparation of this Plan a further 50 hectares of land, known as the Residual Register of the National Estate (RNE) land, was accepted for addition to the Park.

A man-made dam located in the south-west corner of the St Marys Property, commonly known as the “Secret Garden”, has also been zoned as Regional Park. This area has a number of unresolved management issues, including the safety of the dam structure, stormwater management, and the boundary interface with development areas.

Other lands may also be considered for addition to the Regional Park in the future, including the former Air Services Australia sites at both Cranebrook and Shanes Park which are nearby.

Reasons for additions being considered may include, but will not be limited to, enhancement of natural or cultural heritage conservation and improvement of park management operations.

This Plan will apply to any future additions to Wianamatta Regional Park as they are gazetted. Where management strategies or works are proposed for the Park or any additions that are not consistent with this plan, an amendment to the plan will be required.

Any adjoining or proximate acquisitions of land under the National Parks and Wildlife Act, such as at Cranebrook and Shanes Park, will be considered for gazettal as additions to Wianamatta Regional Park. These lands will be managed in accordance with this Plan of Management. No major infrastructure will be constructed in either of these areas until specific amendments covering these areas have been made to the Plan.

1.2 LANDSCAPE

Natural and cultural heritage and ongoing use of land are strongly inter-related and together form the landscape of an area. Much of the Australian environment has been influenced by past Aboriginal and non-Aboriginal land-use practices and the activities of modern-day Australians continue to influence bushland through recreational use, cultural practices, the presence of introduced plants and animals and, in some cases, air and water pollution.

The area proposed as Wianamatta Regional Park protects a significant area of the South Creek sub-catchment. The Park protects remnants of Cumberland Plain vegetation communities including Alluvial Woodland, Shale Plains Woodland, Shale/Gravel Transition Forest and Cooks River/Castlereagh Ironbark Forest. The Regional Park area contains 34 recorded Aboriginal sites and nine identified non-Aboriginal heritage sites relating to its former use as a farm and munitions factory.

The geology, landform, climate and plant and animal communities of the area, plus its location, have determined how humans have used it. There is ample evidence of Aboriginal occupation of the site prior to European settlement, with a number of studies locating Aboriginal artefacts in key areas of the site (Smith 1991, McDonald and Mitchell 1994, Kinhill 1995). Camp sites and scattered stone artefacts dominate the artefacts found and it is considered that this area would have been an important meeting area and source of food for the local Aboriginal communities.

The St Marys Property has undergone a number of major land-use changes over the last 200 years. The area around St Marys was subject to colonial land grants and pastoral activities from about 1803 onwards. Grazing activities continued in the St Marys area throughout the nineteenth century with timber cutting becoming the major industry from the 1860s. Following the outbreak of World War II, the Commonwealth Government decided to establish an explosives and munitions filling factory at St Marys which resulted in substantial modification to the landscape.

During the mid-1950s the remainder of the site was redeveloped for a munitions factory (Allom Lovell & Associates 1994; Kinhill 1995). By the 1990s, Australian Defence Industries had commenced planning to leave the site and redevelop parts of it for urban settlement and associated employment.

Both Aboriginal and non-Aboriginal people place cultural values on natural areas, including aesthetic, social, spiritual, recreational and other values. Cultural values may be attached to the landscape as a whole or to individual components (for example, plant and animal species or stone sources used by Aboriginal people). This plan of management aims to conserve both natural and cultural values. For reasons of clarity and document usefulness natural and cultural heritage, non-human threats and on-going use are dealt with individually, but their inter-relationships are recognised.

2. MANAGEMENT CONTEXT

2.1 LEGISLATIVE, POLICY AND PLANNING FRAMEWORK

The management of regional parks in NSW is in the context of a legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (NPW Act), the *National Parks and Wildlife Regulation 2009*, the *Threatened Species Conservation Act 1995* (TSC Act) and the policies of the National Parks and Wildlife Service (NPWS). Section 72AA of the NPW Act lists the matters to be considered in the preparation of a plan of management. The policies arise from the legislative background and internationally accepted principles of park management. They relate to nature conservation, Aboriginal and historic heritage conservation, recreation, commercial use, research and communication.

Other legislation, international agreements, charters and NSW Government policy may also apply to management of the area. In particular, the NSW *Environmental Planning and Assessment Act 1979* (EPA Act) requires the assessment and mitigation of the environmental impacts of any works proposed in this plan.

Sections of the St Marys Property were listed in 1999 on the Register of the National Estate, including 94% of the area zoned as Regional Park. The Register is Australia's national inventory of natural and cultural heritage places which are considered worth keeping for the future. Listing on the Register means that a place has heritage value and has met various criteria in regard to national estate significance. The values of the RNE lands across the whole St Marys Property include: the presence of rare and regionally significant flora and fauna species, the presence of significant remnants of native vegetation of the Cumberland Plain, and significant examples of Aboriginal and European heritage. The King Family Farm sites located in the Park are also listed on the Register of the National Estate for their significant historic values.

The NSW Government State Plan (DPC, 2010) has established clear priorities to guide decision-making and resource allocation across the whole of government. These priorities were identified through a comprehensive community consultation that highlighted the importance of protecting our native vegetation, biodiversity, land, rivers and coastal waterways and included providing opportunities for Aboriginal people to take part in the management of Country. The management of the natural and cultural values of the Wianamatta Regional Park will help to achieve the targets identified within the State Plan.

The NSW Government's *Metropolitan Plan for Sydney 2036* (DoP, 2010) provides a vision for the development of Sydney over the next 25 years guided by the principles of economic, social and environmental sustainability. Part of the planning process identified nine core focus areas to fulfil the objectives of the Metropolitan Plan including tackling climate change and protecting Sydney's natural environment. The Plan aims to protect biodiversity through the implementation of the *Draft NSW Biodiversity Strategy 2010-2015* (DECCW and DII, 2010) once it is finalised and the *Cumberland Plain Recovery Plan* (DECCW, 2011). Areas of regional cultural significance to the Aboriginal people will also be identified to improve cultural outcomes and facilitate development planning. As the population increases, demand for access to parks and bushland areas for recreation and relaxation will also increase

The *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* (Growth Centres SEPP) provides the legal framework for streamlining land releases for development in western Sydney. The Growth Centres SEPP is guided by the New South Wales State Plan (DPC 2010) and Metropolitan Plan. The North West Growth Centre is to the north-east of the Park and will contain approximately 70,000 new dwellings across 16 development precincts. This will have implications for the Park in terms of providing suitable recreational

opportunities for these residents and ensuring the integrity of the natural and cultural heritage.

Wianamatta Regional Park will be a critical part of meeting the recreation needs of the population of western Sydney while also conserving valuable natural and cultural heritage.

The St Marys Property has been the subject of a long and extensive planning and assessment process. The following sections summarise the three main components of the planning framework that have been established for the St Marys Property, with particular reference to the Regional Park.

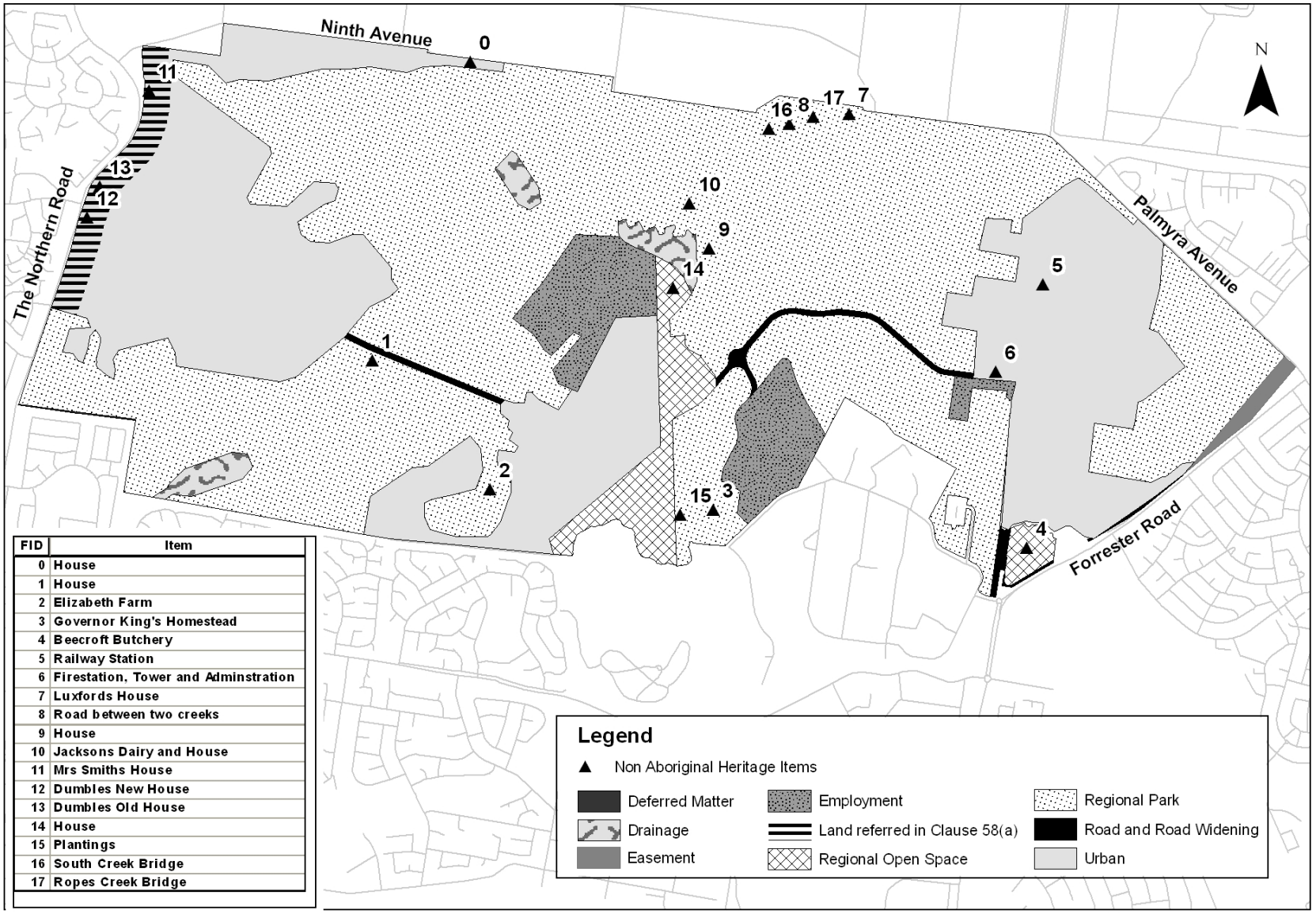
2.1.1 Sydney Regional Environmental Plan No. 30 – St Marys

The *Sydney Regional Environmental Plan No.30 – St Marys* (SREP 30) was gazetted on 21 December 2000. SREP 30 is a statutory environmental planning instrument prepared under the EPA Act. It provides the main basis for controlling development and future land-uses on the site. SREP 30 zones the site for a mixture of conservation, urban, employment, open space and related purposes (Figure 1). Each zone has a set of objectives and permissible uses.

The objectives of the Regional Park zone are:

i. to identify land that is to be or is reserved or dedicated under the *National Parks and Wildlife Act 1974;*
ii. to conserve and enhance the range and variety of ecological communities, native flora and fauna species and plant and animal habitats within the area;
iii. with regard to the views of local Aboriginal communities, to conserve the Aboriginal values of the area to ensure they are available for interpretation to future generations; and
iv. to provide recreational facilities that are consistent with the natural and cultural values of the land to which this plan applies.

The SREP 30 also establishes the process for undertaking detailed site planning within the areas available for development, and specifies the matters to be addressed by precinct plans and development applications, including performance objectives and specific development controls for the whole site.



FID	Item
0	House
1	House
2	Elizabeth Farm
3	Governor King's Homestead
4	Beecroft Butchery
5	Railway Station
6	Firestation, Tower and Adminstration
7	Luxfords House
8	Road between two creeks
9	House
10	Jacksons Dairy and House
11	Mrs Smiths House
12	Dumbles New House
13	Dumbles Old House
14	House
15	Plantings
16	South Creek Bridge
17	Ropes Creek Bridge

Figure 1: Sydney Regional Environmental Plan No 30 – St Marys zoning.

2.1.2 St Marys Environmental Planning Strategy 2000

The *St Marys Environmental Planning Strategy 2000* (EPS) provides additional guidance for management and conservation of the site, and supports the statutory REP instrument. The EPS provides more context and background to the St Marys Property, its values and how the desired planning objectives are to be achieved.

The EPS requires the implementation of a number of strategies relevant to the management of the Regional Park, including:

- Implementation of a development agreement.
- Preparation of a Plan of Management for the regional park, which is to consider various matters and desired uses.
- Provisions for the management of contamination in the eastern sector of the Park.
- Preparation of a fire management plan.
- Preparation of a bush regeneration plan.

The EPS also includes more specific development controls to be addressed in precinct plans, in managing the park boundary interface, among other matters. The requirement to prepare a Macrofauna Management Plan (*Macrofauna Management Plan* (MFMP) (Cumberland Ecology 2004)) is specified in the EPS.

2.1.3 St Marys Development Agreement

The St Marys Development Agreement (2002) is a legal agreement between the developer and the NSW Government. It specifies the financial and other obligations and responsibilities of the parties to the Agreement with respect to a range of matters.

In summary, the Agreement provides for the following commitments with respect to the Regional Park:

1. a staged process for transfer of land to the Minister for the Environment;
2. a process for considering the 47 ha. of Residual RNE listed land not currently included in the Park. This includes a requirement for the landowner to protect the listed values if the lands are not added to the Regional Park;
3. identification and creation of easement requirements within the proposed Regional Park boundaries;
4. a process for seeking a contamination indemnity;
5. management arrangements for lands transferred for Regional Park;
6. preparation of a Statement of Management Intent and development of a Plan of Management (PoM);
7. establishment of an advisory group to assist with the PoM;
8. matters to be provided for and considered in the PoM;
9. a process for undertaking capital improvements prior to adoption of the PoM;
10. financial contributions totalling $6.9 m staged over the life of the development, mostly for capital improvements in accord with the PoM. Contributions may be made via: payment of money, carrying out of capital improvements within the Park, or provision of services, information or works related to the Park;
11. procedures for checking that the required contribution has been provided and expended as intended;

12. decontamination works in the eastern sector, essentially to ensure the provisions of the site audit statement are complied with;
13. provisions dealing with any new works in the eastern sector, e.g. paths, where it would be the obligation of DECCW to address contamination issues and undertake the relevant assessments;
14. coordination of the provision of capital works in the Regional Park with the development of the land; and
15. commitment to gazette lands as Regional Park.

2.1.4 Statement of Management Intent

A Statement of Management Intent (SIMI) has been adopted for the Park and has guided management of the Park prior to the adoption of this Plan of Management. The SIMI is consistent with the SREP 30, the EPS, the St Marys Development Agreement and the National Parks and Wildlife Service (NPWS) policy 'Managing Parks prior to adoption of a plan of management'.

2.2 MANAGEMENT PRINCIPLES AND OBJECTIVES

Regional Parks in New South Wales

Regional parks are reserved under the NPW Act to protect and conserve areas in a natural or modified landscape that are suitable for public recreation and enjoyment.

Under the Act, regional parks are managed to:

i. provide opportunities, in an outdoor setting, for recreation and enjoyment in natural or modified landscapes;
ii. identify, interpret, manage and conserve the Park so as to maintain and enhance significant landscape values;
iii. conserve natural and cultural values;
iv. promote public appreciation and understanding of the Park's natural and cultural values;
v. provide for sustainable visitor use and enjoyment that is compatible with the conservation of the Regional Park's natural and cultural values; and
vi. provide for the sustainable use (including adaptive reuse) of any buildings or structures or modified natural areas having regard to conservation of the Regional Park's natural and cultural values.

The management of Wianamatta Regional Park will be in accord with the NPW Act. Consistent with this, management of the Park under this plan will also comply with:

1. *Sydney Regional Environmental Plan 30 – St Marys* (SREP 30).
2. *St Marys Environmental Planning Strategy 2000* (EPS).
3. Clause 11 of the *St Marys Development Agreement* (2002).
4. The *Macrofauna Management Plan* (MFMP) (Cumberland Ecology 2004) for the St Marys Property.

It is an obligation of the St Marys Development Agreement that the Plan of Management give due consideration to the inclusion of the following principles:

a) the principle of environmental sustainability, which will involve:
    i. the preservation, protection and rehabilitation of remnant bushland;

ii. the preservation, protection and improvement (where practicable) of the biodiversity values of the Regional Park, recognising the importance of the Regional Park to the local area, including the Land; and
iii. the retention of fauna and flora, recognising that sections of the Regional Park may be used for macrofauna conservation in accordance with a macrofauna management plan to be prepared and implemented by the Developer.

b) the principle of economic sustainability, which will involve:
   i. the development of the Regional Park to minimise capital and maintenance costs;
   ii. the making of capital improvements to maximise employment and training opportunities;
   iii. maximising the opportunities to access external funding and grants for the Regional Park; and
   iv. the identification of appropriate revenue generating opportunities relating to the Regional Park and the use of that revenue to offset the capital and maintenance costs of the Regional Park.

c) the principle of social/community sustainability, which will involve:
   i. maximising educational opportunities for school and community groups;
   ii. highlighting aboriginal heritage at appropriate locations within the Regional Park;
   iii. involving community groups in the rehabilitation and maintenance of the Regional Park; and
   iv. maximising the opportunities for community interaction and passive recreation within the Regional Park.

The St Marys Development Agreement also requires that the Plan of Management:

a) identify a set of clear management objectives which reflect the principles of plans of management in accordance with the *National Park and Wildlife Act 1974*, and the social and economic context of the Regional Park;
b) identify a set of clear management objectives in relation to the Regional Park reflected from the principles and obligation of the St Marys Development Agreement, SREP 30 and EPS 2000;
c) identify a set of priority works which are essential to the achievement of the objectives of the Plan of Management; and
d) assesses the relative priority of identified works in relation to short- and long-term objectives of the Plan of Management
e) is accompanied by a realistic and pragmatic budget and timeframes to undertake those works.

Site specific objectives will be consistent with the principles and objectives of this section and will be dealt with in Sections 4 – 10 of the Plan as desired outcomes.

3. KEY VALUES AND MANAGEMENT DIRECTIONS

3.1 VALUES OF THE AREA

The key values and the significance of the Park are summarised below:

Natural values

- The Park protects a number of Endangered Ecological Communities including Shale Plains Woodland, Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Alluvial Woodland.
- A large section of the Park is listed under the *Environment Protection and Biodiversity Conservation Act 1999* in recognition of the significant endangered vegetation communities and threatened species it conserves.
- The Park protects examples of Freshwater Wetland and Alluvial Woodland communities and Castlereagh Scribbly Gum Forest community, both of which are relatively poorly conserved in western Sydney.
- The Park protects the threatened plant species *Dillwynia tenuifolia*, *Pultenaea parviflora*, *Micromyrtus minutiflora*, *Persoonia nutans*, *Pimelea spicata* and *Grevillea juniperina* subsp. *juniperina*.
- The Park protects an endangered population of the species *Marsdenia viridiflora* subsp. *viridiflora.*
- The Park protects at least six threatened animal species; the Cumberland Land Snail (*Meridolum corneovirens*), Common Bent-wing Bat (*Miniopterus schreibersii*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Speckled Warbler (*Sericornis sagittatus*), Diamond Firetail (*Stagonopleura guttata*) and Black Bittern (*Ixobrychus flavicollis*).
- The Park protects a number of regionally significant plant and animal species.
- The Park is a significant link for plant and animal movements along both South and Ropes Creek corridors and to and from other regional areas. Although the macrofauna fence impedes movement of macrofauna and some other native species, the Park still forms an important link in this corridor, enhancing biodiversity and ecological viability in this part of western Sydney.
- The biodiversity values of the Park have been recognised by the Australian Heritage Commission and the National Trust of Australia (NSW).
- The Park makes a significant contribution to the area of western Sydney where natural ecological processes are able to continue, in accordance with the NSW Metropolitan Plan.
- The Park protects an area where four soil landscape groups can be seen in close proximity.
- The Park protects an area where an east-west gradation in soil and geology occurs, thereby demonstrating the close relationships between soils and vegetation that have evolved over millions of years in the Cumberland Plain.

Scenic values

- The Park lies within the South Creek Subcatchment, which is part of the Hawkesbury-Nepean Catchment, and South and Ropes Creek cross the Park in a north-south direction providing good examples of riparian environments with large trees, channels and the floodplain itself.
- The Park protects a major example of a partly confined discontinuous floodplain.
- The Park provides a range of vegetation, including grassy woodland floodplain vegetation and other Cumberland Plain vegetation.

- Local man-made features such as the earthen mounds surrounding some buildings and the railway permanent way add to the local scenic value of the area.

Cultural heritage values

- The floodplain of the 2 major creeks in the Park (Ropes and South/Wianamatta Creek) would have been an important meeting place and source of food for Aboriginal communities.
- The Park protects spiritual values attributed to the heritage of the Park by the Aboriginal community and evidence of Aboriginal occupation and use across the site in the form of stone artefacts and open artefact scatters.
- The Park contains a large area of western Sydney landscape which has been relatively undisturbed, thereby providing a significant opportunity for future research into Aboriginal site distribution and land-use
- Parts of the Park have a history of stock grazing and timber clearing from 1803 to the 1940s and beyond. These areas provide examples of the impacts of these historic practices on the landscape and the processes of ecological recovery.
- Structures such as old fence lines indicate original grazing property boundaries, sections of the munitions factory and grazing of sheep by Commonwealth Scientific and Industrial Organisation (CSIRO).
- During World War II the Commonwealth developed the St Marys munitions factory with two major periods of manufacturing occurring during the 1940s and 1950s. Ammunition manufacturing also occurred from the 1950s to 1993. There are a number of historical remains that demonstrate munitions production and storage in the Park.
- The park contains a number of locally significant heritage sites including: 'Dunheved Homestead site', 'tree plantings near the homestead', 'Elizabeth farm site', 'Luxford's House', 'Ropes Creek Bridge', 'South Creek Bridge', 'the road between the two bridges', 'Jackson's Dairy', 'House site' and 'House site-chimney'.

Recreation and tourism values

- There is a substantial demand in the region for informal recreation opportunities in a natural setting, and the Park provides these opportunities.
- The variety of landscapes in the Park provides a range of potential outdoor recreation opportunities, including walking and picnicking.
- The Park's linkages to surrounding regional and local open space areas increase the opportunities for recreational activities that traverse the landscape, such as long-distance walking and cycling trails.
- The Park is of a sufficient size that visitors can escape the urban environment and experience quiet space and solitude as they interact with nature.
- The park provides potential opportunities to see macrofauna in a natural setting.

Research and educational values

- The natural heritage of the site will make it a suitable area for ecological research particularly research on the recovery processes of Cumberland Plain environment's after disturbance.
- The cultural resources of the park provide opportunities for archaeological, historical and social research.
- The Park provides significant opportunities for interpretation of the natural heritage, cultural heritage and the geology and landforms of the Park.

3.2 THREATS TO PARK VALUES

Isolation and fragmentation

The clearing of vegetation across the Cumberland Plain has resulted in isolated and fragmented remnants of vegetation that are distributed on both public and private lands. The Regional Park zone is 900 hectares in size, but quite fragmented, narrow in places and has a very irregular boundary. The Park will be dissected by roads from the proposed development of the St Marys Property and as a result will be divided into five distinct parts.

Adjacent land use will include a combination of urban, industrial, agricultural and regional open space. The activities in the surrounding area generally have a significant impact on remnant biodiversity. As the surrounding area becomes more populated the ability of a remnant to support many species is almost certain to be compromised and this is likely to result in reduced species richness. Areas zoned urban and employment in the St Marys Property (Figure 2) will incorporate mitigation measures to reduce any potential impact on the biodiversity values of the Park. These mitigation measures will include the appropriate incorporation of existing endemic native vegetation in the urban zones, and the provision of local open space including drainage and vegetation corridors that assist in providing habitat linkages to the Park. Other urban areas outside the St Marys Property may not incorporate mitigation measures and therefore may result in further isolation and fragmentation of the Park. Open space corridors will connect to the Park along South and Ropes Creek providing significant wildlife corridors in the south. However, corridors linking the Park in the north, west and east have not yet been planned or defined, and may lead to reduced biodiversity if they are inadequate.

Introduced Species

A number of introduced species have been recorded in the Regional Park including Narrow-leaved and Broad-leaved Privet (*Ligustrum lucidium* and *L. sinense*), African Olive (*Olea europea* subsp. *cuspidata*), Willow (*Salix spp*.), African Boxthorn (*Lycium ferocissimum*), Blackberry (*Rubus fruticosa*), Bridal Creeper (*Asparagus asparagoides*), Lantana (*Lantana camara*), Mother of Millions (*Bryophyllum delagoense*), Noogoora Burr (*Xanthium spp*.), African Lovegrass (*Eragrostis curvula*), Prickly Pear (*Opuntia spp*.), Crofton Weed (*Ageratina adenophora*) and Pampas Grass (*Cortaderia spp*.) (ERM 2003a). These species already have a significant adverse effect on the natural and cultural heritage of the Park.

The feral animals that may have a substantial impact on the flora and fauna of the Park include the European Fox (*Vulpes vulpes*), Dog (*Canis familiaris*), Cat (*Felis catus*), and Rabbit (*Oryctolagus cuniculus*). Other feral species recorded on the site include the Black Rat (*Rattus rattus*), House Mouse (*Mus musculus*), Indian Myna (*Acridotheres tristis*), Common Starling (*Sturnus vulgaris*) and Plague Minnow (*Gambusia holbrooki*) (ERM 2003b).

Other introduced species can be expected to threaten Park values as development continues around the Park.

Fire

Although fire is an important process in the Australian landscape, inappropriate fire regimes may have an impact on the biodiversity of the Park. Fire could also damage the cultural heritage of the Park and built and natural Park assets.

The fire history of the St Marys Property has been recorded since 2000. Most of the unplanned fires were suspected arson attacks originating along roads and tracks. Prior to this, some areas of the site were managed with planned fire events almost yearly to prevent any threat to stored munitions from wildfire (ERM 2002). By contrast the majority of the Property has not been burnt.

Soils

The Park contains four soil landscape groups of the Cumberland Plain in close proximity, which is an important educational and research resource. As a result of past land-use activities a number of soil management issues have arisen which may pose a threat to the protection of these soils, as well as natural and some cultural features in the Park. The management of soil processes and associated geological features will be important for the protection of these features. If neglected or managed inappropriately, soil erosion and salinity will have a major impact on the values of the Park and may also minimise the opportunities for community interaction and recreation within the Park.

Urban Runoff

The Park lies within the South / Wianamatta Creek sub-catchment, which is part of the Hawkesbury-Nepean Catchment. Both South / Wianamatta Creek and Ropes Creek cross the Park in a north-south direction. Urban run-off and agricultural activities within the sub-catchment have an impact on the health of the Park.

Future management will need to ensure that the quality of water entering the Park, within the Park and leaving the Park are within the limits specified by the SREP 30 to maintain natural catchment processes, biodiversity and visitor safety.

3.3 MANAGEMENT OBJECTIVES

The Park will be managed to maintain the remnant vegetation and associated biodiversity. Significant cultural and scenic values will also be protected and promoted. Visitor and research opportunities will be provided that are consistent with the conservation values of the Park. The key objectives of management for the Park are:

1. Protection and enhancement of the natural heritage of the Park, particularly the endangered ecological communities and the threatened flora and fauna species through the management of fire, disturbed areas, drainage, introduced species, access and visitor us.
2. Recognition and protection of traditional and contemporary Aboriginal cultural heritage, landscape and spiritual values through providing opportunities for the involvement of the traditional owners and the local Aboriginal community in the protection, interpretation and management of this heritage and values.
3. Protection of historic sites and relics through identifying, recording, conserving and interpreting historic resources;
4. Protection of the catchment values of South and Ropes Creeks through managing any disturbances, particularly those associated with fire, access and drainage.
5. Provision of recreational facilities that are appropriate in a regional context and are designed, located and managed to protect the natural and cultural heritage and visual values of the Park.

6. Provision of interpretive and educational opportunities through signage, park brochures and activities to assist visitor understanding and enjoyment of the Park.
7. Improving knowledge of natural and cultural heritage, corresponding threats and the evaluation of management programs through research and monitoring. Working with local government, other agencies and authorities, the community and commercial interests to maximise community interest and involvement in the conservation of the Park, and the implementation of sympathetic conservation measures in the neighbouring environment.

4. CONSERVATION OF NATURAL AND CULTURAL HERITAGE

4.1 GEOLOGY, LANDFORM AND SOILS

The Park is located within the Cumberland Plain, which is in the major geological formation of the Sydney Basin. Sandstone plateaus surround the Cumberland Plain to the north, the south and the west. The Cumberland Plain is gently undulating country with elevations from 10 metres above sea level to 100-150 metres (Young 1991). The geology of the Cumberland Plain is dominated by the Wianamatta Group, formed by sediments from the middle Triassic age. In some areas of the Plain, the Wianamatta Group is overlain by Tertiary and Quaternary sediments including Londonderry Clay in the St Marys area. The Wianamatta Group consists of Bringelly Shale, Minchinbury Sandstone and Ashfield Shale (Jones & Clark 1991).

The three main geological formations that occur in the St Marys area are: Quaternary sediments, Londonderry Clay and Bringelly Shale (Jones & Clark 1991).

Bringelly Shale is a complex formation characterised by claystone and siltstone, laminite, sandstone, and carbonaceous claystone. It underlies the Quaternary and Tertiary sediments and is extensive across the Cumberland Plain (Bembrick et al. 1991). This formation occurs in the eastern and the western sections of the Park (Jones & Clark 1991).

Londonderry Clay is Tertiary in age and overlays the Bringelly Shale. This unit is characterised by impervious clay composed of kaolinite, illite and mixed layered clay, with associated iron and quartz material. Sand is found in patches and laterite pisolites (pea stone) and nodules are also common throughout this unit (Smith & Clark 1991). This formation occurs in the north-central section of the Park adjacent to Ropes Creek (Jones & Clark 1991).

Quaternary sediments, which were deposited in the most recent era, occur along major watercourses on the Cumberland Plain. These overlay the older Tertiary sediments and the Wianamatta Group. These alluvial sediments have accumulated along the South and Ropes Creek systems. They are derived from the erosion of Hawkesbury Sandstone and Wianamatta Shale, and are characterised by fine-grained sand, reddish brown silt and clay (Smith & Clark 1991). This geological formation occurs along the drainage channels and floodplains of South and Ropes Creeks (Jones & Clark 1991).

Four soil landscapes groups occur within the Park; these are South/Wianamatta Creek, Berkshire Park, Luddenham and Blacktown (Bannerman & Hazelton 1990).

The Luddenham soil group occurs on the Wianamatta group. The soils are shallow dark podzolic soils on crests, moderately deep red podzolic soils on upper slopes and moderately deep yellow podzolic soils and prairie soils on lower slopes and drainage lines. This group only occurs in the western section of the Park.

The Blacktown soil group also occurs on the Wianamatta Group. The soils are shallow to moderately deep red and brown podzolic soils on the crests grading to yellow podzolic soils on lower slopes and drainage lines. This group only occurs in the eastern part of the Park.

The Berkshire Park soil group occurs on Tertiary sediments. The soils are orange heavy clays and clayey sands, often mottled and ironstone nodules are common. This group occurs in the north central section of the Park adjacent to Ropes Creek.

The South/Wianamatta Creek soil group occurs on the Quaternary alluvium derived from Wianamatta Group shales and Hawkesbury sandstone. The soils are often deep layered sediments over bedrock or relict soils. The dominant soil material includes brown sandy or clay loams, and bright brown clay. This soil group occurs in the middle of the Park along the drainage lines and floodplain of South and Ropes Creeks.

Very few site-specific soil and geological data exist for the area. All of the data used to describe the geology and soil landscapes group comes from work completed at a 1: 100 000 scale and therefore does not highlight the likely site variations that may occur when different geologies and soils are present.

The Park provides a good example of the flat landscape typical of the Cumberland Plain. South and Ropes Creek cross the Park in a north-south direction providing good examples of streamside vegetation with large trees, channels and floodplain landforms. There are clear differences in the distribution of vegetation communities and of individual plant species that relate to the different soils present in the Park. The Park provides a good example of how the Australian flora has evolved in concert with the changing landscape to survive over millennia in a range of different environments.

The Park also contains significant areas of artificial landforms, mainly being constructed berms around ammunition storage areas to minimise blast damage. These landforms provide significant opportunities for interpreting the recent history of the site, as well as providing an interesting landscape for passive recreation.

ISSUES

- The Park environment is important as a study site where an increased understanding of all natural processes can be obtained.
- Soil erosion and salinity may be threats to features in the Park.

DESIRED OUTCOMES

- Features, sites and processes of geological, natural geomorphological and/or pedological significance will be protected.
- Research is conducted to confirm the location of the different geology and soil associations across the Park.
- Significant landscape features of the Park including the two creeks, and associated floodplains and undulating landscape will be protected.
- Exposed geologic cross-sections, where safe, may remain accessible to the public and maintained in their natural state for education purposes.
- Manage any risks imposed by contamination from previous owners (See Section 5.1) through adherence to the Eastern Regional Park Contamination Management Plan and relevant Site Audit Statements.

STRATEGIES

4.1.1 Locate and design management and visitor facilities to minimise their visual impact from public access roads, lookouts and other vantage points.

4.1.2 Liaise with neighbours and authorities to minimise the impact of adjacent land use on the scenic values of key locations in the Park.

4.1.3 Undertake research to better determine the location of geological and soil landscape groups, and of artificial landforms.

4.1.4 Develop and apply protocols for soil protection and management (see Section 5.1 for more detail).

4.2 NATURAL HERITAGE

4.2.1 Vegetation Communities

Temperate eucalypt woodland and forest vegetation are among the most poorly conserved and threatened ecosystems in Australia due to their widespread conversion to agricultural landscapes. In Sydney, examples of temperate woodlands occur on the geology of sandstone, shale and alluvium. The woodlands that occur on the Cumberland Plain have a mixed understorey of grassy to shrubby species (Benson 1992).

The Cumberland Plain was one of the first areas of Australia to receive the full impact of European clearing and land-use. This is because the shale-derived and alluvial soils of the Cumberland Plain are relatively fertile, especially when compared to the sandstone-derived soils that lie under much of Sydney. In general terms, in the first 100 years of European settlement clearing of vegetation was for agricultural purposes and in the following 100 years for urban expansion (Benson & Howell 1990b). Generally, sandstone vegetation communities and species are well conserved, whereas the other vegetation communities of Sydney survive only as fragmented remnants (Benson & Howell 1990b).

A number of different studies have described the vegetation of the Cumberland Plain and specifically the St Marys Property. The relationships between the different names for these communities used in these reports and the TSC Act are highlighted in Table 1. The names used in this document follow the first column of this table. Six vegetation communities are present in the Regional Park (NPWS 2002) namely Cooks River/Castlereagh Ironbark Forest, Castlereagh Scribbly Gum Woodland, Shale Plains Woodland, Alluvial Woodland, Shale/Gravel Woodland and Freshwater Wetlands (Figure 3). Four of these communities are listed on the TSC Act (as endangered ecological communities) (refer Table 1).

Cooks River/Castlereagh Ironbark Forest is predominantly an open-forest to low woodland structure. It is dominated by Broad-leaved Red Ironbark (*Eucalyptus fibrosa*), with a dense understorey of White Feather Honeymyrtle (*Melaleuca decora*) and in some areas Ball Honeymyrtle (*M. nodosa*) (ERM 2003a). This community occurs on clay soils on Tertiary Alluvium, or shale soils on Wianamatta Shale (NPWS 2002). This community dominates the most eastern section of the Park, with small patches occurring west of the Eastern Precinct development area (Figure 3).

Castlereagh Scribbly Gum Woodland is dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Parramatta Red Gum (*E. parramattensis subsp. parramattensis*) and Narrow-leaved Apple (*Angophora bakeri*). The understorey is dominated by White Feather Honeymyrtle (*Melaleuca decora*), with Ball Honeymyrtle (*M. nodosa*) and Black She-Oak (*Allocasuarina littoralis*) (ERM 2003a). This community usually occurs on sandy soils derived from Tertiary Alluvium. Two small patches of this community occur in the eastern most section of the Park (Figure 3).

Shale Plains Woodland is dominated by Grey Box (*Eucalyptus moluccana*), Forest Red Gum (*E. tereticornis)* and Narrow-leaved Ironbark (*E. crebra*) and Broad-leaved Red Ironbark (*E. fibrosa*). This community was listed on the TSC Act as Cumberland Plain Woodland (Table 1). It occurs on clay soils derived from Wianamatta Shale (NPWS 2002). The understorey is often grassy with the shrub species Blackthorn (*Bursaria spinosa*) dominating in areas (Kinhill 1995). There are two major occurrences of this community in the Park: east of Ropes Creek where it merges with the Alluvial Woodland and Shale/Gravel Transition Forest communities in that area, and in the west where it is the dominant vegetation community.

Alluvial Woodland is dominated by Forest Red Gum (*Eucalyptus tereticornis*) with other common species including Swamp She-Oak (*Casuarina glauca*), Snow-In-Summer

(*Melaleuca lineariifolia*), Broad-leaved Apple (*Angophora subvelutina*) and Rough-barked Apple (*A. floribunda*) (Kinhill 1995, ERM 2003a). This community occurs along minor watercourses in floodplain areas on soils derived from Wianamatta Shale (Figure 3) and is part of the Sydney Coastal River Flat Forest listed on the TSC Act. In the Park, this community occurs along Ropes and South/Wianamatta Creeks and the unnamed creek in the west. Parts of this community also contain populations of Blue Box (*E. baueriana*), which is a relatively uncommon species in existing reserves. Extensive areas of this community are infested with exotic species such as Privet, Lantana, Bridal Creeper and Blackberry (ERM 2003b). The amount of Alluvial Woodland currently protected in the NPWS reserve system (approximately 167.8 ha) will more than double in area with the acquisition of the Regional Park at St Marys (amount in St Marys is approximately 196.2 ha). It represents a significant conservation improvement for the protection of this vegetation type.

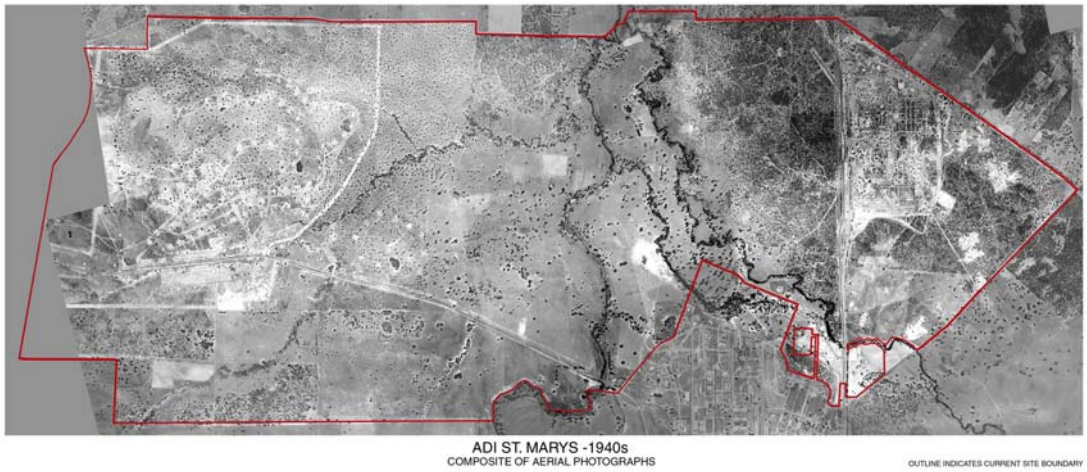
Shale/Gravel Transition Forest has an open woodland structure and is a transitional community, made up of species that occur on both clay and gravel soils. The canopy of this community is dominated by Broad-leaved Red Ironbark (*Eucalyptus fibrosa*) with other species such as Forest Red Gum (*E. tereticornis)* and Grey Box (*E. moluccana*) (ERM 2003a). This community occurs where gravel deposits overlay shale soils, sometimes in association with ironstone concentrations (NPWS 2002). It occurs in the northern section of the Park, adjacent to South/Wianamatta Creek and the Eastern Precinct Development Area.

Freshwater Wetland is dominated by Broad-leaved Cumbungi (*Typha orientalis*) with other species including Snow-In-Summer (*M. lineariifolia*), Gotu Kola (*Centella asiatica*), Common Rush (*Juncus usitatus*), Slender Knotweed (*Persicaria decipiens*) and Couch Grass (*Cynodon dactylon*) (Kinhill 1995). These wetlands occur in dams and some watercourses across the site (Figure 3).

The remainder of the vegetation in the Park has been disturbed and modified during the development of the munitions factory or was cleared for agricultural purposes (Gunninah 1996). There is some suggestion that pasture improvement activities occurred during the agistment of sheep by CSIRO (Fisher 1985). However, the extent to which exotic grasses were planted on the site is not clear. This would be important to resolve when considering regeneration strategies for plant communities in these areas.

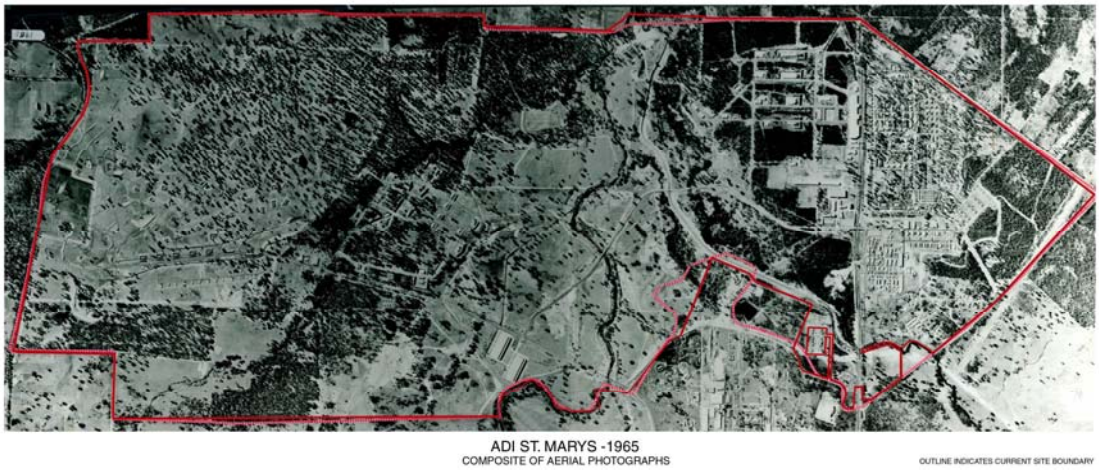
Most of the vegetation in the Park has been affected by past land-use practises. Vegetation was cleared for agricultural purposes during the 1800s and during the construction of the two munitions factories, as can be seen in the aerial photo from the 1940's (Figure 2a). There has been a history of logging in the area as well, perhaps concentrated on the ironbark species. During the 1960s sheep grazing continued on parts of the site during the munitions factory period to reduce ground-cover fuel loads. Vegetation in the Park's north-west has also been subject to slashing and mowing for fire mitigation purposes. This has resulted in the modification of the structure of this vegetation. From the 1960s onwards the native vegetation on the site started to regenerate as evident from the aerial photos taken in 1965, 1978 and 2000 (Figure 2c, d, e). However very few large hollow-bearing trees have survived (Gunninah 1997) and there may also be a shortage of logs on the ground through clearing of debris both of which may have an impact on the type of native animals inhabiting the Park.

There are also major areas of weed infestation throughout the Park (this will be addressed in more detail in Chapter 5). Recent research into Cumberland Plain Woodland has indicated that fire is an important factor in the dynamics of the vegetation type (Thomas 1994, Wood 2001, Hill & French 2003, 2004). The seeds of many native plant species may be stimulated to germinate by the effects of fire (e.g. smoke, heat and more light following the fire), and the relative dominance between native grasses and shrubs in the understorey may also be affected by fire. Fire may also be an important factor affecting the relative dominance of weeds (this will also be addressed in more detail in Chapter 5).



(a) The 1940s

(b) 1955



(c) 1955

(d) 1978

(e) 2000

(f) 2010

Figure 2: Aerial photos from (a) the 1940s, (b) 1955, (c) 1965, (d) 1978, (e) 2000, and (f) 2010 indicating the extent of changes in vegetation cover across the St Marys Property. Source: Delfin Lend Lease.

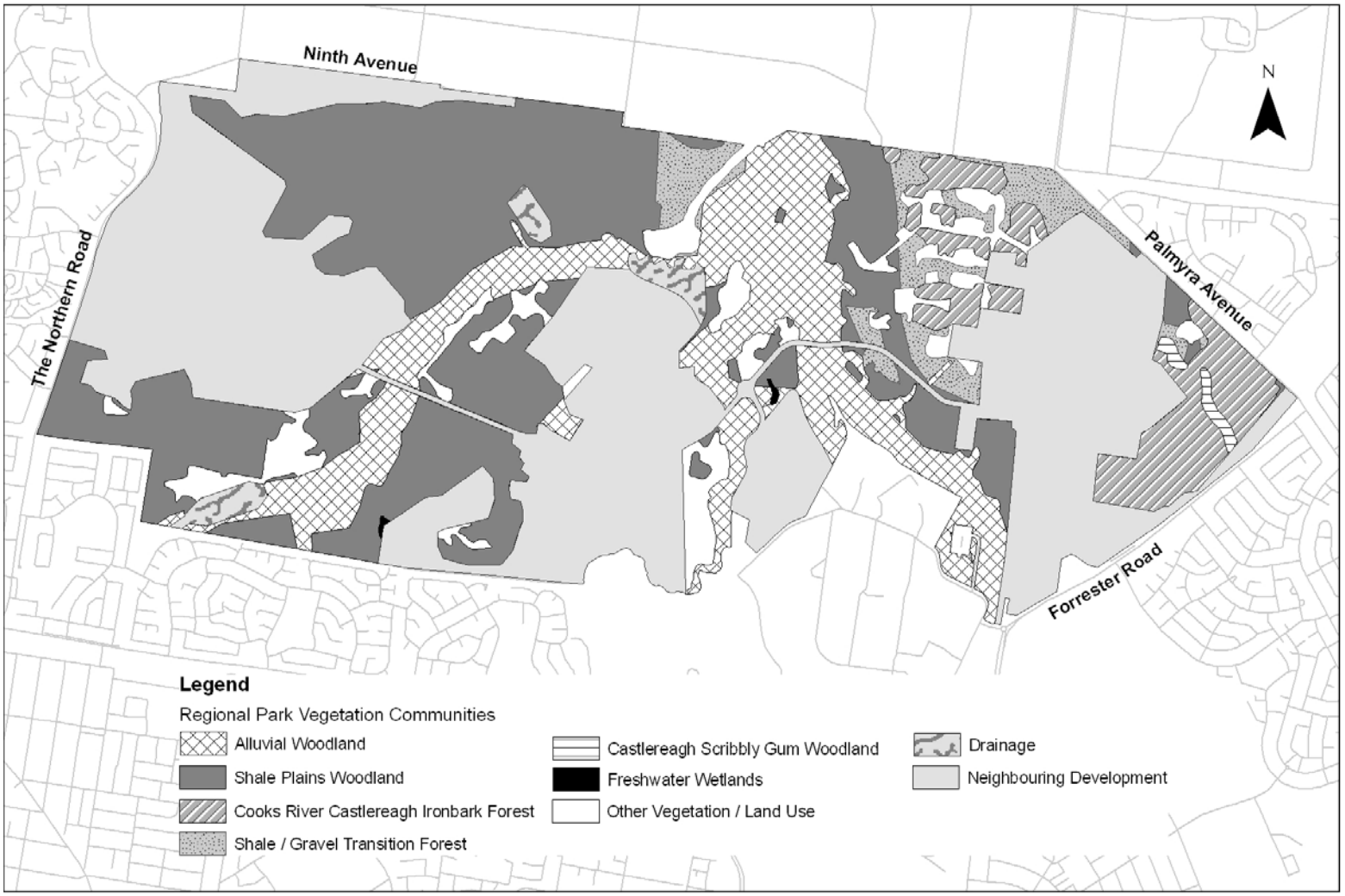


Figure 3: Vegetation Communities of the Park.

Table 1. The relationship between the ecological communities in the regional park at St Marys and the communities described in previous vegetation studies, or listed on Schedule 1 of the TSC Act (Adapted from NPWS 2002). Please note that the area does not total 900 ha due to buildings, roads and previously cleared areas, some of which are regenerating.

Native vegetation surveyed in Wianamatta Regional Park (NPWS 2002)	**NSW *Threatened Species Conservation Act 1995***	**The Natural Vegetation of the Penrith 1:100 000 (Benson 1992)**	**Urban Bushland Biodiversity Survey (NPWS 1997)**	**Gunninah (1996)**	**Area in the Park (ha.)**
Cooks River/Castlereagh Ironbark Forest	Cooks River/Castlereagh Ironbark Forest	Shale/Gravel Transition Forest (9d) Castlereagh Ironbark Forest (9e)	Eastern Shale/Sandstone Transition Forest Castlereagh Ironbark Forest	Shale/Gravel Transition Forest	80.7
Castlereagh Scribbly Gum Woodland	Not listed	Castlereagh Scribbly Gum Woodland (14a)	Castlereagh Scribbly Gum Woodland	Included in Shale/Gravel Transition Forest	4.8
Shale Plains Woodland	Cumberland Plain Woodland	Grey Box Woodland (10c) Grey Box Ironbark Woodland (10d)	Grey Box Woodland Grey Box-Ironbark Woodland	Grey Box Woodland, Grey Box/Ironbark Woodland	409.9
Alluvial Woodland	Sydney Coastal River Flat Forest	River Flat Forest (9f)	River-flat Forest (Cumberland Plain creek systems)	Riparian communities	200.3
Shale/Gravel Transition Forest	Shale/Gravel Transition Forest (9d)	Shale/Gravel Transition Forest	Shale/Gravel transition Forest	Shale/Gravel transition Forest	55.2
Freshwater Wetlands	Not listed	Freshwater Wetlands (28a)	River-flat Forest (Wetlands)	Included in Riparian communities	0.9

4.2.2 Native plants

There have been 191 native plant species recorded on the whole St Marys Property (Kinhill 1995, James 1993). Based on the maps in these reports, it is reasonable to assume that most of these species, if not all, have been recorded in the Park. Six threatened plant species have been recorded in the Park (Table 2). Forty-four species recorded within the whole St Marys Property are considered important in western Sydney (Kinhill 1995, James et al. 1999). Of those species, eight are considered to being regionally significant due to their rarity (Table 2, Gunninah 1994, Kinhill 1995, NPWS 1997).

Table 2. Threatened and regionally significant plant species recorded in the St Marys Property.

Species	Status †	Habitat ‡
(a) Threatened species		
Dillwynia tenuifolia	V	CRCIF, SPW, SGTF, AW
Pultenaea parviflora	E	CRCIF, SPW, SGTF, AW
Micromyrtus minutiflora	E	CRCIF, SPW, SGTF, AW
Persoonia nutans	E	CRCIF, SPW, SGTF, AW
Pimelea spicata	E	SPW
Grevillea juniperina subsp. *juniperina*	V	CRCIF, SPW, SGTF, AW
(b)Regionally Significant Species		
Acacia paradoxa		
Dodonaea falcata		
Dodonaea multijuga		
Eucalyptus baueriana		
Gratiola pedunculata		
Haloragis heterophylla		
Marsdenia viridiflora subsp. viridiflora		
Oxalis chnoodes		
Prostanthera scutellarioides		

† Status: E = Endangered (Schedule 1 of the TSC Act), V = Vulnerable (Schedule 2 of the TSC Act)
‡ Habitat codes: CRCIF = Cooks River/Castlereagh Ironbark Forest, SPW = Shale Plains Woodland, SGTF = Shale/Gravel Transition Forest, AW = Alluvial Woodland.

One of these species, *Marsdenia viridiflora* subsp. *viridiflora*, is listed as an endangered population under the TSC Act within the Park. This species is a twining climber and is rare in the Sydney Region with most of its known locations on the Cumberland Plain lost (Benson & McDougall 1993). Populations of this species are known to occur as very scattered plants in areas of remnant vegetation (NSW Scientific Committee Final Determination 2002). Recent records of its distribution include Prospect, Bankstown, Smithfield and Cabramatta Creek. This species has been recorded in the northern area of the Park along Ropes Creek and South/Wianamatta Creek. Threats to populations include habitat destruction due to urban development and stochastic events such as fire due to the small size of populations.

Other threatened species listed under the TSC Act that may be present in the Park, based on the presence of suitable habitat in the Cumberland Plain region (based on James et al. 1999), include *Acacia bynoeana* (Vulnerable), *Acacia pubescens* (Vulnerable) *Allocasuarina glareicola* (Endangered) *Hypsela sessiliflora* (Endangered) and *Thesium australe* (Vulnerable).

4.2.3 Native animals

The shale and alluvial soils of Western Sydney support a faunal assemblage that is somewhat different to the surrounding sandstone landscapes and more closely resembles the open woodlands on the western side of the Great Divide. An example of this unusual biogeographic pattern is the assemblage of woodland birds and frogs that have been recorded on the site.

There have been at least 116 bird species, nine mammal species, eight frog species and ten reptile species recorded on the whole of the St Marys Property (Kinhill 1995). Seven threatened vertebrate species have been surveyed in the Park (Table 3, Kinhill 1995, ERM 2003a). Eight regionally significant species have been surveyed in the Park (Table 3, Kinhill 1995, ERM 2003a). Historic records indicate the presence of Green and Golden Bell Frog (*Litoria aurea*) recorded on the site in 1966 (Wildlife Atlas 2004).

Table 3. Threatened and regionally significant animal species recorded in the St Marys Property.

Species	**Status** †
(a) Threatened species	
Cumberland Land Snail (*Meridolum corneovirens*)	E
Common Bent-wing Bat (*Minopterus schreibersii*)	V
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V
Speckled Warbler (*Sericornis sagittatus*)	V
Diamond Firetail (*Stagonopleura guttata*)	V
Black Bittern (*Ixobrychus flavicollis*)	V
(b)Regionally Significant Species	**N/A**
Azure Kingfisher (*Alcedo pusilla*)	
Crested Shrike-tit (*Falcunculus frontatus*)	
White-winged Chough (*Corcorax melanorhamphos*)	
Chestnut-breasted Mannikin (*Lonchura castaneothorax*)	
Peregrine Falcon (*Falco peregrinus*)	
Rufous Night Heron (*Mycticorax caledonicus*)	
Bearded Dragon (*Pogona barbata*)	
Lace Monitor (*Varanus varius*)	

† Status: E = Endangered (Schedule 1 of the TSC Act), V = Vulnerable (Schedule 2 of the TSC Act)

There are a number of threatened species which are likely to occur in the area, based on their habitat requirements and records for the Cumberland Plain as a whole, but which have not been recorded on the site at the time of writing. These include the Barking Owl (*Ninox connivens*) (Vulnerable), Black-chinned Honeyeater (*Melithreptus gularis*) (Vulnerable), Brown Treecreeper (*Climacteris picumnus*) (Vulnerable), Bush Stone-Curlew (*Burhunus grallarius*) (Endangered), Comb-crested Jacana (*Irediparra gallinacea*) (Vulnerable), Hooded Robin (*Melanodryas cucullata cucullata*) (Vulnerable), Masked Owl (*Tyto novaehollandiae*) (Vulnerable), Painted Honeyeater (*Grantiella picta*) (Vulnerable), Powerful Owl (*Ninox strenua*) (Vulnerable), Regent Honeyeater (Xanthomyza phrygia) (Endangered), Swift Parrot (*Lathamus discolor*) (Vulnerable), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) (Vulnerable), Grey-headed Flying Fox (*Pteropus poliocephalus*) (Vulnerable), Koala (*Phascolarctos cinereus*) (Vulnerable), Large-footed Myotis (*Myotis adversus*) (Vulnerable), Squirrel Glider (*Petaurus norfolcensis*) (Vulnerable) and Yellow-bellied Glider (*Petaurus australis*) (Vulnerable). Some scats which were consistent with Koala scats were collected from the Park in 2004, but no further evidence of Koalas has come to light.

Threatened species require special management consideration to promote their recovery. Under the TSC Act recovery plans may be prepared to identify actions and priorities for

threatened species, populations and ecological communities. Also under the Act, a threatened species priorities action statement (PAS) must be prepared. The PAS outlines the broad strategies and detailed priority action in NSW to promote the recovery of threatened species, populations and ecological communities and to manage key threatening processes. The PAS and recovery plans will be used to guide management of threatened species in the area.

The St Marys Property also supports a sizeable population of macrofauna consisting of Eastern Grey Kangaroos (*Macropus giganteus*), Red Kangaroos (*M. rufus*) and Emus (*Dromaius novaehollandiae*). The macrofauna have been introduced to the site since the late 1950s and are not derived from native populations of the Cumberland Plain with the nearest natural Red Kangaroo population occurs around 400 kilometres to the west (Cumberland Ecology 2004). The detailed origin of the macrofauna introduced to the site is unknown, but it is known that most macrofauna introduced to the site were orphans that had been collected from many different areas of NSW, and then brought to Sydney and raised by members of the community. When these animals became too big to keep, they could not be released into the wild locally since they were not native to Sydney. They could not be returned to their original habitat since it was usually remote, and often not known, and therefore they were released into captivity in the St Marys Property (Cumberland Ecology 2004).

During 2004, the St Marys MFMP was prepared by the Joint Venture Partnership to provide a plan for the humane and ecologically sustainable management of the macrofauna populations that exist on the St Marys Property, including the Regional Park (Cumberland Ecology 2004). The Department endorsed this Plan subject to 31 conditions and recognised that the management of the macrofauna within the St Marys Property, including the Regional Park, will be in accordance with the MFMP. The key objectives of the MFMP outline short (< 2 years), medium (2 to 10 years) and long-term (> 10 years) management strategies, which aim to reduce the macrofauna population to a sustainable level within the St Marys Property through fertility control. It is not known what a sustainable population would number, and the MFMP includes research into the effects of grazing pressure on the native vegetation of the Regional Park, which will allow this to be established. The MFMP specifies a maximum target density of 0.3-0.5 kangaroos per hectare, which is approximately 270 – 450 animals, until further research into grazing impacts on vegetation is completed. Recent population census results estimate there are approximately 1200 animals in the St Marys Property. At these densities, grazing pressure is still relatively high, and male animals in particular are more inclined to show territorial and aggressive behaviour. There is an expectation that visitors to the Park will be able to view these animals. However, due to the current size of the population and the risk to public safety, visitor access to the Park will necessarily be limited until the macrofauna population has declined significantly.

There are a number of important examples of habitat for birds, mammals, reptiles and amphibians in the Park. Forest and woodland communities provide habitat with a distinct canopy and a grassy or a shrubby understorey structure. Fauna species are able to shelter, forage, nest and breed in these areas. However, there appears to be a lack of old trees, hollows and fallen logs in the Park, which may be a threat to many native animals due to the loss in microhabitat. The riparian habitats provide areas where fauna species can shelter, forage and breed although part of the current route of Ropes Creek is now a concrete channel and the availability of suitable habitat such as reed beds and streamside may be limited by this (ERM 2003a). The aquatic habitats in the dams across the Park may also not be large enough to support some species of wetland birds (ERM 2003a). The disturbed areas of the Park where grass species dominate are an important food resource for the kangaroo population.

ISSUES

- This Park has significant fauna management requirements and significant expectations of the development of visitor facilities and infrastructure.
- Current knowledge of the presence, distribution and significance of flora and fauna species, and their habitat requirements are inadequate for decision-making on detailed at this time.
- This site has had a significant amount of disturbance over a number of years and this has the potential to affect the resilience and ability of the soil seedbank to regenerate.
- There are many gaps in our knowledge regarding the location of the pasture improvement and sheep grazing activities carried by CSIRO on the site. This information may help understanding of the regeneration of native vegetation in the Park.
- An unsustainable population density of macrofauna is a threat to the natural values of the Park.
- Adequate provision needs to be made for the natural movement of native species through the Park using corridors and/or linkages.
- Existing and proposed fencing in the St Marys MFMP may have the potential to impact (positively and negatively) on fauna movement corridors.
- Removal of dead and fallen timber for firewood may be a threat to many native species due to the loss of microhabitat.

DESIRED OUTCOMES

- The full range of native plant and animal species and their habitats found in the park is conserved.
- A diversity of vegetation structures and other habitat values are conserved, and restored where they have been subject to past disturbance.
- The endangered ecological communities and populations within the Park are protected.
- Rare, threatened & regionally significant native species and their habitats within the Park are protected.
- Park neighbours support conservation of remaining areas of privately owned native vegetation near the Park.
- Habitat linkages for biodiversity movement within a regional context are established and maintained.
- A sustainable population of macrofauna will be retained in the Park.
- Any decision on long-term fencing for the management of macrofauna, once they have reached a sustainable population size, will seek the best possible environmental result.
- Protection of habitat of native species will include actions to minimise illegal activities.
- Threatening processes from surrounding urban areas are minimised.

STRATEGIES

4.2.1 Ensure that management, visitor facilities and recreation opportunities do not have a negative impact in areas of habitat for significant plant and animal species or restricted plant or animal communities.

4.2.2 Allow natural regeneration of previously disturbed areas, apart from areas set aside for visitor usage or cultural heritage conservation.

4.2.3 Implement appropriate recovery plan or PAS actions for threatened species, endangered ecological communities & populations when they have been prepared;

4.2.4 Do additional vegetation surveys, in particular to cover threatened species and check for additional significant species.

4.2.5 Implement a program to monitor the status of the significant communities and threatened plant species and to evaluate the impacts of threatening processes and the success of management programs.
4.2.6 Liaise with neighbours, Bushcare, vegetation management committees and land-use authorities to encourage retention, and if possible expansion, of areas of native vegetation close to the Park.
4.2.7 Protect the habitats of threatened and biogeographically significant fauna species from visitor impacts, the effects of introduced species and inappropriate fire regimes;
4.2.8 Continue to record the distribution of threatened and significant fauna species.
4.2.9 Protect and maintain corridors to enhance biodiversity linkages between the various sections of the Park and within the region, and investigate and monitor the impacts of internal barriers on these linkages. Liaise with the land developer to ensure that the St Marys MFMP is implemented.
4.2.10 Prepare and implement a bush regeneration plan, which will identify: areas that require weed management; disturbed areas that require revegetation with native (endemic) species; and areas where natural regeneration of vegetation may occur.
4.2.11 Liaise with local communities to mitigate threatening processes from surrounding urban areas.
4.2.12 Liaise with other land management authorities and developers to mitigate threatening processes from surrounding urban areas.
4.2.13 Focus on the impacts of gathering and removal of timber in and around the Park in law enforcement, education and research activities.

4.3 CULTURAL HERITAGE

4.3.2 Aboriginal Heritage

The strong attachment of Aboriginal people to the land is acknowledged. They have cultural links with the whole landscape and specific locations. Individual places of significance may include living places, art sites, ceremonial sites, spiritual places and contact sites. Aboriginal sites and places are also important to non-Aboriginal people as they provide information about the past lifestyles of humans.

The Gomerigal-tongara clan occupied the area now covered by the Regional Park. This clan belongs to the Darug language group whose territory was bounded by Port Jackson and Botany Bay in the east, Blue Mountains to the west, the Hawkesbury River in the north and Appin in the south (Kohen & Lampert 1987). From 1789 to 1790 smallpox had a devastating impact on the Aboriginal population in the Sydney Region with large numbers of Aboriginal people dying from the disease (Kohen & Lampert 1987).

The Regional Park falls within the boundaries of the Deerubbin Local Aboriginal Land Council. In 2007 a Memorandum of Understanding (MOU) was negotiated with members of the Darug community. This MOU acknowledges the Darug's ongoing interest in the management of their traditional lands. There may also be other Aboriginal community organisations and individuals with an interest in use and management of the park.

The archaeological potential of the Regional Park is predicted to be quite high as the two major water courses (South and Ropes Creek) and floodplain would have provided a major focus for Aboriginal occupation (Kinhill 1995, McDonald 1997a). It is believed that this area would have provided sources of water, a diverse range of foods and other organic raw materials and resources, and access to a range of raw materials for stone artefact production (Kinhill1995).

Known sites in the St Marys Property do not conform to predictive models for other areas of the Cumberland Plain (i.e. unlike other areas, sites regularly occur at a significant distance from permanent water). Therefore, sites may be expected to occur other than those along the creek lines (Smith 1991) and may be more indicative of Aboriginal usage of natural springs in the area (Colin Gale pers. comm.). Evidence for sites along the creek lines may have been covered by alluvial deposits during flooding (Smith 1991). Open sites (stone artefact scatters) are the most likely type of archaeological site found in the Park. Scarred trees may occur in the uncleared areas but are likely to be very rare.

Sites surveyed in the Smith report (1989) were estimated to have a density of 1/0.2 ha. (5 sites/ha.). Three of these sites are some of the largest sites, in terms of artefact numbers and densities, recorded on the Cumberland Plain (Smith 1989). This suggests that there is significant correlation of site size and distribution with the proximity to water and the proximity to stone material sources (McDonald & Mitchell 1994). These 13 sites have been assessed as having high to very high archaeological significance. This was based on the level of disturbance and the type of artefacts or rare features surveyed at each site.

The archaeological potential around the munitions factory is considered to be low due to the amount of development and disturbance in these areas. Undeveloped areas, including the areas along the creek lines and tributaries, are considered to have high archaeological potential (Smith 1991).

Smith (1989) recorded rare artefact types such as axes, a grindstone, and a glass artefact made of bottle glass (indicating that the site was occupied during the contact period). A total of 71 sites covering the whole of the St Marys Property are registered with DECCW, including open camp sites, isolated finds and quarry sites. A wide range of stone materials were found within the St Marys Property, including silcrete, chert, indurated mudstone, basalt, quartz and quartzite and this is considered unusual on the Cumberland Plain as most archaeological sites contain a limited number of source materials (Smith 1989, Kinhill 1995). Extensive disturbance has occurred within the St Marys Property due to earth works related to the development of the munitions buildings, roads, and services such as the 330kV-transmission line (Smith 1991).

The archaeological evidence in the form of stone artefacts visible on the soil surface is distributed across the entire St Marys Property (Smith 1991; Kinhill 1995). However, this does not indicate the density or characteristic of the artefacts in different parts of the landscape on the site (Kinhill 1995). The site is likely to be regionally significant given the archaeological evidence and the setting (floodplain) and areas should be conserved that represent the diversity of landscapes on the site. McDonald (1995) proposed that intact landscape units and not individual sites be defined and conserved. Based on this model, three broad geomorphic environments (Tertiary terrace, Quaternary alluvium and shale/sandstone hillslopes) are conserved within the Regional Park, which represent the range of landscapes across the whole area of the former ADI site (McDonald 1995).

More recent work by McDonald (1997a, b, c) has identified areas of high archaeological potential and a representative sample of a range of landscapes using previous land- use disturbance and a predictive model for sites on the Cumberland Plain. This work divided the St Marys Property into 4 zones (Figure 4), but with no broad scale ground-truthing of the model (McDonald 1997a). These zones are:

- Zone 1 – core conservation, recommends a management plan for this zone. It represents most intact land surface across the site and includes a representative range of the three main landscape units, very high potential for undisturbed archaeological sites, falls within the boundary of the Regional Park.

- Zone 2 – high potential for archaeological sites, and based on the predictive model has a high potential for significant sites.
- Zone 3 – moderate potential for undisturbed sites, assessed as having a lesser potential for significant sites.
- Zone 4 – highly disturbed, low or no archaeological potential.

However, the major recommendations for each zone were made on the basis of whether an area was to be developed rather than developing management strategies suitable for a NPWS reserve. Most reports written regarding the archaeology of the St Marys Property were done with the aim of determining where the development areas for the site would be located and also finalising the zones for the models developed by McDonald.

Further work is required to determine appropriate management strategies for the Aboriginal heritage in the Park. This will also include a review of all archaeological works done to date across the St Marys Property.

The Black She-Oak has special significance to the local Aboriginal people and is found in different areas of the Regional Park. It is believed that it was so named the She-Oak because they were known as the Aboriginal 'woman's tree'. As very little grows underneath these trees, it was a safe place for the children to play as snakes would avoid travelling over the fallen branches. These trees are also part of men's business as the wood could be used to make a variety of tools and locally, fires were made from this wood to harden spears for hunting.

While the Department presently has legal responsibility for the protection of Aboriginal sites and places it acknowledges the right of Aboriginal people to make decisions about their own heritage. It is therefore Department policy that Aboriginal communities be consulted and involved in the management of Aboriginal sites, places and related issues and the promotion and presentation of Aboriginal culture and history. There may be interest from the local Aboriginal community in undertaking cultural and teaching activities in the park. Cultural activities, including a place for ceremonies, may be appropriate provided they comply with this Plan of Management and have minimal environmental impact.

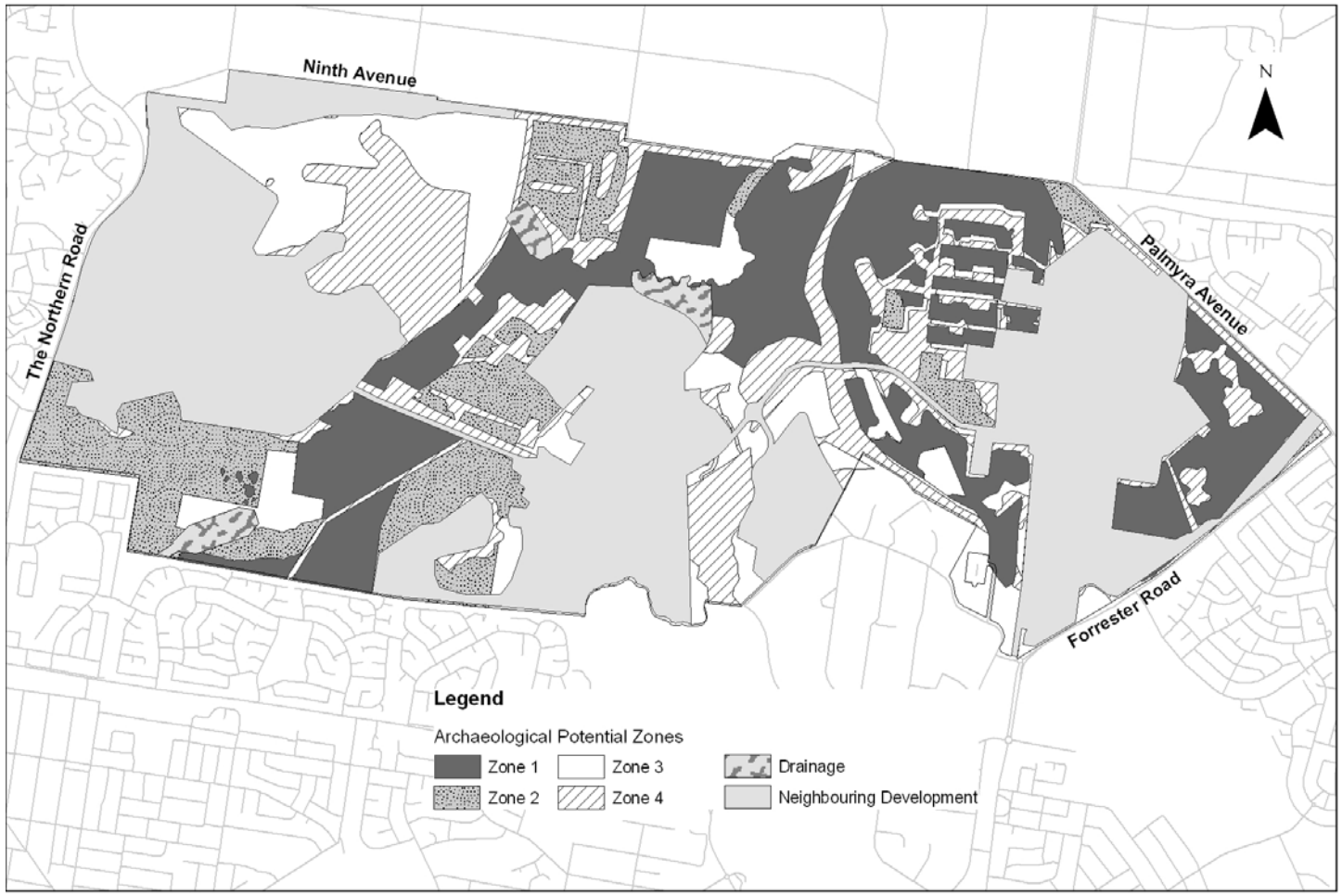


Figure 4: The archaeological potential of the Regional Park based on the landscape features of the site and level of disturbance from past land use activities. Zone 1 represents the core conservation area. Zone 2 represents the area with high potential for archaeological sites. Zone 3 represents the areas with moderate potential. Zone 4 represents the most disturbed areas and thus has the least archaeological potential. Source: McDonald (1997c).

4.3.3 Historic heritage

The land including and surrounding the Park has been subject to four major eras of land use in the last 200 years:

1. Colonial land grants and associated settlement and farming activities.
2. The establishment of an explosives and filling factory during World War II.
3. The establishment of the munitions factory and storage facility during the mid-1950s.
4. Revitalisation and conservation.

Colonial land grants and associated settlement and farming activities

Around 1803, surveying and subdivision of the area south from the Hawkesbury River and east of the Nepean was commenced by Surveyors Grimes and Meehan, with Governor King and members of his family benefiting from this. Other free settlers to benefit from land grants in the St Marys district at the time included John Oxley, George Druitt, James Whalan, Mary Putland, Mary O'Connell and James Erskine (Gartell & Spearritt 1991; Casey & Lowe 1994).

In 1806, Governor King granted his son, Philip Parker King, 600 acres on South/Wianamatta Creek adjacent to his sister's land grant known as 'Elizabeth Farm'. From 1806 grazing commenced on the King's land grants, which is estimated to include about one quarter of the former ADI site (Kinhill 1995). Philip Parker King named his property 'Dunheved' and it is believed that the homestead on this property was built around 1810. The King family resided at Dunheved until the 1840s. The King family ran a dairy and horse stud, stocked the property with sheep and cattle and cultivated vegetables and fruit trees. The farm was reported to being one of the best in the colony in the 1st half of the 19th century (Casey & Lowe 1994).

In 1924, John William Fisher, a grazier, consolidated the King family land under one title; this land would eventually become the munitions factory site. A number of other smaller land grants were also surveyed between 1806 and the1850s along South / Wianamatta Creek and these made up the parcels of land that were resumed between 1941 and 1943 by the Commonwealth Government for the establishment of the filling and explosives factory (Casey & Lowe 1991, Kinhill 1995).

A number of historic structures and other relics remain in the Park, which reflect the use of the site by different landholders for agricultural purposes. These include the previously mentioned Dunheved Homestead site and the associated pine tree plantings on the western side of South/Wianamatta Creek, Elizabeth Farm site, Luxford's House, Jackson's Dairy, an unnamed house site, and a house chimney. Other historic items in the Park include Ropes Creek Bridge, South / Wianamatta Creek Bridge, and the road between the two bridges, which is believed to be the original route of Ninth Avenue.

During the period from the 1840s to the 1860s, major changes to the surrounding area occurred with the expansion of the railway west. The St Marys Township was established within the subdivision of Mary Putland's estate and the local area was increasingly subjected to timber cutting, firstly to supply railway sleepers, then to supply Sydney construction and firewood needs (Kinhill 1995). In 1891, St Marys Municipality was declared. This was amalgamated with Penrith City Council in 1949.

The industries around the district included tanneries, sawmills, brick makers and wheelwrights (Stacker 2002). F.C. Pye owned the Dunheved property at the time of resumption by the Commonwealth Government (Casey & Lowe 1994). It is believed that the homestead was used during the construction of the explosives and filling factory (1941-43)

by surveyors and engineers but was then demolished to make way for new buildings around this time (Kinhill 1995).

Three historic sites are listed on the Register of the National Estate: the Dunheved Homestead site, the Elizabeth Farm site and the pine trees on the western side of South/Wianamatta Creek. This is in recognition of their significance for their association with the settlement of the area by the King family and also due to their association with the pastoralist phase of the New South Wales colony.

The establishment of an explosives and filling factory

The next major change was to occur in the area during WWII, when the Commonwealth Government decided to establish a filling and explosives factory at St Marys. The site was chosen due to its close proximity to road and rail transport systems and the availability of land in a relatively undeveloped part of Sydney (Allom Lovell & Associates 1994). Between 1941 and 1942, the Government resumed 5 parcels of land around the St Marys area. This included land outside the current boundary of the St Marys Property, giving a total size at this time of 1841 hectares compared with the current size of 1545 hectares.

The factory was designed to assemble and fill bombs, shells and fuses. It also produced signal and smoke pyrotechnics and flame floats, sea markers and flares (Allom Lovell & Associates 1994). The site was divided into different sections reflecting the different functions of the factory: Pyrotechnics, High explosives, Magazines, Administration, Fuse, Maintenance, Proof-at-Rest, the Toluol section and the Proof Range. At its peak production (1943 – 44) 324 professional, managerial, clerical and foreman staff, and 2175 factory workers were employed on the site (Allom Lovell & Associates 1994).

After the war, in 1946 the factory was scaled back and parts of the site in the south were used for private industrial development (Allom Lovell & Associates 1994, Kinhill 1995). Parts of the Park in the west may contain relics of this era such as the single line railway and the Kingswood magazine area.

The establishment of the munitions factory and storage facility

During the 1950s, the Commonwealth Government decided to build a new munitions factory at St Marys. Some of the land that formed the earlier factory was used as well as a portion of land to the north of the main site resumed by the Commonwealth Government. This was to avoid disruption to the newly established industrial operations in the south where an area of approximately 300 ha was sold in 1957 and is now known as Dunheved Industrial Area.

The new munitions factory development was known as Project 590 and work commenced in 1955. Prime Minister Robert Menzies officially opened the factory in 1957; however production did not start until 1958. The number of workers on the site varied over time depending on the production levels of the factory. For example, during the Vietnam War (1965-75) the workforce was about 1200 with the greater demand for ammunition, bomb filling and pyrotechnics stores. After the war, the workforce dropped (to about 400 by 1977) due to the decline in munitions production. With commercial orders and concerns about work safety and efficiency levels, the workforce increased to about 800 in 1985 (Allom Lovell & Associates 1994). In 1990, the Government-owned Australian Defence Industries Ltd (ADI) was created by the Commonwealth Government to manage defence supply production (Allom Lovell & Associates 1994). The Branch railway also closed at this time. In 1993, production ceased at the ADI St Marys Facility and the site was placed on the Urban Development Program at the request of the Commonwealth Government.

Most reports written about the munitions factory era were done as part of a comprehensive investigation into the redevelopment of the St Marys Property. Allom Lovell and Associates (1994) concluded that the St Marys facility did not have sufficient heritage significance to justify general protection at a state or local planning level; other ADI facilities in Victoria were considered to be of greater significance. However, they did recommend the retention of representative groupings of structures and associated service infrastructure and blast mounds in some sections as evidence of the munitions factory.

Most of the buildings from the munitions factory era retained on the St Marys Property were kept based on their potential for reuse, whether they were uncontaminated and their general condition (Kinhill 1995). Three munitions era buildings that remain in the Park are Transit stores S42, S43 and S44. They were used for storing finished products prior to being transported off the St Marys Property (Allom Lovell and Associates 1994). There are a number of earthworks and structures from the munitions factory era associated with transport, drainage and blast containment in the Park, including the Mine Filling building (S29) adjacent to the eastern and central precincts. Potentially other relics from this era may also occur in this area. The future use and interpretation of any historic structure needs to also investigate the potential for its adaptive reuse.

Revitalisation and Conservation

With the decision to close the facility in the early 1990s, ADI undertook a number of studies to determine what should be done with the site between 1994 and 2000. This resulted in the release of the SREP 30, which divided the site into different land use zones including a regional park. A joint venture was sought with a view to developing the site for residential use. Delfin Lend Lease was awarded the tender in 1994 and entered into a joint venture with the newly created body ComLand, which itself had been established to help dispose of Commonwealth land no longer required. Almost at once, a local grassroots campaign began in opposition to the wholesale redevelopment of the site. Local residents were concerned about the possibility of 8,000 new dwellings in the area, the impact on the remaining bushland, especially remnant and regrowth stands of Cumberland Plain Woodland and the prospect of the removal of the kangaroo and emu populations, which had become a much-loved feature of the area. In 1993 the ADI Residents Action Group was formed and at its first public meeting — attended by representatives of ADI Planning, the National Parks and Wildlife Service and Penrith City Council — it decided to oppose the development of the site.

With ongoing lobbying, in 1997 the Australian Heritage Council placed an Interim Heritage Order on 1,100 hectares of the site based on the presence of Cumberland Plain Woodland vegetation. This was later reduced to 900 hectares with the provision for up to 5,000 houses, and the 900 hectares was identified to become Regional Park managed by the NSW National Parks and Wildlife Service.

Six broad cultural heritage themes can be seen in the Park. These are:

1. Aboriginal occupation over many centuries.
2. The first contact with the Aboriginal people and pioneering settlement at the beginning of the 19th century.
3. The intensification of rural settlement, and construction of road and transport infrastructure during 19th and early 20th century.
4. The rapid development of the explosives and filling factory in response to Australia's isolation during WWII.
5. The further development and operation of a munitions factory from the 1950s in response to Cold War pressures.
6. The battle for conservation versus development .

ISSUES

- There are gaps in knowledge about Aboriginal occupation and use of the area.
- There are gaps in knowledge about European occupation and use of the area, particularly the munitions period and activities carried out by CSIRO.
- A number of historic sites are listed on the Register of the National Estate in recognition of their values.
- A Conservation Management Plan would assist in determining the significance of places and their management requirements.

DESIRED OUTCOMES

- Aboriginal sites and places are protected from damage by human activities.
- Aboriginal people are involved in management of Aboriginal cultural and natural values in the park, and able to use the Park for ceremonial purposes where appropriate.
- Historic features are appropriately documented, conserved, managed and interpreted.
- Community and Department knowledge and understanding of Aboriginal and historic values within the Park is increased.
- Intact landscape units are preserved as a means of protecting Aboriginal heritage.

STRATEGIES

4.3.1 Manage Aboriginal heritage in consultation with the Deerubbin Local Aboriginal Land Council, Darug People's Advisory Committee and other relevant Aboriginal community members, and consider the provision of an appropriate place for ceremonial activities.

4.3.2 Prepare a Conservation Management Plan for the Park, including investigation into adaptive reuse of buildings and structures, prior to any works being carried out in the Park.

4.3.3 Retain and protect all sites of cultural heritage potential pending preparation of the Conservation Management Plan.

4.3.4 Ensure that visitor facilities and recreation opportunities do not impact on any significant Aboriginal and historic sites and places and are consistent with the Conservation Management Plan.

4.3.5 Restrict information on the location of Aboriginal sites and places except where the agreement of relevant Aboriginal community members has been obtained. Prior to any promotion of a site or place, prepare a conservation study and undertake any management work necessary to protect the site or place.

4.3.6 Develop public awareness programs that inform the public about the historical cultural value of the Park and about aboriginal culture as it relates to the Park.

4.3.7 Ensure that intact landscape management units are mapped and included in the Conservation Management Plan.

4.3.8 Ensure that all areas of known and potential archaeological significance have the required approvals under the *Heritage Act 1977* prior to any excavations commencing.

5. PARK PROTECTION

5.1 SOIL MANAGEMENT

Erosion

Factors influencing soil erosion includes rainfall intensity, landscape features, climate, human and animal impacts, vegetation cover, soil characteristics, slope and geology. Management of soil erosion and the resultant sedimentation are key geomorphic processes that need to be considered in catchment management (Martens et al. 1999). Vegetation cover on steep slopes and along waterways can reduce erosion and sedimentation problems within sub-catchment and catchment areas. Removal of vegetation can increase water run-off, which may lead to an increase in soil erosion and salinity and a decline in catchment health. Chemical pollutants used in the catchment can also attach to eroded soil particles, which settle in deposits of sediments during erosion events, affecting the health of waterways (Martens et al. 1999).

Other activities in the catchment that may contribute to soil erosion include fire and urban development. Fires reduce the vegetation cover and can thus temporarily increase the erosion hazard and sedimentation of a particular area. Urban development can also increase the sedimentation of waterways, resulting in an increase in turbidity, damage to aquatic ecosystems, a reduction in recreational value and stream capacity (Martens et al. 1999). Water and gravity are the two main causes of soil erosion in the Hawkesbury-Nepean catchment. Soil eroded by water is transported downslope by surface run-off. The mass movement of soil by gravity is mainly caused by flows or landslides in steep sandstone areas of the catchment with slopes greater than 11 degrees (Martens et al. 1999).

The soil landscape units found within the Regional Park include the Blacktown, Luddenham, South/Wianamatta Creek and Berkshire Park units and have been discussed in detail in Chapter 4 (Bannerman and Hazelton 1990). Outlined in Table 4 are the soil and landscape limitations for the soil landscape groups that occur in the Regional Park. Soils with high erodibility and erosion hazard may limit the development of structures like trails, tracks and some visitor facilities in the Park. However, in some situations these constraints can be overcome with good design. The erodibility and erosion hazard of soil may also limit the type of activities that may occur in those sections of the Park which are constrained by soil characteristics.

Two approaches can be used to prevent and control soil erosion in a catchment. The first approach involves the construction of soil conservation works such as reshaping land, stormwater drains and retention basins. The second approach involves the restoration of altered surfaces, which may include revegetating areas with native vegetation cover, or planting trees to intercept groundwater (Martens et al. 1999). This latter approach is complicated by the fact that the Park contains a large drainage system in a varying state of repair. Both of these approaches will be investigated further when more is known about the drainage of the Park.

Salinity

Salinity is the presence of salt in the land surface, in soil or rocks, or dissolved in water in rivers or groundwater. Salinity can develop naturally, however this process can be accelerated in areas where there have been alterations to the ecosystem and the natural hydrology of the landscape by human disturbance. Salinity can impact on natural ecosystems, reduce the viability of agricultural lands and damage infrastructure. Different

types of salinity include dryland, irrigation, urban, river and industrial salinity. They differ according to the impacts and how and where the salt has been mobilised (DLWC 2000).

Parts of western Sydney have been affected by urban salinity. Urban salinity is a combination of dryland and irrigation salinity. It is caused by a number of factors including:

- Removal of native vegetation.
- Over-watering of public recreation areas, domestic lawns and gardens.
- Leaking water and sewer pipes, drains, tanks and other infrastructure.
- Seepage from septic tanks and sullage pits.
- Surface water that has become ponded by structures (such as roads) built across normal drainage systems.

Activities recommended for the prevention and control of salinity within a catchment include protecting and replanting native vegetation on hillsides and replanting along lower slopes and creeks. Other activities include preventing soil erosion, avoiding developing land with potential salinity problems, minimising the use of irrigation water and protection of large native trees (DEC 2005). Revegetation of sections of the Park will be investigated further during the preparation of the Bush Regeneration Plan.

Salinity potential is an indication of the likelihood of an area to have a salinity problem due to its geological and soil properties, the topography and location in the catchment. The Department of Infrastructure, Planning and Natural Resources (2002) modelling of the salinity potential for Western Sydney indicated that the area covered by the Regional Park has a moderate salinity potential especially along the creek lines. The occurrence of or potential for soil salinity in the Park (Table 4) may limit the location and types of activities or structures that may occur in those sections of the Park. This will be investigated further when areas of soil salinity have been identified.

Table 4. Soil and landscape limitations for each soil landscape group in the Regional Park*

Soil landscape unit	Erodibility †	Erosion hazard †	Surface movement potential †	Salinity	Landscape limitations †
Blacktown	Moderate	Slight – moderate	Moderately reactive	Localised occurrence	• Surface movement potential • Seasonal waterlogging
Luddenham	Moderate	Moderate – very high	Moderately reactive	N/A	• Erosion hazard • Moderate surface movement potential
South Creek	High	Very high – extreme	Generally low	High limitation with widespread occurrence	• Flood hazard • Waterlogging (localised) • Permanently high water tables (localised) • High erosion hazard • Non-cohesive soil (localised) • Seasonal waterlogging
Berkshire Park	Low – high, depending on the soil material within the landscape unit	Low – high	Slightly reactive	N/A	• Flood hazard (localised) • Seasonal waterlogging • Erosion hazard

*Adapted from Bannerman and Hazelton (1990)
† see Definitions sections

Soil contamination and remediation

As previously stated in Chapter 4, the St Marys Property (including parts of the Regional Park) was used as a munitions factory from 1941 to 1996. Some of the factory's activities, such as burning of out-of-date chemicals, resulted in areas of contaminated soil. The majority of the site has been subject to extensive contamination investigation and remediation work by the landowner over the period 1993 to 1997. The objective of that work was to:

1. Assess the nature, degree and location of any contamination and remediate the property to a sufficient level to ensure the suitability of the property for the uses gazetted in SREP30;
2. Comply with relevant legislation, particularly the *NSW Contaminated Land Management Act 1979*; and
3. Set up a framework for ongoing management of residual risk.

The main activities on the site during the munitions factory era included the filling of ordnance (shells and bombs) and ammunition (20 mm cannon) with explosives and

propellants, quality assurance testing, storage and related activities. Most of the components were manufactured off-site and only small quantities of the most sensitive explosives were manufactured on site. Some test-firing of detonators, fuses and smaller ordnance occurred at designed areas. All large munitions were test-fired off-site at army firing ranges. Unserviceable or off-specification munitions were destroyed by boiling out the explosive and propellant before burning it at designated burning grounds and recycling the scrap metal. The residual ash was buried in on-site landfills along with general waste from the factory. Effluent from the various manufacturing operations was passed through the settling ponds, referred to as labyrinths, before discharge to the sewer. The labyrinths were cleaned out periodically and the explosive material was taken to burning grounds for destruction.

During the decontamination process, the St Marys Property was divided into nine sectors for remediation and validation purposes. Soil remediation involved excavation and stockpiling of contaminated soils followed by appropriate disposal methods, including high temperature thermal desorption and destruction of explosives using an on-site thermal soil remediation unit (TSRU), landfarming of hydrocarbon contaminated soils, and disposal to off-site licensed landfill of asbestos and other wastes. Concrete from demolition activities was stockpiled in proposed development areas for recycling, and soils treated in the TSRU were validated and then used as backfill in some excavations. Validation testing was performed on all excavations and on treated soils to ensure that materials remaining on site complied with the agreed remediation acceptance criteria or validation criteria for the St Marys Property. Subsurface imaging surveys were used to locate metallic items, which were then excavated, identified and disposed of appropriately to ensure that the site was clear of any explosive ordnance, either on the surface or buried.

The outcome of investigation and remediation work was:

1. A remediation and audit process that was consistent with State requirements and integrated into the zoning process and planning and development framework established for the property.
2. The Property was independently audited under the direction of the State Government prior to gazettal of rezoning.
3. An accredited Auditor (under the *NSW Contaminated Land Management Act 1979*) issued Site Audit Statements for the entire property.
4. The inclusion in the St Marys Development approval process (SREP, EPS and the St Marys Development Agreement) of the strategy for dealing with residual contamination risk.

All sectors, except areas known as Site 6, Site 23 (former burning grounds) and areas under existing infrastructure have been investigated, remediated and validated. The Site Auditor (AGC Woodward Clyde 1999) has concluded that the majority of the site (excluding the Eastern Sector) is suitable for any form of development, including low-density residential development. The Site Audit Statement for the Eastern Sector of the Regional Park has concluded that this area is suitable for passive recreational use (HLA-Envirosciences P/L 2006 and 2007).

Site Audit Statements

There are some areas of the St Marys Property that have not been extensively surveyed to ensure that they are free of contamination. For the Regional Park these include the areas known as Site 6, Site 23 and areas under existing buildings, car park areas and roads. These areas have been excluded from the Site Audit Statement covering the whole St Marys Property. Should active recreational land use (e.g. picnic areas) be planned in either Site 6 and or Site 23 the final surface of any earthworks in these areas must be surveyed by a

metal detector by appropriately qualified and experienced personnel and the works reviewed by an independent site auditor.

Residual contamination risk

Despite the thoroughness of the clearance work, there remains a residual risk that some small items of explosive ordnance or other contamination remain buried in parts of the St Marys Property, especially in those areas not yet investigated including buildings and paved areas. With respect to ordnance, the Site Auditor (AGC Woodward Clyde 1999) concluded the following:

- The level of risk of finding any identifiable piece of explosive ordnance with hazardous content, is considered to be significantly less than 1 X 10-6 (i.e. less than 1 in 1 000 000) over the majority of the site, excluding the Eastern Sector.
- The risk of harm to the public from explosive ordnance remaining on the majority of the St Marys Property (excluding the Eastern Sector) is considered to be lower again than 1 X 10^{-6} (i.e. less than 1 in 1 000 000). This is due to contact alone with a hazardous item of explosive ordnance is unlikely to cause injury, unless it is hammered or burnt in a fire.

The *Eastern Regional Park Remnant Contamination Management Plan* (URS, 2006) identifies procedures for the safe handling and disposal of any items of ordnance that may be found during earthworks in the eastern section of the Regional Park. There is no Contamination Management Plan for the rest of the Park. The Development Agreement also obliged the landowner to use "best endeavours" to obtain an indemnity from the Commonwealth Government in relation to contamination caused by previous Commonwealth uses. The landowner has recently obtained a definitive response from the Commonwealth that a site-specific indemnity will not be provided. Any future indemnity issues will be dealt with under the Australia-wide policy adopted by the Commonwealth in 1999.

ISSUES

- Sites of active soil erosion and/or salinity have not been comprehensively mapped in the Park.
- There is a limited understanding of the impact flooding may have on soil erosion.
- Lack of native vegetation cover may be a significant influence on soil erosion in the Park.
- The management of existing and new trails will need to ensure soil stability and prevent soil erosion.
- Some soils within the Park are highly erodible and require particular care in managing operational and/or recreational development and activities.
- The residual contamination risk needs to be recognised and appropriate actions under the Contamination Management Plan implemented when specific risks are identified.

DESIRED OUTCOMES

- Human induced soil erosion in the Park is minimised.
- Soil Management practises within the Park does not have any negative impacts on neighbouring landholders.
- Areas affected by soil erosion, salinity and contamination in the Park are identified and remediated.

STRATEGIES

5.1.1 Minimise soil erosion and incorporate soil conservation principles and values for all earthwork operations carried out in the Park.
5.1.2 Map, monitor and if necessary, treat areas of soil erosion, salinity, potential contamination and previous site audit remediation works.
5.1.3 Rehabilitate areas affected by soil erosion, salinity and remediation taking into account catchment management strategies (see Section 5.2).
5.1.4 Incorporate revegetation strategies consistent with the Bush Regeneration Plan (see Section 4.2) to minimise erosion and salinity.
5.1.5 Develop a protocol for the movement of soil within and into the park so that the origin, location and provenance is known and recorded.
5.1.6 Ensure all earthworks will comply with the conditions of the relevant Site Audit Statements.
5.1.7 Undertake a risk assessment in relation to residual contamination in the Park.
5.1.8 Test soils under existing buildings, carparks and roads for ordnance or chemical contamination and prepare required site audits for these areas if these facilities are removed.
5.1.9 Survey site 6 and site 23 using appropriate methodology should active recreational land use (eg picnic areas) be planned at these sites.
5.1.10 Implement the procedures for the safe handling and disposal of any items of ordnance that may be found during earthworks as set out in the Remnant Contamination Management Plan.

5.2 CATCHMENT MANAGEMENT

The Hawkesbury Nepean catchment covers an area of 22 000 km^2 and extends from Lake George in the south, Lithgow in the west, and the McDonald River and Brisbane Water systems in the north. The catchment is divided into two sections, with the upper catchment being the area above the water storage dams of Warragamba, Cataract, Cordeaux, Nepean and Avon and the lower catchment being the area below these dams (DLWC 2003).

The Hawkesbury Lower Nepean River catchment covers 12 000 km2 and extends from Picton in the south, Broken Bay and Pittwater in the east, Rylstone in the north-west and almost to Singleton in the north (DLWC 2003). The lower catchment has significant indigenous and European heritage. Today approximately 800 000 people live in the lower catchment, the majority of who live in the greater Sydney urban area (DLWC 2003). The lower catchment topography varies from the rugged sandstone terrain mainly in the north and west, to undulating Cumberland Plain in the south and has a wide variety of natural landscapes. Much of this area is bushland in the sandstone areas however the catchment also contains most of the urban development of western, north-western and south-western Sydney (DLWC 2003).

There are a variety of land uses within the lower catchment including major urban centres and extensive areas used for agricultural and rural purposes. Additional activities in the whole Hawkesbury Nepean catchment which may affect the water quality and hydrological patterns include coal mining, power generation, water supply (dams and weirs), and sand and gravel extraction (DLWC 2001, 2003). The key issues for the Hawkesbury Lower Nepean catchment relates to three key areas: river health, biodiversity and land use. Issues relating to river health include the management of sewage, river flows, groundwater and stormwater in new and existing urban and rural developments. Issues relating to biodiversity include the conservation and rehabilitation of native aquatic and terrestrial species, the controlling of pest species, and community participation in catchment health. Issues relating

to land use include sustainable development, the environmental impacts of urban and rural development, and the management of natural and cultural heritage (DLWC 2003). The Hawkesbury Lower Nepean Catchment Blueprint (DLWC 2001) has developed and prioritised targets and management actions to address these key issues over the life of the blueprint (10 years).

The Hawkesbury Nepean catchment has been divided into 33 sub-catchments and the Park falls within the South Creek sub-catchment. South Creek sub-catchment is approximately 620 km^2 in size and over 60% of the catchment area is upstream of the St Marys Property (Kinhill 1995b). The main tributaries that drain South / Wianamatta Creek sub-catchment are Kemps, Eastern, Ropes and Rileys Creeks. South / Wianamatta Creek itself is a major tributary of the Hawkesbury River that significantly influences the water quality of the Hawkesbury River downstream of Windsor.

Two major watercourses, South and Ropes Creek, cross the Park in a south-north direction. Immediately north of the Park, Ropes Creek joins South/Wianamatta Creek which then continues to flow north for a further 15 km until it joins the Hawkesbury River at Windsor. The Regional Park is subject to flooding from a number of sources. The site is mainly susceptible to backwater flooding from the Hawkesbury-Nepean River system however localised flooding during heavy rainfall can also have an impact on the site (Kinhill 1995b). Parts of the Park are within the 1:100 year floodplain of South/Wianamatta Creek and Ropes Creek and below the probable maximum flood (PMF) level (Kinhill 1995b). A number of smaller watercourses feed into the Park (and the floodplain) from the surrounding suburbs to the north, west and south of the Park (Kinhill 1995a). Ropes Creek has been modified to flow through a concrete channel within the Park. This re-routing runs parallel with the original creek channel and was built to limit flooding on the site (Kinhill 1995a). Groundwater at the St Marys Property is fed by rainfall onto the surrounding catchment. Water quality analysis indicates that the groundwater is brackish to saline (Kinhill 1995b).

South Creek sub-catchment includes major areas of urban development and rural activities (DLWC 2001). The sub-catchment has a number of varying land uses including rural, grazing, market gardens and other intensive agricultural industries, urban and industrial areas. Very little native vegetation remains in the sub-catchment as a proportion of the total area. However, some of the remnant blocks are significant including Castlereagh Nature Reserve, Windsor Downs NR, Kemps Creek NR and the Wianamatta Regional Park. Other infrastructure affect the sub-catchment is the presence of waste management facilities at Eastern Creek and Marsden Park and the presence of Sewage Treatment Plants (STP) which discharge tertiary treated effluent into South and Eastern Creeks (DLWC 2001), including the St Marys STP adjoining the Regional Park.

A corridor of urban development follows the Great Western Highway midway across the catchment including the suburbs of Kingswood, St Marys, Mt Druitt, Rooty Hill, Doonside and Quakers Hill. The St Marys Sewage Treatment Plant (STP) services this corridor (Kinhill 1995b). A small watercourse carries treated effluent from the back of the St Marys STP and joins up with South / Wianamatta Creek inside the Regional Park (Kinhill 1995a). The St Marys STP currently services the St Marys Property. Water quality in the South / Wianamatta Creek sub-catchment is generally of very poor quality due to run-off from urban and agricultural areas, point source inputs and discharges from STPs. During wet weather, concentrations of phosphorus, suspended material and faecal bacteria increase. Levels of nitrogen decrease at sites downstream of STPs but increase at urban and rural sites not affected by STP effluent (DLWC 2001). The water within the South / Wianamatta Creek sub-catchment does not comply with the environmental values and the water quality indicators used to assess the health of the catchment (DLWC 2001) and regularly exceeds the standard in the Australian and New Zealand Environment and Conservation Council guidelines for fresh and marine waters (Kinhill 1995b). The water cycle of the catchment has

been affected by the urbanisation of the catchment, the building of Warragamba Dam and discharge from STPs. The average dry weather flow from the St Marys STP now represents a baseflow in South / Wianamatta Creek downstream of the STP (Kinhill 1995b), that is, the majority of water in South / Wianamatta Creek during dry weather is supplied by the STP.

The Catchment Management Authorities Act 2003 provides a framework for taking action to achieve cleaner water, less soil erosion, improved vegetation cover, the maintenance of ecological processes and a balanced and healthier environment. It also provides a focus to balance conservation needs and development pressures and encourages a more aware and involved community. An important means of achieving these aims is the formation and support of Catchment Management Authorities (CMA). The CMAs will engage regional communities in the key natural resource management issues facing their catchment. The Park is within the area of the Hawkesbury-Nepean Catchment Management Authority. The involvement of NPWS reserve managers with the Hawkesbury-Nepean CMA will be an important means of achieving identified catchment management aims.

The Hawkesbury – Nepean Replacement Flows Project is an initiative by Sydney Water to save drinking water from Warragamba Dam (approximately 18 million litres of water a year) by replacing this water that's released into the river to maintain the natural ecosystem and maintain sufficient flows for water users with highly treated water. Sewerage Treatment Plants for St Marys and Quakers Hill will continue to release highly treated wastewater into South and Eastern Creek to maintain flows. As part of this project a pipeline linking the various treatment plants was installed and part of this runs along the southern boundary of the Park. The project is expected to be operational later in 2010.

Future management of the Park may need to identify and implement policies, programs and procedures to ensure that the quality of the water entering the Park, within the Park and leaving the Park are within the limits necessary to maintain natural catchment processes, biodiversity and visitor safety. Urban runoff and agricultural activities within the sub-catchment have a major influence on the water quality within the Regional Park. Identifying the impacts and minimising the damage to the Park from upstream activities will be important to improving the health of the catchment. Within the Regional Park, the development of strategies to manage sewage, groundwater, soil erosion, and stream and floodplain issues will help improve the health of the catchment within the Park as well as downstream. The Department will continue to develop its understanding of the key issues upstream and within the Park. This will enable the Department to take action to redress, improve or prevent any catchment problems leaving the Park and affecting the catchment downstream. Catchment management decisions in the Park will apply the precautionary principle approach and will endeavour not to contribute to any decline in the health of the catchment.

The management of stormwater and drainage is complicated by the existence of a large stormwater drainage network within the Park which formerly carried run-off from paved surfaces and buildings, many of which no longer exist. In some areas natural drainage patterns have been disrupted or even destroyed by man-made features. Where natural drainage is significantly altered, or no longer exists, it may be necessary to re-instate and maintain parts of the stormwater drainage system.

The potential for impacts within the Park also exists with the risk of the failure of existing utility infrastructure, such as sewerage mains. Utility infrastructure failures have occurred in other Parks in western Sydney and have resulted in major impacts on the health of the catchment within these parks. Any future management of the Wianamatta Regional Park may need to identify and implement policies, programs and procedures to ensure that response and mitigation measures are in place in the event of infrastructure failure.

Water and drainage infrastructure traversing through the Park will be confined to established easements, agreed to prior to transfer of the Regional Park land to the Department, with the exception of those drainage basins identified in the structure plan of SREP 30 and excluded from the Park. The design, location and management of these basins (by an external agency) will have the least possible impact on the Park, consistent with the requirements of, the SREP 30, the EPS and the St Marys Development Agreement. There will be no formed trunk drainage channels on land zoned for the Regional Park as stated under the EPS.

ISSUES

- There is a need to identify and monitor future impacts from development in the catchment.
- The Park has an important role in the management of the catchment values of South/ Wianamatta Creek, due to its position near the confluence with Ropes Creek and the presence of a naturally vegetated floodplain.
- There is a limited understanding of the impacts of existing and future development on the hydrology of the Park.
- The quality and quantity of the water entering the Park, within the Park and leaving the Park are not always within the limits necessary to maintain natural catchment processes, biodiversity and visitor safety.
- There is limited understanding and knowledge of the existing infrastructure and its effects on the Park's catchment values.
- There is a need for emergency response preparedness for incidents involving utility infrastructure failure and prevention of possible impacts on the catchment.

DESIRED OUTCOMES

- The Park's catchment values and the water quality and health of streams and waterbodies within the Park are maintained.
- The management of the Park does not cause any degradation of the downstream catchment.
- Potential catchment management impacts caused by upstream activities are minimised.
- Park facilities and infrastructure will utilise environmentally sustainable development principles and practices where possible.

STRATEGIES

5.2.1 Design and undertake all works in a manner that minimises water pollution and is consistent with water management regulations and polices.

5.2.2 Liaise with local government and other authorities as needed to maintain the water quality of the Park's catchments.

5.2.3 Liaise with the Hawkesbury-Nepean Catchment Management Authority to ensure that park management is integrated with the catchment management of South / Wianamatta Creek Catchment.

5.2.4 Investigate and incorporate where appropriate practices to improve the catchment values of the Park.

5.2.5 Investigate and map existing and disused utility and drainage infrastructure to assist in the mitigation of adverse impacts on catchment values.

5.2.6 Use Water Sensitive Urban Design strategies, where appropriate, for recreation and interpretative facilities located in the Park.

5.2.7 Encourage the monitoring of the water courses and aquatic ecosystem health within the Park over a long-term period.

5.2.8 Take catchment management values into account in soil management strategies, as outlined in Section 5.1.

5.3 INTRODUCED SPECIES

The long history of clearing and agricultural activities on the St Marys Property and adjacent areas prior to the establishment of the munitions factory on the site was established in previous chapters. As a consequence of past land use activities and the on-going influences of disturbance on the natural environment, the Regional Park contains a number of introduced species which present a major challenge to the future management of this area.

The NPWS *Sydney Region Pest Management Strategy* (2008-2011) establishes the strategic direction for pest management activities within the NPWS Sydney Region.

The aims of this strategy are to:

- Maximise the effectiveness of pest control programs.
- Identify the major pest populations within the Region.
- Establish criteria for prioritising control programs.

The strategy also provides a brief summary of control programs to be undertaken in the Region. The major objective of NPWS pest control programs is to conserve biodiversity and cultural heritage. Programs aim to:

- Increase community understanding of adverse impacts of pests on biodiversity and Aboriginal and historic cultural heritage.
- Manage pest populations to minimise their movement into and out of NPWS estate where they may impact on agricultural production.
- Satisfy legislative responsibilities e.g. *Threatened Species Conservation Act 1995*, *National Parks and Wildlife Act 1974*, *Rural Lands Protection Act 1998* and *Noxious Weed Act 1993.*
- Support cooperative approaches to pest species management with other agencies and the community.
- Foster community support.

The Plan of Management for the Regional Park is consistent with the Sydney Region Pest Management Strategy (NPWS 2008).

5.3.1 Introduced plants

Introduced plant species are those species that are not native to an area. Introduced plant species in the Park can have impacts on the conservation of local native species and plant communities, on recreational values and on neighbouring properties. There are 13 major introduced plant species that have been identified in the Park (Table 5, ERM 2003a). This list is not comprehensive and it is likely that more introduced species occur in the Park than have yet been recorded.

It is also important to note that there are a number of plantings of exotic species in the Park which have been identified by preliminary investigations as potentially having significant cultural heritage values. These are plantings around a number of the European heritage sites including the site of the Dunheved Homestead. These include plantings of Osage Orange trees (*Maclura pomifera*), Hoop Pine (*Araucaria cunninghamiana*), Bunya Pine (*Araucaria bidwillii*), Stone Pine, Camphor Laurels (*Cinnamomum camphora*), an English Oak tree (*Quercus sp*.) and scrambler roses (*Rosa sp.*).

Table 5. The significant introduced plant species occurring in the Park.

Species	Location *	Potential Impact †	Noxious Weed ‡	WONS§
African Boxthorn *Lycium ferocissimum*	Occurs as scattered individuals within the Park	Invades disturbed land and produces thickets, which provides habitat for feral animals.	4	-
African Lovegrass *Eragrostis curvula*	Occurs on the edges of roads and tracks throughout the Park.	Is an aggressive species capable of dominating the ground cover. Infestations are more common alongside roads and walking tracks.	4	-
African Olive *Olea europaea* subsp. *cuspidata*	Clumps occur along creeklines, with one patch of an estimated 100-1000 plants/hectare in an area east of Ropes Creek.	Infestations shade and crowd out ground-flora and over-storey plants, forming dense thickets over time which prevents virtually all regeneration of native species. Plants produce thousands of seeds, which are consumed and spread by foxes and birds. The thickets also provide shelter for foxes and rabbits and may encourage Bell-miner dieback. Infestations of African olives are a serious threat to ecological communities in western Sydney reserves.	4	-
Blackberry *Rubus fruticosa*	Clumps occur along creeklines and in areas of past disturbance. Large infestations of 100-1000 plants/ha occur along the western tributary of South / Wianamatta Creek.	Invades disturbed areas with potential to move into bushland. Provides habitat for rabbits and foxes.	4	•
Bridal Creeper *Asparagus asparagoides*	Large infestations occur along most creeklines.	It is a highly invasive species forming dense curtains capable of eliminating all indigenous ground-flora and smaller trees and preventing over-storey regeneration. It is a prolific seeder with seed viability close to 90%. Plants commonly grow amongst the roots of indigenous plants making physical removal problematic. Seeds are dispersed by birds.	5	•
Lantana *Lantana camara*	Large infestations occur along most creeklines.	Plants physically crowd or shade out indigenous vegetation and prevent most regeneration occurring. They also alter soil chemistry and nutrient cycles. Provides cover for rabbits, introduced birds and foxes.	5	•
Mother of Millions *Bryophyllum delagoense*	Small patch occurs on the boundary of the Park and the Eastern Precinct, north of Ropes Creek	Species is able to vegetatively reproduce daughter plants from the edges of its leaves. These plantlet-producing buds drop readily and take root. Forms colonies from the plantlets along roadsides, fence lines and in areas of past disturbance. They can survive long periods of drought.	3	-

Noogoora Burr *Xanthium spp.*	A large population (100-1000 plants/ha) occurs along the top boundary in the western section of the Park.	Minimal impact to native vegetation. Widespread along watercourse and floodplains after late spring or summer rain.	4	-
Pampas Grass *Cortaderia spp.*	Scattered individuals occur east of Ropes Creek and isolated occurrence on the boundary of South/Wianamatta Creek and the Golf course.	Pampas grasses are aggressive invaders of disturbed open sites. They form dense stands that exclude most other ground flora and seriously impede over-storey recruitment and are prolific seeders.	4	-
Prickly Pear *Opuntia spp.*	Scattered individuals and a large population (100 – 1000 plants/ha) occurs in the central section of the Park.	Scattered prickly pears probably only have a minor impact on native vegetation communities, but large stands can hinder the growth and regeneration of indigenous plants. The fine bristles and spines of prickly pears pose a public safety risk, and may also hinder the movement of native animals.	4	-
Privet – Broad leaf *Ligustrum lucidium*	Large infestations occur along most creeklines.	Privets are highly invasive in moist habitats. Dense thickets totally exclude virtually every indigenous plant and prevent regeneration occurring. Privets also produce thousands of seeds that are dispersed by birds and water. Mass fruiting also helps sustain pest exotic bird species in urban bushland.		-
Privet – Small leaf *Ligustrum sinense*	Large infestations occur along most creeklines.	As above	4	-
Willow *Salix spp.*	One occurrence on the boundary of South / Wianamatta Creek and the Golf course.	Willows cause modification of stream morphology, hydrology and stability, alterations to ecological processes in streams including energy fluxes and nutrient cycling, alterations in water temperature and quality, and destruction of in-stream and streambank indigenous vegetation communities. Willows compete vigorously for space, water and nutrients eliminating virtually all native vegetation within an infestation.	5	•

* Information has been taken from ERM (2003a).
† NPWS (2004)
‡ See Definitions section
ß Weeds of National Significance

The *Noxious Weeds Act 1993* places an obligation upon public authorities to control noxious weeds on land that they occupy to the extent necessary to prevent such weeds spreading to adjoining lands.

Infection of native plants by *Phytophthora cinnamomi* is a key threatening process listed under the TSC Act. Plant infection may result in death and the reduction of habitat complexity. *Phytophthora cinnamomi* is a soil borne pathogen that spreads through the movement of spores. Spread of the disease may occur due to mycelial growth from infected roots to roots of healthy plants, and through transport of spores by vehicles, animals and bushwalkers. The Commonwealth Government has prepared a Threat Abatement Plan and consideration will be given to applying the principles of this to the Regional Park.

5.3.2 Introduced animals

Introduced animals are species that are not native to an area and include feral, domestic and native species. Introduced animals can have a detrimental impact upon the natural values of the Park by disturbing native vegetation, increasing soil erosion and through competition and predation of native species. The *Rural Lands Protection Act 1998* (RLP Act) sets out conditions where by animals can become declared pests and provides for the control of such pest species. The RLP Act binds the Crown for the control of pest animals declared under the Act. Land managers are required to eradicate (continuously suppress and destroy) pest animals.

Introduced animals observed in the Park include Foxes (*Vulpes vulpes*), Rabbits (*Orcyctolagus cuniculus*), Hares (*Lepus capensis*), Dogs (*Canis familiaris*), Cats (*Felis catus*), Black Rats (*Rattus rattus*), House Mice (*Mus musculus*), Indian Mynas (*Acridotheres tristis*), Common Blackbirds (*Turdus merula*), Common Starlings (*Sturnus vulgaris*), European Goldfinch (*Carduelis carduelis*), Feral Pigeons (*Columba livia*), House Sparrow (*Passer domesticus*), Red-whiskered Bulbul (*Pycnonotus jocosus*), Spotted Turtle-Dove (*Streptopelia chinensis*) and Plague Minnow (*Gambusia holbrooki*) (Kinhill 1995, ERM 2003b). The Park also supports populations of native species that are not indigenous to this area. These include Red Kangaroos (*Macropus rufus*), Eastern Grey Kangaroos (*Macropus rufus*), Eastern Ringneck Parrot (*Barnardius barnardi*) and possibly the Emu (*Dromaius novaehollandiae*) population (Kinhill 1995). Foxes, cats, dogs and rats are likely to have the most impact on native fauna in terms of predation of animals and the spread of disease and dispersal of weed species.

Competition and grazing by the feral European rabbit is a key threatening process listed under the TSC Act. Rabbit and hares may affect the regeneration of native vegetation by grazing on seedlings and young plants, competing with native fauna for habitat, modifying habitat and making it unsuitable for other species, and dispersing weeds species (NPWS 2008). Predation by foxes is listed as a key threatening process under the TSC Act. NPWS has prepared a Threat Abatement Plan that aims to reduce the impacts of the red foxes on threatened species and help conserve biodiversity within the State (NPWS 2001). A strategic baiting program is established within Sydney Region using 1080 baits (NPWS 2008) and in the future this will be extended to the Regional Park.

Predation by Plague Minnow (*Mosquito Fish*) is listed as a key threatening process under the TSC Act. The Plague Minnow is likely to occur within most drainages with the Park (ERM 2003b). This species is considered to be a contributing factor in the decline of native freshwater species such as fishes, macro-invertebrates and frog species. NPWS has prepared a Threat Abatement Plan for this species as it is believed to be a serious threat to the survival of threatened species such as the Green and Golden Bell Frog (*Litoria aurea*) and other freshwater native fauna species (NPWS 2003). Predation by feral cats is listed as a key threatening process under the TSC Act. In some areas it is difficult to determine whether animals are truly feral or are domestic animals utilising areas on an occasional

basis. Within the St Marys Property there are stray cats and potentially domestic cats that visit the property from surrounding urban areas (ERM 2003b).

The presence of domestic dogs (leashed or unleashed) is not compatible within those areas of the Park where large numbers of kangaroos occur due to the risk of disturbance or harassment or attacks on the native animals. Dogs can also prey on smaller native animals and their scent can disrupt breeding and feeding by native animals. There will be ample opportunity for dog walking and exercising in the open space adjoining the Park.

As discussed in Chapter 4, the Park is an area of significant habitat for native fauna and flora species. As the surrounding area becomes more developed the Park will be more isolated, becoming a virtual island of habitat surrounded by development. This is likely to result in extra pressure from introduced animals which has the potential to have a critical impact on the survival of native species in the Park.

It has been suggested that one strategy to protect native fauna from introduced animals in the Park would be to construct feral-proof fencing along the Park boundary. This would have the obvious benefit of preventing any impacts from cats, foxes or dogs, provided that all existing feral animals within the fenced areas are removed. This strategy however needs careful consideration as such fencing may also have negative impacts on some native species by preventing their movement within and between habitats. Since the Park is effectively 5 separate blocks of land, it would further divide the native fauna populations within the Park, and potentially block the movement of fauna through the Park, especially along the South and Ropes Creek corridors. This would not only risk isolating these fauna within the Park into populations of insufficient size to be viable in the long-term, but it would also prevent recolonisation after fire, flood and drought. It may be possible to convert the macrofauna fencing required as part of the implementation of the MFMP (Cumberland Ecology 2004) into feral-proof fencing however before that decision can be made the Department needs to determine:

- The level of threat to native fauna species from introduced animals.
- The level of threat to native species from the presence of feral-proof fencing.
- The relative merits of different methods of preventing impacts from introduced animals, including feral-proof fencing.

Detailed pest and native fauna surveys within the Park and along Ropes and South / Wianamatta Creek corridors, in conjunction with a detailed analysis of the fencing impact, will help to determine whether feral-proof fencing is an appropriate management strategy in the Park.

ISSUES

- The need to identify and monitor any invasion of the Park by new introduced species from outside the Park such as perennial grasses, aquatic species and pathogens.
- The exclusion of dogs and cats from the Park will be a major management issue and a community education program should target this issue.
- There are introduced plant species in the Park that may have cultural heritage values, but may also pose a risk for weed invasion.
- The need to determine the impact of introduced animals within the Park, and the appropriateness of different methods of preventing this impact, including feral-proof fencing of the Park.
- The need to ensure that actions to control introduced species do not have an adverse impact on native species.

DESIRED OUTCOMES

- The impact of introduced species on native plants and animals is minimised.
- Monitoring of new introduced species in the Park results in eradication before they establish.
- Increasing neighbour and community awareness about the impacts of introduced animals and plants on the Park's natural values, and about the desirability of sympathetic management in areas adjoining the Park.
- Introduced species of cultural significance are managed to have no impact on environmental values of Park.
- There is no establishment of *Phytophthora cinnamoni* within the Regional Park.

STRATEGIES

5.3.1 Give priority for the control of introduced species to those species where:
- They are declared noxious or are known to be an important problem in other parks or states or for which a national emergency control program has been declared.
- They have a significant environmental impact, including damage to threatened species, catchment values and recreation values.
- They may affect neighbouring lands or are considered to be of high priority by the community.
- They may invade from neighbouring lands or are considered to be of high priority by the community.
- Management is needed to maintain benefits gained from previous control programs or to allow another high priority management program to be effective, or
- A window of opportunity occurs where the chances of control or eradication are improved.

5.3.2 Avoid unnecessary environmental disturbances. Where disturbance is inevitable or is planned, consider the likely impact of the activity in terms of both introduced and native species and put in place controls or programs to reduce any such impact.

5.3.3 Cooperate with neighbours in implementing weed and pest animal control programs. Undertake control in cooperation with the Cumberland Livestock Health and Pest Authority and Hawkesbury River County Council.

5.3.4 Investigate the relative prevalence and impact of introduced animals within the park through analysis of fauna surveys, now and in the future.

5.3.5 Prepare, implement and review annually a Pest Species Management Strategy to minimise or prevent the impact of introduced animals on native species, with consideration of the appropriateness and impacts of different control methods including the use of feral-proof fencing on the Park's boundary.

5.3.6 Include soil management and hygiene protocols in pest management strategies.

5.3.7 Develop and implement an education program for neighbouring communities on the potential impact of exotic species.

5.3.8 Implement weed management strategies/actions from the Bush Regeneration Plan (Section 4.2).

5.3.9 Replant selected cleared areas to reduce opportunities for invasion by introduced plant species.

5.3.10 Encourage Bushcare groups to work in the Regional Park.

5.3.11 Design and implement weed and anti-Phytophthora hygiene protocols, and monitor the Park to detect any outbreaks.

5.3.12 Review the current location of fences and ensure that the fences that are required for park management purposes are retained.

5.4 FIRE MANAGEMENT

Fire is a natural feature of the environment and is essential to the survival of some plant and animal communities. However, inappropriate fire can damage natural and cultural heritage and endanger park visitors and neighbours. The management of bushfire in the Park is a complex issue, particularly due to the NPWS's dual role of achieving both long-term conservation of native plant and animal communities and ongoing protection of life and property within and adjacent to the Park. The primary fire management objectives of the Department (from NPWS 2010) are to:

- Protect life, property and community assets from the adverse impacts of fire.
- Develop and implement cooperative and coordinated fire management arrangements with other fire authorities, reserve neighbours and the community.
- Manage fire regimes within reserves to maintain and enhance biodiversity.
- Protect Aboriginal sites and places, historic places and culturally significant features known to exist within NSW from damage by fire.
- Assist other fire agencies, land management authorities and landholders in developing fire management practices to conserve biodiversity and cultural heritage across the landscape.

Ecological requirements

Bushfire regimes are a major determinant of the distribution and abundance of plants and animals in the Park. They also affect nutrient cycles, erosion patterns and hydrological regimes. Ecological research suggests the following requirements for biodiversity conservation:

- Variability of fire intervals and area burnt is important to conserve floristic diversity and provide diversity of habitat for animals; fire at regular intervals will lead to loss of species.
- Most plant species and communities require infrequent fires of moderate to high intensity to achieve regeneration but patchy burns are better for fauna as they retain shelter and food refuges.
- Fires during the breeding season are the most damaging to fauna communities because of direct killing of young and increased exposure.
- A fire frequency of between 5 and 30 years is generally appropriate for the Park's vegetation communities; species decline is predicted if successive fires occur less than 5 years apart or there are no fires for more than 30 years.

Natural heritage

Fire management and biodiversity conservation in fragmented landscapes need to consider using a number of management tools, not just fire (Hobbs 2001, Keith et al. 2001). Issues to consider include weed invasion, the lack of regeneration of native plant species, and the lack of suitable habitat such as logs and litter for animals. It is also important to consider past disturbance regimes in the context of current and future management. Recent research has shown that fire is important for the regeneration of native flora species within remnants of Cumberland Plain Woodland (Thomas 1994, Wood 2001, Hill & French 2003, 2004). Fire is also likely to aid in the regeneration of species within the Alluvial Woodland, Cooks/River Castlereagh Ironbark Forest, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest communities found in the Park. Fire regimes and management guidelines will be developed for plant communities and the threatened plant species surveyed in the Park in a reserve fire management strategy.

In many remnants of temperate eucalypt woodlands past disturbances such as fragmentation, grazing and clearing have had a significant impact on animal species, with declines in populations and abundances seen (Lunt & Bennett 1999, Sivertsen & Clarke 1999). Habitat fragmentation and loss of habitat is the biggest threat to native animals in

Sydney. The impacts of fire on animal species have been poorly examined, with many studies lacking the scientific rigour to be useful in developing predictive models and management guidelines (Woinarski 1997, Whelan et al. 2001). It is believed that the effect of prescribed burning on animal species is probably not benign, as the impacts caused by fire may change vegetation structure and floristic composition. Post-fire recovery of animal populations is dependent on the reproductive strategies of individual species (e.g. mammals) and the need for food, shelter and foraging patterns (e.g. reptiles and amphibians) (Whelan et al. 2001). Guidelines will be developed in a reserve fire management strategy, for the management of threatened animals based on their requirements for habitat, shelter and food.

Fire may enhance weed invasion and change the fuel distribution in temperate eucalypt woodlands. This may have an impact on the frequency and intensity of subsequent fires and weeds may compete with native species and prevent the regeneration of these species (Hobbs 2001). Recent work has shown that the litter from African Olive and Privet are deeper and larger in mass than the litter of native species in Cumberland Plain Woodland (Cooke 2001). This supports the idea that weed invasion will change the fuel characteristics of an area and has implications for prescribed burning where fire may be more intense and seed germination from the soil-stored seedbank could be limited.

Burning areas as a sole method to control weed species may not be a useful strategy, as many weeds are known to increase in richness and abundance following fire in roadside areas (Milberg & Lamont 1995). Adopting combined strategies such as the use of slashing, herbicides and fire may be more useful (Davies 1998). For example, burning in summer with post-fire herbicide control has been shown to control the regrowth of *Paspalum dilatatum* (Johnson 1999). The use of fire in a landscape which is fragmented and invaded by weed species needs to ensure that post-fire strategies are developed for the effective control and eradication of these species. Over time, fires of varying size, frequency, intensity and season of burn will ensure that changes in species composition and vegetation structure avoid local extinctions of native plant and animal species, threatened communities and populations.

Fire vehicles in particular have the potential to introduce weed propagules and soil pathogens. It will be important to manage vehicle cleanliness to minimise the chances of this occurring, and monitor burnt areas in the post-burn period to detect any new introductions.

Cultural heritage

Fire can also damage some types of Aboriginal sites and historic places. Features such as scarred trees, old buildings and farming implements can be permanently damaged or lost from wildfire. Other sites can be damaged by use of heavy machinery for fire suppression activities. Fire management guidelines will be developed for all known cultural heritage sites in the Park in a reserve fire management strategy.

Fire history

Fire records for the St Marys Property indicate that most of the unplanned fires during the period 2000 – 2003 were suspected arson attacks originating along the roads, creeks and other tracks. These were mostly fires contained to a small area. Prior to 2000, fire management on the site has consisted of a regime of hazard reduction burning on some parts of the site on an annual basis by the previous owners (ADI Ltd) and in conjunction with RFS (ERM 2002, Graham Duncan pers. comm.). There have been no hazard reduction burns carried out on the St Marys Property since 1998, instead mowing and slashing has been used to reduce fuels on the site.

Strategies and cooperative arrangements

Under the *Rural Fires Act 1997* the National Parks and Wildlife Service is a designated fire authority and as a public authority is responsible for controlling fires on managed land and ensuring that they do not cause damage to other land or property. An important part of the Service's fire management is participation in local co-operative fire management arrangements, including implementation of Bush Fire Risk Management Plans developed by District Bush Fire Management Committees. The Department is a member of the Cumberland Zone Bush Fire Management Committee, which covers the St Marys Property.

A fire management plan has been prepared by ERM (2002) for the whole of the St Marys Property. This plan identifies assets and infrastructure and natural and cultural heritage sites that require protection from fire. The plan also outlines the strategies used to prevent and fight fire on the St Marys Property. Following the gazettal of the Park, this fire management plan will be reviewed and updated for the Regional Park sections of the St Marys Property, to the standard of a NPWS reserve fire management strategy. In general, most assets on the St Marys Property will be in the development areas. Fire protection for those development precincts will be provided for in the precinct areas themselves. Fire protection in the reserve fire management strategy will be for the Park assets. Fire management objectives will concentrate on good ecological management of fire in relation to threatened species, endangered ecological communities and weed management.

Management of fire will aim to maintain biodiversity by restricting fires to only a part of the distribution of a vegetation community at any one time and ensuring that the fire regime thresholds are not exceeded. A range of fire management strategies will be developed including fuel reduction, fire trails, detection and cooperative arrangements. Some, or at times, all of these will be applied where appropriate to best protect life, property and natural and cultural assets. Close to boundary areas, fuel reduction programs and fire trail maintenance will be designed and implemented in cooperation with neighbours.

ISSUES

- The protection of life and property on or adjacent to the Park.
- Variable fire intensities and frequencies are desirable for all plant and animal communities in the Park, within the context of an urban environment.
- The rate of fuel accumulation in different plant communities and the role of grazing as an alternative to burning for fuel reduction are not well studied.
- The lack of detailed fire records, including incidents of arson and other fire activities in the Park.
- The interaction between fire and the potential increase of introduced plant species in the Park needs more investigation.
- Macrofauna densities will influence the intensity of post-fire grazing and will also be subject to impacts by fire. Both issues need to be considered during fire management operations.
- The need to prepare the Fire Management Strategy for this Park.

DESIRED OUTCOMES

- Reserve fire management planning for the Park must ensure the protection of life and property on or adjacent to the Park.
- Fire regimes are appropriate for long-term maintenance of the Park's plant and animal communities.
- The occurrence of unplanned bushfires and the spread of bushfires on, from, or into the Park are minimised.

- Aboriginal sites, historic places and culturally significant features are protected from damage by bushfires.
- Fire is managed to enhance spatial variability and to ensure species always have habitat available within the Park.
- Fire is managed to maintain a range of structural types within the vegetation (eg some high *Bursaria spinosa* density/cover patches, some low *Bursaria spinosa* cover/density)
- Fire management is used to decrease, rather than increase the occurrence of introduced plant species in the Park.

STRATEGIES

5.4.1 Carry out appropriate fuel management for the protection of the Park and community, in accordance with the District Bushfire Risk Management Plan.
5.4.2 Prepare a Fire Management Strategy which integrates fire management activities with weed management.
5.4.3 Identify, assess, map and maintain, where appropriate, a fire trail network and water sources in the Park.
5.4.4 Undertake fuel reduction programs, trail maintenance, research and monitoring programs in accordance with the policies outlined above and the Fire Management Strategy.
5.4.5 Use prescribed fire to achieve a variety of fire regimes that maintain fire thresholds for each vegetation community in accordance with a Fire Management Strategy.
5.4.6 Avoid the use of heavy machinery for fire suppression in areas of rare plants, Aboriginal sites and historic places.
5.4.7 Implement vehicle hygiene measures, as per action 5.3.11, and implement close monitoring of burnt areas after fires to detect any introduction of weeds or pathogens.
5.4.8 Rehabilitate areas disturbed by fire and fire suppression operations as soon as practical after the fire.
5.4.9 Encourage research into the ecological effects of fire in the park, particularly the fire response of significant plant species and the fire requirements of plant communities;
5.4.10 Ensure fire management is linked to vegetation structure.
5.4.11 Continue to actively participate in the Cumberland Zone Bush Fire Management Committee. Maintain close contact and cooperation with Council fire officers and volunteer bush fire brigades.
5.4.12 Consider closing the Park to the public during periods of severe and above fire danger.
5.4.13 Maintain fire records for the Park.
5.4.14 Adopted recovery plans and the priority action statement will be considered in the Park Fire Management Strategy.
5.4.15 Liaise with other fire authorities to encourage community awareness of fire management practices and property protection.
5.4.16 Liaise with Councils, landowners and District Bush Fire Management Committee to minimise risk of unplanned fires entering the Park, especially while the St Marys Property is under development.
5.4.17 Carefully consider macrofauna issues during any fire management planning and operations.

6. VISITOR OPPORTUNITIES AND EDUCATION

6.1 INFORMATION PROVISION

Wianamatta Regional Park contains a diversity of natural and cultural heritage values and features that provides a strong foundation for visitor enjoyment, appreciation and understanding of the Park and its environment. Information provision assists the protection of natural and cultural heritage, promotes support for conservation and increases the enjoyment and satisfaction of visitors.

Features of particular interest to visitors in the Regional Park are the large extent of Cumberland Plain vegetation and habitats such as the woodlands, creeks and wetlands in the Park. Other features of interest to visitors relate to the cultural heritage in the Park, in particular the site of the Dunheved Homestead, agricultural heritage and cultural landscape features and the remaining structures of the munitions factory. It is possible that one of the remaining structures in the Park would be suitable for a visitor and/or cultural centre, should this be adjudged feasible. The Park also provides an important opportunity to see native plants, especially in relation to the varying soil types within the Park. There may also be opportunities to see native fauna, particularly macrofauna. These features will be promoted and interpreted to visitors in a manner that facilitates effective understanding and protection of these special values and encourages appropriate interaction and use.

Provision of information about the Regional Park will involve four levels:

- Promotion to increase community awareness of the existence of the Park, its conservation importance and visitor opportunities.
- Promotion of the importance of sympathetic conservation management in areas around the Park.
- Orientation and regulatory information to enable visitors to find their way around the Park, introduce them to its landscape and advise them about appropriate use.
- Interpretation of individual components of the Park's environment in order to increase visitor understanding and appreciation of the Park's values and of the environment in general, and provision of information about minimising any impact from use.

Promotion of the Park may be provided through a visitor and/or cultural centre, guided and self-guided tours, events, interpretive displays, education programs, websites and the publication of information sheets and brochures. There is currently no on-site information about the Park or directional signs. Once a Conservation Management Plan has assessed the built structures within the boundaries of the Park there may be opportunities to provide interpretative signage for these structures.

ISSUES

- Provision of interpretative signs and other resources for natural and cultural heritage interpretation will be required to raise awareness and appreciation of the Park's values.
- Park orientation signage and design will be essential in providing directions for visitors to move around and through the park.
- Consideration of the establishment of a visitor and/or cultural centre must be informed by a needs and feasibility analysis.

DESIRED OUTCOMES

- There is widespread community understanding and appreciation of the Park's natural and cultural values.
- Visitors are aware of the Park's recreational opportunities and can easily find their way to park facilities.
- The Park is a useful educational resource for local schools and community organisations.
- There is community understanding and acceptance of park management practices.
- There is community recognition of the role of the Park in the provision of recreational opportunities within the context of regional and local open space.
- There is community recognition and support for sympathetic conservation management on lands surrounding the Regional Park.

STRATEGIES

6.1.1 Produce media releases and attend meetings with neighbours and community organisations to promote community understanding and appreciation of Park values and management strategies, and the role of sympathetic conservation in surrounding areas in ensuring the Park's long-term sustainability.

6.1.2 Emphasise the following themes in promotion and interpretation programs:
- Natural heritage, including an understanding of ecological processes;
- Cultural heritage
- Catchment function
- Conservation in western Sydney
- Pest species management
- Fire management in an urban setting
- Macrofauna management in an urban setting
- Recreational opportunities in the Park
- Recreational context and role of the Park
- Illegal and inappropriate activities.

6.1.3 Prepare and distribute a park brochure to tourist information centres, NPWS visitor centres and other appropriate locations, and update the brochure as needed.

6.1.4 Ensure that the Park is included, and its features highlighted within regional reserve information.

6.1.5 Update the NPWS website to include park information and events as required.

6.1.6 Provide appropriate directional, interpretive and regulatory signage integrated with Park visitor facilities and access points.

6.1.7 Involve the Aboriginal community in the development of material and programs for interpretation, particularly concerning Aboriginal culture.

6.1.8 Encourage and assist educational use of the Park by schools, community groups, individuals and commercial operators.

6.1.9 Liaise with other providers of recreation opportunities and public open space with the aim of providing park visitors with a comprehensive overview of the recreation options in the region.

6.1.10 Undertake a needs and feasibility analysis to inform the possible establishment of a visitor and/or cultural centre.

6.1.1 Actively include and promote the Park in education and Discovery programs provided by NPWS and allied agencies in western Sydney, including the provision of guided tours and educational activities when appropriate.

6.2 RECREATION OPPORTUNITIES

Visitor opportunities provided in NPWS reserves are generally those at the low-key end of the spectrum, in natural and undeveloped settings. Recreational uses which are ecologically sustainable and which directly contribute to the visitors' understanding and appreciation of the Park's values are considered appropriate. Management to ensure ecologically sustainable visitor use requires placing limits on the number of access points, design of facilities to ensure that numbers of visitors and the style of use is appropriate for the site, and promotion of minimal impact use.

The provisions below are designed to maintain the low key, scenic, natural settings which are the special feature of the Park and to provide for future use in a manner which protects ecological integrity and cultural heritage values. Provision for visitor use of the Park has been considered in a regional context. Public land managed by the Service and other authorities in the region include Rouse Hill Regional Park, Western Sydney Regional Park, Nurragingy Reserve, Ropes and South/Wianamatta Creek Regional Open Space Corridors, the proposed Penrith Lakes parklands, Western Sydney Parklands, Blue Mountains National Parks, Cattai National Park, Bents Basin State Recreation Area and Scheyville National Park. These parks provide opportunities for a range of activities including canoeing/kayaking, cycling, picnics, camping, horse riding, walking and fishing.

Two major studies have investigated the recreation needs in the Blacktown and Penrith Local Government Areas. The Penrith City Council study found that 77% of respondents participated in informal passive recreation (picnicking, walking and socialising with friends) and that informal recreation (passive and active) was the most popular form of recreation activity undertaken by Penrith LGA residents (Urbis Keys Young 2002). The Blacktown City Council study found that 89.3% of respondents thought it was important that passive recreation opportunities are provided for in their area. The major types of informal recreation included walking (60.4 % of surveyed respondents), swimming (29%), picnicking (28%), bike riding (24%), walking a dog (22.9%), bushwalking (8.4%), and jogging/running (4.8%).

Respondents in both the Blacktown and the Penrith studies thought experiencing the natural bushland was an important part of their recreational experience in their respective local government areas.

Another recent study has been investigating the Regional Open Space lands located within the St Marys Property and along both Ropes and South / Wianamatta Creek corridors to the south of the St Marys Property. The land in this study is characterised by extensive local and district reserve systems focusing on sports usage. The vision for these corridors is to form a scenic and accessible parklands system, which will be managed to balance their cultural, recreational and environmental values (Cloustons 2004). From a recreation focus these lands will provide sporting precincts and associated passive recreation facilities at regional and district levels. It is proposed that all district level sport reserves and local reserves in the corridor will be upgraded and enhanced, and transport links, paths and cycleways within and around the corridors and major reserves will be improved.

As well as the Regional Open Space opportunities, there will be a number of local open space opportunities within the St Marys Property. The local open space opportunities in the Eastern Precinct section of the St Marys Property will include 1 district level park (5-6 ha), 4 neighbourhood parks (0.7-2 ha each) and 6 local parks (0.4-1 ha each). The open space in the Eastern Precinct will provide: active sports facilities, informal turfed areas, shaded seated areas, shaded playgrounds, cycle and pedestrian paths, shaded picnic and barbecue facilities (DLL – Eastern Precinct Development Strategies 2004). Similar open space opportunities will be provided as required in the Central and Western Precincts when these areas have been developed.

Wianamatta Regional Park is unusual as a regional park in that it has relatively high significance for conservation, and limited areas that are suitable for substantial infrastructure development. Approximately 828 hectares of the Regional Park is listed on the Register of the National Estate. Reasons for its listing include the presence of rare and regionally significant plant and animal species, the presence of significant remnants of native vegetation of the Cumberland Plain, and significant examples of Aboriginal and European heritage. Other areas in the Park that are also listed on the Register of the National Estate include the archaeological sites associated with the King family (including Dunheved Homestead site, Elizabeth Farm site and the pines planted on the western bank of South / Wianamatta Creek). The listed areas will be managed to protect and enhance these listed values and therefore high impact modes of visitor access or use will not be compatible with sustainable management of these areas.

Recreation opportunities in the Wianamatta Regional Park will be concentrated at the passive end of the recreational spectrum which will include picnicking, bushwalking, running and cycling. This is appropriate in the regional context, because of the demonstrated demand for passive recreation, and the relatively limited opportunities for such recreation in a bushland setting in the local and regional environment. In addition, the current and proposed enhancements of active recreation facilities in regional and local open space will ensure that more active recreational pursuits are adequately catered for elsewhere in the area.

Access to the Park

There is currently no public usage of Wianamatta Regional Park and there has been restricted access to the whole site for at least the last 60 years. Future visitor use of the Park will include the people living in the new developments on the St Marys property, which are predicted to gradually build up to between 12000 – 14000 residents by 2015. Visitors to the Park are also likely to include other residents from the Penrith and Blacktown local government areas as well as visitors from outside the region.

Once development of the St Marys Property has been completed, Wianamatta Regional Park will be surrounded and divided by public roads. These roads will provide a number of potential opportunities for access by visitors to the Park, where appropriate. The main public access road is planned for the middle of the St Marys Property running in an East – West direction (see Figure 1). This road also splits the Regional Park though the middle in two locations. Park access points along this road should utilise existing roads and trails wherever possible to avoid new disturbances. The fence along the Park boundary, which is required to manage the macrofauna, will also restrict the location and number of access points into the Park.

There is currently a network of vehicle trails in the Park, which were developed to service different activities on the site by the previous landowners. Many of these are tarred roads in varying states of repair and their suitability for different uses such as walking and cycling needs to be assessed. All existing trails will also need to be reviewed in terms of their function, maintenance requirements and impact. Some trails within the Park will be maintained and used by NPWS for management and emergency purposes and will be unavailable for public vehicular use. Access points, wherever possible, should utilise existing roads and trails into the Regional Park, and relate to the access planning in adjoining areas. An Access Plan will be developed to identify access points along the public roads for members of the public to gain entry into the Park within the context of other constraints such as a high-density macrofauna population. In the short-term, access to areas of the Park may be constrained by the need to contain and manage macrofauna populations. The Access Plan should identify priority areas for public access for example in areas adjacent to the Regional Open Space zones and the Dunheved Homestead site.

Appropriate activities in the Park

The Park provides an excellent opportunity for the community to experience and learn about the Australian bush, and the Cumberland Plain and its endangered biodiversity in particular. A better understanding of the recreation opportunities in the Park will be developed during the planning of a Visitation Strategy which will include the Access Plan. The Access Plan will consider the opportunities for public access to the Park, and take into account threats to visitor's safety from macrofauna, management of possible residual contamination and development of adjoining residential areas.

The Regional Park is a unique area with endangered vegetation communities, rare and threatened plant and animal species and significant items of cultural heritage. The Park also plays a significant role in maintaining the catchment health of South and Ropes Creeks.

Significant constraints in the Park include the risk to public safety from a high population density of macrofauna and some areas of contamination risk. There are also many threats to the natural and cultural heritage values of the Park, including invasion by introduced species and pathogens, inappropriate fire regimes and disturbances to catchment function. Prior to gazettal the Park's values were protected by a security fence around the St Marys Property, however as the Park is opened to public access these values are at risk from unsustainable activities in the Park.

As stated throughout this Plan, the Regional Park is characterised by many significant features. The protection, promotion and enhancement of these features and values will determine the appropriate visitor opportunities in the Park. Management zones have been developed for the Park and should be used to guide visitor opportunities and management operations (Figure 5).

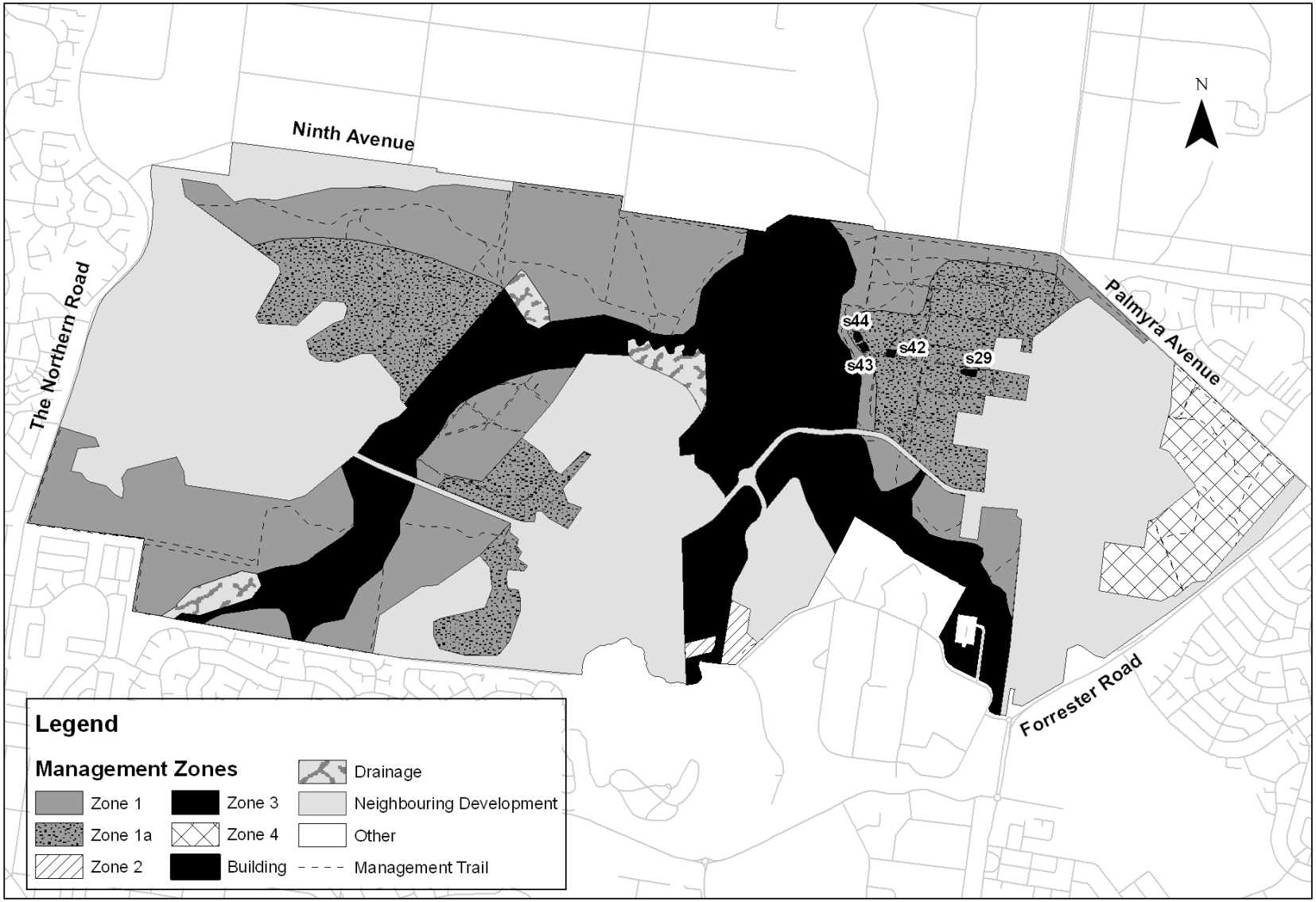


Figure 5: Management zones for the Regional Park to guide possible visitor opportunities and management operations.

The main features and management guidelines for these zones are:

- **Zone 1** – Includes the land in the Park that is listed on the Register of the National Estate for its conservation and heritage significance. It is estimated that approximately 85% of the Regional Park is vegetated with native Cumberland Plain bushland, leaving 15% as cleared areas. The cleared areas include roads, infrastructure and heritage sites. This zone contains most of the significant bushland areas in the Park. Therefore, recreation and management activities in this zone should be of a low impact nature that are sympathetic to the protection of the natural and cultural heritage values of the Park, and that promote understanding and enjoyment of these values. **Zone 1a** is the area of Zone 1 that is cleared and will be used as recreation precincts that wherever possible utilises existing trails, infrastructure and previous building footpads while still upholding the conservation requirements listed in this zone. This zone can include the adaptive reuse of buildings.

- **Zone 2** – Includes land that is listed on the Register of the National Estate in recognition of its cultural significance. In particular, this zone has been identified as significant due to its association with the family of Governor King. There may be good educational and recreation opportunities here, but this will be somewhat dependent on the outcomes of the Conservation Management Plan. Potential activities may include walking, cycling and small-scale picnic facilities.

- **Zone 3** – Includes land in the Park that has been identified as important riparian habitat. As previously stated in the Natural Heritage section of this Plan, when the Park is gazetted, the total area of the Alluvial Woodland vegetation community protected within the NPWS reserve system will more than double in size. A high priority within the Park will be the protection and enhancement of this vegetation community. Therefore, it is proposed that large sections of the creek line (which is most of this zone) should be weeded and revegetated to restore the native vegetation of this area. Recreation infrastructure will not generally be compatible in revegetated areas and within 50 metres of any creek lines.

- **Zone 4** – Limited Access area. The Site Audit Statement determined that this area was suitable for use as a regional park, under the provisions of the *Eastern Regional Park Contamination Management Plan* (URS, 2006). This Zone contains large populations of a number of threatened plant species, as well as endangered vegetation communities that are not widely distributed across the Park. There are also a number of Aboriginal sites, and deposits of stone material which are significant to the Darug people. These values have been recognised in the acceptance of the area into the Register of the National Estate. It is considered that this area is especially vulnerable to the disturbances and impacts that can arise from unlimited access, due to its small size and relative isolation from the remainder of the Park. The area will be open for advertised periods, and guided walks will be available for visitors. Movement will be restricted to existing well-marked tracks and boardwalks to ensure the protection of threatened species and heritage.

The Park will provide excellent opportunities for low-impact recreation that is sympathetic to the protection of the natural and cultural heritage of the Park, particularly walking and cycling. There will be opportunities to provide picnic and other visitor facilities in selected areas.. The Park will thus be able to meet a significant known recreation demand and complement existing and proposed recreational opportunities in the region. Access into the Regional Park, however, will continue to be restricted in the short-term due the threat to public safety from the large macrofauna population, and the need to contain and manage this population. As the macrofauna population declines over time, areas of the Park may be determined

suitable for access. However, the abundance of kangaroos in the Park and across the whole St Marys Property will dictate accessibility into the future.

Bushwalking

Bushwalking is an activity that can be enjoyed by people of varying ages and interests, with different levels of physical fitness and mobility. Visitors will be able to explore and appreciate the natural and cultural heritage within the Park. Management trails will be reviewed in terms of their function, maintenance requirements and impact including a determination of their suitability for recreation activities such as bushwalking, and the standard of access that can be provided.

Orienteering and Rogaining activities will be considered in the Park subject to prior environmental assessment and monitoring of any impacts to the Park after the event. Proposed events must be in accordance with this Plan and the NPWS policies relating to orienteering, rogaining and geocaching activities.

Picnicking

Small-scale picnic shelters and benches will be provided in appropriate areas within the Park. More detailed planning will determine the type and location of Park facilities to provide visitor enjoyment but minimise the impact of visitors on the Park's values as well as ensuring visitor safety from the macrofauna.

Due to the presence of significant plant communities and species, and the risk of fires escaping into the bush areas of the Park and potentially threatening surrounding urban areas, wood and charcoal barbecues and fires will not be permitted. Gas or similar fuel barbecues may however be provided for in any picnic areas where shelters are present.

Cycling

Cycling opportunities will be provided on management trails (i.e. those trails principally used by Department vehicles for fire and park management purposes) as indicated by signage. Management trails available for cycling will also be available for walking where appropriate and will be developed to industry standards. Periodic, occasional or permanent closure of management trails to cycling will be at the discretion of the Regional Manager. Closures may occur where:

- Trails are being rehabilitated.
- Cycling activities pose an unacceptable risk to safety of other Park visitors;
- native flora or fauna is threatened, or
- Trails are affected by severe weather conditions or events.

Cycling will not be permitted on single track 'walking' tracks unless a sign indicates otherwise. These are generally narrow tracks used principally by walkers and are not suitable for, or maintained for, the purpose of cycling. Park usage will be monitored to ensure minimal conflict between Park visitors. Opportunities for cycling are also likely to be available in surrounding urban areas as well as in the regional and local open space areas. There will be co-ordination with other open space managers to ensure that opportunities for both long-distance cycling and walking trails that traverse the Park are identified and developed where appropriate.

Commercial tourism

A commercial activity is an organised activity conducted within the Park by a business or organisation to generate income or profit. Tours and other commercial activities within the

Park may have many potential benefits. They can increase visitor opportunities to participate in nature-based activities with professional instruction in both safety and minimal impact techniques. Guided activities may also provide opportunities to interpret and promote the natural and cultural heritage of the Park. Conversely, these activities have the potential to impact on park values and the experience of other visitors where there is competition for facilities and overcrowding of sites.

Commercial activities (refer to Chapter 9) in the Park are permitted under the NPW Act and associated regulations. Commercial operators are required to have a lease or a licence with the Department, while organised non-commercial groups are required to have consent. All commercial activities must be consistent with those activities permitted within this Plan, and should increase the enjoyment and understanding of the heritage values of the Park. Licensing of commercial activities therefore has to specify limits to visitor numbers and frequency of activities, as well as considering and regulating the impacts of any proposed activity.

Inappropriate activities

There are a number of recreational activities that would be detrimental to the protection of natural and cultural heritage values in the Park and thus are considered unsustainable include horse riding, dog walking, camping, BMX and motorbike riding, skateboarding and rollerblading. Opportunities to undertake these activities exist in areas outside the Park, or in other NPWS reserves in the Region.

Camping

Camping is not considered an appropriate activity in the Park due to the lack of suitable areas and the conflicts with other uses. Developed picnic and camping facilities, including electric and wood barbecues, are provided for in other parks in the Sydney Region such as Cattai National Park and Bents Basin State Conservation Area. Less formal camping facilities are available in a number of other Parks in the Sydney area including Blue Mountains National Park and Darug National Park. It is considered that these sites provide adequate camping opportunities to meet the current demand within the local area.

Dog walking

The Park contains a significant number of native fauna species, in particular kangaroo and emu populations. The presence of dogs in the Park would create an unacceptable and unnecessary threat to native animals such as kangaroos due to the risk of disturbance, harassment or attacks on native animals. There have already been a number of incidents of macrofauna injury and death caused by dogs entering the site. Dog excrement also has the potential to spread internal parasites to native animals. There will be ample opportunities for dogs to be exercised in existing local open space in the nearby area. Therefore, all dogs, other than trained assistance animals, will be prohibited in the Park.

Horse riding

Horses and associated activities have been found to cause erosion of soils and tracks, increase soil compaction, and introduce weeds and plant species not native to the area. The Park contains significant areas of natural heritage, including endangered communities and threatened flora species. Large sections of the Park consist of fragile creek environments that can be damaged by horses. In consideration of limiting the impact of non-native animals on the values of the Park a precautionary approach has been adopted and horses will be prohibited in the Park. Opportunities for horse riding exist elsewhere in the region, including the Olympic Equestrian Centre, Scheyville National Park and Rouse Hill Regional Park.

Skateboarding, rollerblading and similar activities

Skateboarding, rollerblading and similar activities could pose a risk to other Park uses and damage to Park facilities, and are therefore prohibited in the Park. Alternative opportunities to provide for these activities will exist in local and regional open space areas.

Visitor facilities

Currently there are no facilities available to support visitor activities. For example, there are no toilets, picnic areas or information facilities in the Park. More detailed planning will be required in the form of a Master Plan to determine the appropriate type and location of Park facilities. The Master Plan will be guided by the adopted Plan of Management, as well as the information and actions arising from:

- The Conservation Management Plan (Chapter 4).
- The Bush Regeneration Plan (Chapter 4).
- The Fire Management Strategy (Chapter 5).
- The endorsed St Marys MFMP (Cumberland Ecology 2004).
- The Visitation Strategy (Chapter 6).
- The natural and cultural values of the Park, and
- with particular reference to the Register of the National Estate listing.

The Master Plan will also be consistent with the Metropolitan Plan, SREP 30, EPS and the St Marys Development Agreement.

ISSUES

- Access to the Park will need to be controlled in areas of high macrofauna density due to the risk to public safety.
- The timing of increased public access to the Park will need to consider surrounding development and the implementation of the St Marys MFMP.
- The potential for visitors to have impacts on the natural and cultural heritage of the Park will need to be minimised and balanced with the benefits of providing recreation opportunities.
- The high conservation value and potential vulnerability of the threatened species and vegetation in the eastern sector of the Regional Park requires that access be restricted to advertised periods with provision of guided walks.
- New visitor facilities and recreation opportunities will need to comply with the conditions of relevant Site Audit Statements and the Contamination Management Plan.
- A range of opportunities for recreational activities such as walking, cycling and picnicking should be provided, as well as opportunities to visit isolated areas to allow the experience of peace and quiet whilst protecting the values of the Park.
- Appropriate commercial recreation activities in the Park need to be considered.

DESIRED OUTCOMES

- A variety of informal visitor opportunities are available that encourage appreciation of the natural and cultural environment and enjoyment of the park.
- Facilities are designed and managed to provide a satisfying and informative visitor experience and minimise impacts.
- Visitor use is compatible with the management direction of the Park and is ecologically, economically and socially sustainable.
- Appropriate recreation and visitor opportunities are provided within the Park, that take into account the proximity and nature of regional and local open space.
- Future planning of recreation activities takes the regional context into account.

- A sustainable macrofauna population is retained in the Park and linked to visitor experience.
- Where appropriate, the impact of the macrofauna fencing on visitor experience is minimised.
- Opportunities exist for sustainable and appropriate commercial recreation activities.
- Construction of new facilities complies with the conditions of any relevant Site Audit Statements and the Contamination Management Plan.

STRATEGIES

6.2.1 Prepare a Master Plan for Park facilities and infrastructure with a focus on recreation opportunities in natural settings, ensuring that this Plan is consistent with the Conservation Management Plan, the Visitation Strategy, the Fire Management Strategy, the Bush Regeneration Plan and the listed values on any RNE listed land, and is environmentally, economically and socially sustainable.

6.2.2 Prepare a Visitation Strategy that is consistent with the Conservation Management Plan, the Fire Management Strategy, the Bush Regeneration Plan and the listed values on any RNE listed land, and is environmentally, economically and socially sustainable.

6.2.3 Prepare an Access Plan that considers priority access areas, minimisation of visitor impacts on the Park environment, NPWS management facilities and operations as well as threats to visitor's safety from macrofauna, management of possible residual contamination and development of adjoining residential areas.

6.2.4 Plan visitor access within the constraints of environmental sustainability, public safety and macrofauna management.

6.2.5 Provide controlled visitor access to the eastern sector of the Park to minimise the impacts on threatened plant species.

6.2.6 Design and manage visitor facilities and recreation opportunities to be ecologically, economically and socially sustainable and provide a satisfying and informative visitor experience.

6.2.7 Ensure that visitor facility construction complies with the conditions of any relevant Site Audit Statements and the Contamination Management Plan.

6.2.8 Designate particular recreational tracks, management trails and roads for cycling.

6.2.9 Encourage appropriate visitor behaviour to help preserve the natural and cultural heritage of the Park; through the provision of information signs and by other means.

6.2.10 Permit and encourage appropriate commercial and community group tours and activities, subject to consents and licences which specify limits on group sizes and frequency of use, so as to minimise environmental impacts and conflicts with other park users.

6.2.11 Monitor visitor use within the park so as to understand patterns of Park visitation, and minimise impacts on Park values.

6.2.12 Consider the application of park use fees where it assists management of the Park.

6.2.13 Consider providing guided tours and activities to allow visitation to areas where there may be any safety concern including, areas of contamination risk or high densities of macrofauna, or areas where there are sensitive or vulnerable items of heritage.

6.2.14 Consider recreation opportunities in future planning of activities within the broader regional context.

6.2.15 Limit visitor interaction with macrofauna to specific supervised educational programs.

6.2.16 Prohibit domestic animals in the Park.

6.2.17 Prohibit active sporting opportunities, including camping, horseriding, skateboarding, rollerblading and similar activities in the Park.

6.2.18 Prohibit the use of wood and charcoal barbecues in the Park.

7. RESIDUAL REGISTER OF THE NATIONAL ESTATE

The St Marys Property is divided into a number of different planning instrument zones including Regional Park, Regional Open Space, Urban, Drainage Basins, Roads and RNE Land (Figure 2). Approximately 828 hectares of the St Marys Property was listed in 1999 on the Register of the National Estate, this includes approximately 767 hectares of the Regional Park, 19 hectares of land zoned Drainage and approximately 47 hectares of the land referred to as Residual RNE Land in the St Marys Development Agreement.

During the writing of the St Marys Development Agreement (2002) all Parties noted that some lands listed on the Register of the National Estate would present land managers with difficult management issues over the long term. Therefore it was decided that the lands known as Residual RNE Land would be:

'…studied in the drafting of the Plan of Management to assess appropriate park management options for that land, and the Plan of Management will identify the options and requirements for the protection of the listed values of the Residual RNE Land' (Clause 11.5b, St Marys Agreement, 2002).

The values of the RNE lands across the whole St Marys Property (including the Residual RNE Land) are: the presence of rare and regionally significant flora and fauna species, the presence of significant remnants of native vegetation of the Cumberland Plain, and significant examples of Aboriginal and European heritage. During the preparation of the Plan of Management for the Regional Park, the Residual RNE Land has been considered and assessed for inclusion in the Park.

Following concessions by the Joint Venture Partnership in relation to roads so that certain portions will not be isolated and undertakings of sympathetic adjacent development, the Department intends to include all but 0.8 hectares of the Residual RNE land into the Park. The Park will now be approximately 900 hectares in size.

ISSUES

- Recognition of the listed values of all the land in the Park listed on the Register of the National Estate.

DESIRED OUTCOMES

- The listed values of the RNE lands in the Park are protected.

STRATEGIES

7.1 Ensure the protection and enhancement of the listed values of the RNE land through appropriate management.

8. RESEARCH AND MONITORING

The major purpose of scientific study in Wianamatta Regional Park is to improve our understanding of, and assist with the management of, the Park's values. An important secondary aim is to improve knowledge and understanding of the natural and cultural heritage of the Cumberland Plain.

There is a need to encourage research and monitoring, especially in areas where there are major deficiencies in our knowledge and understanding of how to manage and conserve the values of the Park. Possible areas of research with specific management applications for the Park include:

- Natural and Cultural heritage values.
- Geology, hydrology and soils.
- Visitor Opportunities and Recreational uses in the Park.
- Ecosystem processes relating to a modified landscape.
- Long term social and economic benefits.

There have been a number of investigation reports carried out in the St Marys Property since 1991, which have identified most of the key values of the site. Where these reports have been relevant to the Regional Park they have been referred to in previous sections of this Plan and are listed in the reference section. The reports relate to the investigations into the development of the St Marys Property as a multifunctional site consisting of different zones including the Regional Park, Urban Areas, Regional Open Space and Drainage Basins, rather than being scientific studies or monitoring programs.

A small number of studies have used the St Marys Property to conduct scientific research on the endangered vegetation (French et al. 2000), the aquatic macroinvertebrate fauna (Chessman & Williams 1999) and kangaroo population (Cooper et al. 2003).

Currently there are no major scientific studies being conducted in the Regional Park. However a number of research and monitoring programs have been, or will be commenced by the Joint Venture Partnership in the Park. These include the monitoring of the impact of kangaroo grazing, and monitoring of the water quality in the creeks.

The establishment and monitoring of a series of exclosure experiment plots was a condition of the St Marys MFMP (Cumberland Ecology 2004) and is the responsibility of the Joint Venture Partnership. The aim of this experiment is to monitor the impact of kangaroo grazing on the native vegetation so as to determine the ecologically sustainable level of kangaroo grazing within the St Marys Property (including the Regional Park).

The NSW State of the Parks is a comprehensive reporting system, which will systematically monitor the status of all aspects of park management at both a State and park level over time. This reporting system focuses on the lands managed by the Parks and Wildlife Division of the Department of Environment, Climate Change and Water (DECCW) and links the State of the Environment and other government reporting mechanisms. The Regional Park will be included in this reporting system. Future State of the Parks reports will incorporate performance data and analysis to enable comparison over time.

The Park provides an important and unusual opportunity to study the natural and cultural heritage of the Cumberland Plain. The historic long-term restrictions on access to the site, coupled with limited past development across the site, means that the Park contains areas that are relatively undisturbed since the agricultural practices of the early 1900s compared to the majority of the Cumberland Plain. The Park can therefore serve as a reference site for some types of comparative research. Perhaps more importantly, the Park may be able to serve as a "natural laboratory" for researching and improving methods of restoration and recovery of natural ecosystems.

Research by other organisations and students may also provide valuable information for management. Continued acquisition of survey data from groups such as bird watchers and the use of undergraduate and postgraduate university students for research work should be encouraged to achieve some of these research requirements. Collaborative research partnerships with research organisations should be pursued as a particularly effective means of fostering research.

ISSUES

- Measuring and monitoring the impact of threatening processes on the natural heritage of the Park.
- Understanding the ability of disturbed areas within the Park to regenerate from seedbanks.
- Determining the possible impact of disturbances (such as the interaction between fire and grazing) on the spread, establishment and abundance of introduced plant species within the Park, especially the role of fire as a management tool to control introduced species.
- Monitoring and evaluating the impact of recreational activities on the natural, geological and cultural values of the Park over time.
- Monitoring the impact of macrofauna grazing on the native vegetation within the Park.
- Redressing the lack of information regarding the cultural heritage of the Park with particular reference to the interpretation of the different eras of land use.
- Recording the oral histories of people who have a connection with the history of the site, especially while those memories are fresh.
- Monitoring the possible changes in the water quality of the creeks and other catchment values as other areas of the catchment are developed.
- Redressing the lack of information regarding the impacts of soil salinity and erosion.
- Redressing the lack of information regarding the natural and artificial hydrology of the Park.
- Researching information about the availability of colonial station journals (ie during the contact period) which may have recorded information about whether particular flora and fauna species were significant to Aboriginal people.

DESIRED OUTCOMES

- Research is undertaken that enhances the information base and assists conservation and management of the Park, and of the Cumberland Plain.
- Research causes minimal environmental damage.
- Monitoring programs are in place to detect any changes in the status of Park resources and values.
- Monitoring programs designed to assist in the management of the Park comply with the principles of environmental, economical and social sustainability.
- Research and monitoring programs and activities comply with relevant legislation.
- Research participation and co-operation is achieved with tertiary institutions and other major interested organisations.

STRATEGIES

8.1 Do research to provide information about the Park's natural and cultural heritage and human use in order to facilitate management.

8.2 Permit appropriate research by other organisations and individuals and encourage and promote research that is directly useful for management purposes.

8.3 Ensure that any research structures and long-term markers have minimal visual impact and are removed upon completion of the research.

8.4 Prepare a prospectus as a guide to preferred research projects in the Park. Preferred topics will be those of direct relevance to the management of:

- Rare or threatened species, endangered ecological communities and populations;
- Soil landscape and geological units in the Park
- Aboriginal heritage in the Park;
- Historic heritage in the Park, including oral histories of the site;
- Visitor opportunities and patterns of use in the Park;
- Catchment values and processes including natural and artificial hydrology and the impacts of soil erosion and salinity;
- Interactions between fire management, the regeneration of native species, and the control of introduced species;
- Information that assists in minimising the impact of threats to the Park's values; and
- Increased understanding of the impact of different fire regimes on various plant and animal species and vegetation communities.

8.5 Ensure that research groups pass on information gathered in the Park, in formats suitable for use by Park managers.

8.6 Ensure research and monitoring programs comply with relevant legislation.

8.7 Support monitoring of the impacts of grazing pressure as defined in the St Marys MFMP.

9. COMMERCIAL AND OTHER USES

Commercial activities in the Park must have a lease or licence, while organised groups must have consent as required by section 151 of the NPW Act. Leases, licences and consents provide the mechanism for ensuring activities, levels of use and behaviour are appropriate for the Park and for specific locations and compatible with recreational use. Commercial activities considered a risk to public safety, more appropriately located outside the Park or unsustainable would not be allowed in the Park. All commercial leases and licences will be regularly reviewed to ensure:

- Operators comply with their lease or licence.
- Operations are appropriate in terms of the objectives of the Park.
- Operations are providing a valuable service to Park visitors by improving the public's knowledge and understanding of the Park.
- Operations do not have an unacceptable impact on the Park or other visitors.

Commercial activities may also provide mechanisms to maximise opportunities for employment and training, and sources of revenue and strategic partnerships for the Regional Park. Sources of revenue may include, but may not be restricted to, parking fees, commercial licence fees, leasing of buildings for appropriate purposes, sponsorship, State and Commonwealth grant programmes and strategic partnerships. Any such commercial activities or opportunities will be considered on their merits, taking into account other objectives and constraints, stage of development of facilities, markets, financial viability, economic sustainability, and consistency with the objectives of the Park. There are currently no commercial tour or activity operators using the Wianamatta Regional Park.

Adaptive reuse of buildings and structures will be permitted, provided any proposed modification and use is sustainable, is consistent with the management principles for regional parks (refer section 2.2) and conservation of the natural and cultural values of the land and any adopted Conservation Management Plan, and is compatible with the retention of the cultural significance of the buildings and structures. A range of possible future uses is listed below:

- educational facilities for natural heritage, cultural heritage, park management or fire management
- research facilities for natural heritage and cultural heritage
- facilities that assist in the conservation and management of natural or cultural heritage of the Cumberland Plain, such as native plant nurseries
- retail outlets commensurate with the needs of the area in which that outlet is located
- restaurants, cafes, kiosks and other food outlets
- cultural institutions, including museums and galleries
- visitor and tourist accommodation
- facilities for events, conferences and functions
- sporting facilities
- facilities and amenities for tourists and visitors, including information centres and booking outlets
- facilities in relation to Aboriginal culture and Aboriginal cultural activities.

Areas in the Park may be requested for short-term exclusive uses such as community events, private functions (eg weddings, conferences), group picnics and cultural events. Licences may be granted to use land, buildings and structures in the Park for exclusive use for any purpose provided the land is a modified natural area.

Any existing concessions, licences and leases, which are not permissible under the NPW Act, will not be renewed on the expiration of their current term.

Easements

It is acknowledged that the Park will be burdened with easements as stated in the St Marys Development Agreement (2002). In that document, Annexure J identifies a number of existing and proposed infrastructure easements. The process for identifying easement requirements will be ongoing as it is dependent on finer-scale planning occurring in the development areas outside of the Park. The identification and agreement of future easements prior to the transfer of land to the Park will be a priority.

A major focus of the management of easements will be the reduction or elimination of any impact that they may have on Park values.

No new easements will be issued under the NPW Act unless agreed under Clause 11.7 of the St Marys Development Agreement (2002). Existing leases, licences or easements may be extended for a further period of time and short-term licences may be issued for those existing interests which are permissible under Section 39 of the NPW Act.

Boundary problems

The existing chain mesh fence was not constructed on the cadastral boundary in places. There are known encroachments by neighbours along the southern boundary from The Northern Road to the Central Precinct Development Area and this will need to be addressed. Part of this encroachment is included in the Deferred Zoning Matter (0.2 ha) in the St Marys Development Agreement (2002) and thus is not part of the Regional Park.

A similar situation occurs along the Northern Boundary, including the area known as the Griffin Boundary in the St Marys Development Agreement (2002) but mostly involving road easements along Ninth Ave and Palmyra Ave.

ISSUES

- The Park will be burdened with easements.
- There are boundary encroachments from urban development.
- The appropriate management of any existing leases and licences.

DESIRED OUTCOMES

- Commercial and other non-park uses have minimal environmental impact and contribute to the aims of Park management.
- Commercial and other non-park uses contribute to understanding and enjoyment of the values of the Park
- Commercial and other non-park uses are potentially revenue-generating opportunities and provide opportunities for employment and training, where appropriate.

STRATEGIES

9.1 Consider any new lease, licence and easement application in accordance with the provisions of the NPW Act and Regulation, NPWS Policy and Licence Conditions, and relevant provisions of the St Marys Development Agreement.

9.2 Review non-Service utilities, with the aim of removing unnecessary infrastructure from the Park where feasible.

9.3 Consider applications to conduct commercial tours and activities in the Park on merit, and licence as appropriate.

9.4 Investigate leasing of existing buildings for activities that are consistent with the values and management directions of the Park and the adopted Conservation Management Plan.

9.5 Consider applications for organised activit1ies by schools, community and other groups in accordance with the provisions of the NPW Act and Regulation and Department Policy and issue consents as appropriate.

9.6 Exclude encroachments from the Park.

9.7 Include prescriptions for the maintenance of facilities and access roads, and for emergency notification and response in easements and licences.

9.8 Develop protocols with relevant authorities to manage incidents involving infrastructure failure within the Park.

9.9 Consider the application of an appropriate fee structure (if any) to facilities as they are developed or become available.

10. NPWS MANAGEMENT FACILITIES AND OPERATIONS

The Wianamatta Regional Park potentially provides a strategic location to allow for the provision of facilities relevant to NPWS management and operations within western Sydney.

An extensive network of tracks and trails exist in the Park as a result of the former activities within the site. Some of these trails are tarred roads whilst others are unsealed. All are generally eroded and require maintenance of surfaces and drainage. After taking into account the cultural heritage values of the Park and any access requirements of leases, licences or easements, trails not needed for management and recreation purposes should be closed and rehabilitated. Locked gates will be used to prevent unauthorised access into the Park.

Four buildings known as S29, S42, S43 and S44 that date from the munitions era are located in the Park (Allom Lovell & Associates 1994). As stated in the St Marys Development Agreement (2002) the Department acknowledges that these buildings will be accepted in the condition they are in at the date of transfer of the Regional Park to the Minister for the Environment. These buildings are currently unoccupied and not in use. Their suitability for adaptive reuse is currently undetermined as no assessment of their conservation status nor the likely services required for reuse has been completed.

The St Marys property land developer as a requirement of the implementation of the MFMP has produced and mostly implemented a plan for internal fencing within the site to manage the macrofauna population. The plan divides the site (including the Regional Park) into a number of separate paddocks, each of which includes provision of water, shelter, grazing and gates. The developer maintains the perimeter and internal fences to a sufficient standard that macrofauna escapes are minimised. The implementation of the MFMP will continue until the Department has certified that the macrofauna populations have been managed to achieve ecologically sustainable levels. However, if the macrofauna population is reduced, macrofauna fencing may be considered for removal subject to requirements for Park protection and feral animal control.

During the planning of land use and facilities in the Park, areas of known contamination and the requirements of any Site Audit Statement and the Eastern Regional Park Contamination Management Plan need to be addressed (refer to Section 5.1).

ISSUES

- There is a need to identify facilities, infrastructure and operations necessary for management of the Park.
- The requirements and conditions of any relevant Site Audit Statements and the Contamination Management Plan need to be addressed and complied with.
- Management of the Park needs to be coordinated with management of macrofauna and associated infrastructure by the Joint Venture Partnership.

DESIRED OUTCOMES

- Management facilities adequately serve the needs of NPWS objectives, strategies and operations and have minimal environmental impact.
- New management facilities will consider and apply the principles of ecological, economic and social sustainability.
- The conditions of relevant Site Audit Statements and the Contamination Management Plan are complied with prior to the construction of any facilities and/or infrastructure in contaminated areas of the Park.

STRATEGIES

10.1 Use the principles of environmental, economical and social sustainability to guide management operations. Cooperate with other authorities and stakeholders in implementing these principles within the Park.

10.2 Review all management trails and facilities in terms of their function, maintenance requirements and impact. Trails and facilities that are not essential or sustainable will be closed and/or removed and the site rehabilitated.;

10.3 Assess the potential of the former munitions building known as S29, S42, S43 and S44 for reuse as NPWS management facilities, within the principles of sustainability;

10.4 Regularly review boundary fencing to determine whether fencing requirements on the Park boundary change as the macrofauna population is reduced.

10.5 Maintain vehicle tracks to a good standard of stability and access.

10.6 Ensure that only vehicles on authorised management operations or those covered by a lease, licence, easement or agreement are permitted to use management trails within the Park.

10.7 Maintain a system of locked gates and fencing to restrict vehicle access and to reduce degradation of tracks or bushland from general traffic.

10.8 Ensure that close liaison is maintained with park neighbours to ensure sympathetic and co-operative management across Park boundaries on matters of mutual concern.

10.9 Implement requirements of any relevant Site Audit Statements and the Contamination Management Plan prior to the construction of any facilities and/or infrastructure in the Park.

11. PLAN IMPLEMENTATION

This Plan of Management establishes a scheme of operations for the Wianamatta Regional Park. The Plan is part of a system of management developed by the Parks and Wildlife Division of the Department of Environment, Climate Change and Water. The system is based upon the NPW Act, management policies, established conservation and recreation philosophies, and strategic planning at corporate, directorate and regional levels. The latter may include development of related plans such as regional recreation plans, species recovery plans, fire management plans and conservation management plans.

Section 81 of the Act requires that this Plan of Management shall be carried out and given effect to, and that no operations shall be undertaken in relation to Wianamatta Regional Park unless they are in accordance with the Plan.

Implementation of this Plan will be carried out within the annual works programs of the Service's Sydney Region. The actions identified in the Plan are those to which priority will be given in the foreseeable future. Other management actions may be developed consistent with the Plan's objectives and strategies.

Relative priorities for identified activities are set out in Table 6. These priorities are determined in the context of Branch and Regional strategic planning, and are subject to the availability of necessary staff and funds and to any special requirements of the Director-General or Minister. The implementation of the Plan will be monitored and its success in achieving the identified objectives will be assessed.

The environmental impact of proposed activities will be assessed at all stages in accordance with the EPA Act and established environmental assessment procedures. Where impacts are found to be unacceptable, activities will be modified in accordance with the Plan policies.

This Plan of Management does not have a specific term and will stay in force until amended or replaced in accordance with section 73B of the NPW Act. The Plan applies both to the land currently reserved and to any future additions. Where management strategies or works are proposed for additions (or the existing area) that are not consistent with the Plan, an amendment to the Plan will be required.

STRATEGIES

11.1 Undertake an annual review of progress in implementing this Plan of Management.
11.2 Undertake regular reviews of the Park's environmental condition and management as part of the NSW State of the Parks reporting.
11.3 Do an assessment of the effectiveness of managing the Regional Park in accordance with this Plan 5 years after the adoption of this Plan. The assessment will be based on the monitoring programs set out in this Plan, the State of the Parks survey, and any others that may be developed.

Implementation Table

Table 6. Implementation table of priority works to be completed at Wianamatta Regional Park.

Management Strategies	Reference	Priority*
11.1 On-Park Ecological Conservation		
Develop and apply protocols for soil protection and management (see Section 5.1 for more detail).	4.1.4	High
Ensure that management, visitor facilities and recreation opportunities do not have a negative impact in areas of habitat for	4.2.1	High

significant plant and animal species or restricted plant or animal communities.		
Protect and maintain identified corridors to enhance biodiversity linkages between the various sections of the Park and within the region, and investigate and monitor the impacts of internal barriers on these linkages.	4.2.9	High
Liaise with the land developer to ensure that the St Marys Macrofauna Management Plan is implemented.	4.2.10	High
Prepare and implement a bush regeneration plan, which will identify: areas that require weed management; disturbed areas that require revegetation with native (endemic) species; and areas where natural regeneration of vegetation may occur.	4.2.11	High
Incorporate revegetation strategies consistent with the Bush Regeneration Plan (see Section 4.2) to minimise erosion and salinity.	5.1.4	High
Use the principles of environmental, economical and social sustainability to guide management operations. Cooperate with other authorities and stakeholders in implementing these principles within the Park.	10.1	High
Allow natural regeneration of previously disturbed areas, apart from areas set aside for visitor usage or cultural heritage conservation.	4.2.2	Medium
Rehabilitate areas affected by soil erosion, salinity and remediation taking into account catchment management strategies (see Section 5.2).	5.1.3	Medium
Investigate and incorporate where appropriate practices to improve the catchment values of the Park.	5.2.4	Medium
Encourage the monitoring of the water courses and aquatic ecosystem health within the Park over a long-term period.	5.2.7	Low
Take catchment management values into account in soil management strategies, as outlined in Section 5.1.	5.2.8	Low
11.2 Threatened Species		
Implement appropriate recovery plan or PAS actions for threatened species, endangered ecological communities & populations when they have been prepared	4.2.3	High
Protect the habitats of threatened and biogeographically significant fauna species from visitor impacts, the effects of introduced species and inappropriate fire regimes.	4.2.7	High
Ensure the protection and enhancement of the listed values of the RNE land through appropriate management.	7.1	High
Do additional vegetation surveys, in particular to cover threatened species and check for additional significant species.	4.2.4	Medium
Continue to record the distribution of threatened and significant fauna species.	4.2.8	Medium
Implement a program to monitor the status of the significant communities and threatened plant species and to evaluate the impacts of threatening processes and the success of management programs.	4.2.5	Low
11.3 Aboriginal Cultural Heritage		
Manage Aboriginal heritage in consultation with the Deerubbin Local Aboriginal Land Council, Darug People's Advisory Committee and other relevant Aboriginal community members.	4.3.1	High
Ensure that all areas of known and potential archaeological significance have the required approvals under the *Heritage Act 1977* prior to any excavations commencing.	4.3.8	High

Restrict information on the location of Aboriginal sites and places except where the agreement of relevant Aboriginal community members has been obtained. Prior to any promotion of a site or place, prepare a conservation study and undertake any management work necessary to protect the site or place.	4.3.5	Medium
Involve the Aboriginal community in the development of material and programs for interpretation, particularly concerning Aboriginal culture.	6.1.7	Medium
11.4 Historic Heritage		
Prepare a Conservation Management Plan for the Park, including investigation into adaptive reuse of buildings and structures, prior to any works being carried out in the Park.	4.3.2	High
Retain and protect all sites of cultural heritage potential pending preparation of the Conservation Management Plan.	4.3.3	High
Ensure that intact landscape management units are mapped and included in the Conservation Management Plan.	4.3.7	Medium
11.5 Visitor Services		
Update the NPWS website to include park information and events as required.	6.1.5	High
Prepare a Master Plan for Park facilities and infrastructure with a focus on recreation opportunities in natural settings, ensuring that this Plan is consistent with the Conservation Management Plan, the Visitation Strategy, the Fire Management Strategy, the Bush Regeneration Plan and the listed values on any RNE listed land, and is environmentally, economically and socially sustainable.	6.2.1	High
Prepare a Visitation Strategy that is consistent with the Conservation Management Plan, the Fire Management Strategy, the Bush Regeneration Plan and the listed values on any RNE listed land, and is environmentally, economically and socially sustainable.	6.2.2	High
Prepare an Access Plan that considers priority access areas, minimisation of visitor impacts on the Park environment, NPWS management facilities and operations as well as threats to visitor's safety from macrofauna, management of possible residual contamination and development of adjoining residential areas.	6.2.3	High
Provide controlled visitor access to the eastern sector of the Park to minimise the impacts on threatened plant species.	6.2.5	High
Limit visitor interaction with macrofauna to specific supervised educational programs.	6.2.15	High
Prohibit active sporting opportunities, including camping, horse riding, skateboarding, rollerblading and similar activities in the Park.	6.2.17	High
Plan visitor access within the constraints of environmental sustainability, public safety and macrofauna management.	6.2.4	Medium
Prepare and distribute a park brochure to tourist information centres, NPWS visitor centres and other appropriate locations, and update the brochure as needed.	6.1.3	Medium
Ensure that the Park is included, and its features highlighted within regional reserve information.	6.1.4	Medium
Consider providing guided tours and activities to allow visitation to areas where there may be any safety concern including, areas of contamination risk or high densities of macrofauna, or areas where there are sensitive or vulnerable items of heritage.	6.2.13	Medium
Consider recreation opportunities in future planning of activities within the broader regional context.	6.2.14	Medium

Liaise with other providers of recreation opportunities and public open space with the aim of providing park visitors with a comprehensive overview of the recreation options in the region.	6.1.9	Low
Undertake a needs and feasibility analysis to inform the possible establishment of a visitor and/or cultural centre.	6.1.10	Low
Encourage appropriate visitor behaviour to help preserve the natural and cultural heritage of the Park; through the provision of information signs and by other means.	6.2.9	Low
Permit and encourage appropriate commercial and community group tours and activities, subject to consents and licences which specify limits on group sizes and frequency of use, so as to minimise environmental impacts and conflicts with other park users.	6.2.10	Low
Monitor visitor use within the park so as to understand patterns of Park visitation, and minimise impacts on Park values.	6.2.11	Low
Consider the application of park use fees where it assists management of the Park.	6.2.12	Low
Prohibit the use of wood and charcoal barbecues in the Park.	6.2.18	Low
Consider the application of an appropriate fee structure (if any) to facilities as they are developed or become available.	9.9	Low
11.6 Visitor Infrastructure		
Locate and design management and visitor facilities to minimise their visual impact from public access roads, lookouts and other vantage points.	4.1.1	High
Ensure that visitor facilities and recreation opportunities do not impact on any significant Aboriginal and historic sites and places and are consistent with the Conservation Management Plan.	4.3.4	High
Survey site 6 and site 23 using appropriate methodology should active recreational land use (e.g. picnic areas) be planned at these sites.	5.1.9	High
Design and manage visitor facilities and recreation opportunities to be ecologically, economically and socially sustainable and provide a satisfying and informative visitor experience.	6.2.6	Medium
Ensure that visitor facility construction complies with the conditions of any relevant Site Audit Statements and the Contamination Management Plan.	6.2.7	Medium
Designate particular recreational tracks, management trails and roads for cycling.	6.2.8	Medium
Investigate leasing of existing buildings for activities that are consistent with the values and management directions of the Park and the adopted Conservation Management Plan.	9.4	Medium
Assess the potential of the former munitions building known as S29, S42, S43 and S44 for reuse as NPWS management facilities, within the principles of sustainability.	10.3	Medium
Use Water Sensitive Urban Design strategies, where appropriate, for recreation and interpretative facilities located in the Park.	5.2.6	Low
Provide appropriate directional, interpretive and regulatory signage integrated with Park visitor facilities and access points.	6.1.6	Low
11.7 Community Programs & Education		
Liaise with neighbours and authorities to minimise the impact of adjacent land use on the scenic values of key locations in the Park.	4.1.2	High
Liaise with the Hawkesbury-Nepean Catchment Management Authority to ensure that park management is integrated with the catchment management of South Creek Catchment.	5.2.3	High

Continue to actively participate in the Cumberland Zone Bush Fire Management Committee. Maintain close contact and cooperation with Council fire officers and volunteer bush fire brigades.	5.4.11	High
Liaise with Councils, landowners and District Bush Fire Management Committee to minimise risk of unplanned fires entering the Park, especially while the St Marys Property is under development.	5.4.16	High
Permit appropriate research by other organisations and individuals and encourage and promote research that is directly useful for management purposes.	8.2	High
Ensure that research groups pass on information gathered in the Park, in formats suitable for use by Park managers.	8.5	High
Ensure research and monitoring programs comply with relevant legislation.	8.6	High
Support monitoring of the impacts of grazing pressure as defined in the St Marys Macrofauna Management Plan.	8.7	High
Prepare a prospectus as a guide to preferred research projects in the Park. Preferred topics will be those of direct relevance to the management of: Rare or threatened species, endangered ecological communities and populations; - Soil landscape and geological units in the Park Aboriginal heritage in the Park; - Historic heritage in the Park, including oral histories of the site; - Visitor opportunities and patterns of use in the Park; - Catchment values and processes including natural and artificial hydrology and the impacts of soil erosion and salinity; - Interactions between fire management, the regeneration of native species, and the control of introduced species; - Information that assists in minimising the impact of threats to the Park's values; and - Increased understanding of the impact of different fire regimes on various plant and animal species and vegetation communities.	8.4	High
Develop public awareness programs that inform the public about the historical cultural value of the Park and about Aboriginal culture as it relates to the Park.	4.3.6	Medium
Liaise with local government and other authorities as needed to maintain the water quality of the Park's catchments.	5.2.2	Medium
Cooperate with neighbours in implementing weed and pest animal control programs. Undertake control in cooperation with the Cumberland Livestock Health and Pest Authority and Hawkesbury River County Council.	5.3.3	Medium
Emphasise the following themes in promotion and interpretation programs: Natural heritage, including an understanding of ecological processes; - Cultural heritage; - Catchment function; - Conservation in western Sydney Pest species management; - Fire management in an urban setting;	6.1.2	Medium

- Macrofauna management in an urban setting; Recreational opportunities in the Park; - Recreational context and role of the Park; and - Illegal and inappropriate activities.		
Ensure that close liaison is maintained with park neighbours to ensure sympathetic and co-operative management across Park boundaries on matters of mutual concern.	10.8	Medium
Undertake research to better determine the location of geological and soil landscape groups, and of artificial landforms.	4.1.3	Low
Liaise with neighbours, Bushcare, vegetation management committees and land-use authorities to encourage retention, and if possible expansions of areas of native vegetation close to the Park.	4.2.6	Low
Liaise with local communities to mitigate threatening processes from surrounding urban areas.	4.2.12	Low
Focus on the impacts of gathering and removal of timber in and around the Park in law enforcement, education and research activities.	4.2.14	Low
Liaise with other land management authorities and developers to mitigate threatening processes from surrounding urban areas.	4.2.13	Low
Develop and implement an education program for neighbouring communities on the potential impact of exotic species.	5.3.7	Low
Encourage Bushcare groups to work in the Regional Park	5.3.10	Low
Encourage research into the ecological effects of fire in the park, particularly the fire response of significant plant species and the fire requirements of plant communities.	5.4.9	Low
Liaise with other fire authorities to encourage community awareness of fire management practices and property protection.	5.4.15	Low
Produce media releases and attend meetings with neighbours and community organisations to promote community understanding and appreciation of Park values and management strategies, and the role of sympathetic conservation in surrounding areas in ensuring the Park's long-term sustainability.	6.1.1	Low
Encourage and assist educational use of the Park by schools, community groups, individuals and commercial operators.	6.1.8	Low
Actively include and promote the Park in education and Discovery programs provided by NPWS and allied agencies in western Sydney, including the provision of guided tours and educational activities when appropriate.	6.1.11	Low
Do research to provide information about the Park's natural and cultural heritage and human use in order to facilitate management.	8.1	Low
Ensure that any research structures and long-term markers have minimal visual impact and are removed upon completion of the research.	8.3	Low
Consider applications for organised activities by schools, community and other groups in accordance with the provisions of the NPW Act and Regulation and Department Policy and issue consents as appropriate.	9.5	Low
11.8 Weeds		
Give priority for the control of introduced species to those species where: - they are declared noxious or are known to be an important problem in other parks or states or for which a national emergency control program has been declared;	5.3.1	High

they have a significant environmental impact, including damage to threatened species, catchment values and recreation values; they may affect neighbouring lands or are considered to be of high priority by the community; - they may invade from neighbouring lands or are considered to be of high priority by the community; - management is needed to maintain benefits gained from previous control programs or to allow another high priority management program to be effective; or - a window of opportunity occurs where the chances of control or eradication are improved.		
Avoid unnecessary environmental disturbances. Where disturbance is inevitable or is planned, consider the likely impact of the activity in terms of both introduced and native species and put in place controls or programs to reduce any such impact.	5.3.2	Medium
Implement weed management strategies/actions from the Bush Regeneration Plan (Chapter 4.2).	5.3.8	Medium
Include soil management and hygiene protocols in pest management strategies.	5.3.6	Low
Replant selected cleared areas to reduce opportunities for invasion by introduced plant species.	5.3.9	Low
Design and implement weed and anti-Phytophthora hygiene protocols, and monitor the Park to detect any outbreaks.	5.3.11	Low
11.9 Pest Animals		
Prohibit domestic animals in the Park.	6.2.16	High
Investigate the relative prevalence and impact of introduced animals within the park through analysis of fauna surveys, now and in the future	5.3.4	Medium
Prepare, implement and review annually a Pest Species Management Strategy to minimise or prevent the impact of introduced animals on native species, with consideration of the appropriateness of different control methods including the use of feral proof fencing on the Park's boundary.	5.3.5	Medium
11.10 Fire Management		
Carry out appropriate fuel management for the protection of the Park and community, in accordance with the District Bushfire Risk Management Plan.	5.4.1	High
Prepare a fire management strategy which integrates fire management activities with weed management.	5.4.2	High
Consider closing the Park to the public during periods of severe and above fire danger.	5.4.12	High
Identify, assess, map and maintain, where appropriate, a fire trail network and water sources in the Park.	5.4.3	Medium
Undertake fuel reduction programs, trail maintenance, research and monitoring programs in accordance with the policies outlined above and the Fire Management Strategy.	5.4.4	Medium
Carefully consider macrofauna issues during any fire management planning and operations.	5.4.17	Medium
Use prescribed fire to achieve a variety of fire regimes that maintain fire thresholds for each vegetation community in accordance with a Fire Management Strategy.	5.4.5	Low
Avoid the use of heavy machinery for fire suppression in areas of rare plants, Aboriginal sites and historic places.	5.4.6	Low

Implement vehicle hygiene measures, as per action 5.3.11, and implement close monitoring of burnt areas after fires to detect any introduction of weeds or pathogens.	5.4.7	Low
Rehabilitate areas disturbed by fire and fire suppression operations as soon as practical after the fire.	5.4.8	Low
Ensure fire management is linked to vegetation structure.	5.4.10	Low
Maintain fire records for the Park.	5.4.13	Low
Adopted recovery plans and the priority action statement will be considered in the Park Fire Management Strategy.	5.4.14	Low
11.11 General Infrastructure & Maintenance		
Map, monitor and if necessary, treat areas of soil erosion, salinity, potential contamination and previous site audit remediation works.	5.1.2	High
Develop a protocol for the movement of soil within and into the park so that the origin, location and provenance is known and recorded.	5.1.5	High
Ensure all earthworks will comply with the conditions of the relevant Site Audit Statements.	5.1.6	High
Undertake a risk assessment in relation to residual contamination in the Park.	5.1.7	High
Implement the procedures for the safe handling and disposal of any items of ordnance that may be found during earthworks as set out in the Remnant Contamination Management Plan.	5.1.10	High
Develop protocols with relevant authorities to manage incidents involving infrastructure failure within the Park.	9.8	High
Maintain a system of locked gates and fencing to restrict vehicle access and to reduce degradation of tracks or bushland from general traffic.	10.7	High
Test soils under existing buildings, car parks and roads for ordnance or chemical contamination and prepare required site audits for these areas if these facilities are removed.	5.1.8	Medium
Review the current location of fences and ensure that the fences that are required for park management purposes are retained.	5.3.11	Medium
Review non-Service utilities, with the aim of removing unnecessary infrastructure from the Park where feasible.	9.2	Medium
Review all management trails and facilities in terms of their function, maintenance requirements and impact. Trails and facilities that are not essential or sustainable will be closed and/or removed and the site rehabilitated.	10.2	Medium
Ensure that only vehicles on authorised management operations or those covered by a lease, licence, easement or agreement are permitted to use management trails within the Park.	10.6	Medium
Implement requirements of any relevant Site Audit Statements and the Contamination Management Plan prior to the construction of any facilities and/or infrastructure in the Park.	10.9	Medium
Minimise soil erosion and incorporate soil conservation principles and values for all earthwork operations carried out in the Park.	5.1.1	Low
Design and undertake all works in a manner that minimises water pollution and is consistent with water management regulations and polices.	5.2.1	Low
Investigate and map existing and disused utility infrastructure to assist in the mitigation of adverse impacts on catchment values.	5.2.5	Low
Include prescriptions for the maintenance of facilities and access roads, and for emergency notification and response in easements and licences.	9.7	Low
Regularly review boundary fencing to determine whether fencing	10.4	Low

requirements on the Park boundary change as the macrofauna population is reduced.		
Maintain vehicle tracks to a good standard of stability and access.	10.5	Low
11.12 Assessments, Acquisitions & Establishment		
Undertake an annual review of progress in implementing this Plan of Management.	11.1	High
Undertake regular reviews of the Park's environmental condition and management as part of the NSW State of the Parks reporting.	11.2	High
Do an assessment of the effectiveness of managing the Regional Park in accordance with this Plan 5 years after the adoption of this Plan. The assessment will be based on the monitoring programs set out in this Plan, the State of the Parks survey, and any others that may be developed.	11.3	High
Consider any new lease, licence and easement application in accordance with the provisions of the NPW Act and Regulations, Department Policy and Licence Conditions, and relevant provisions of the St Marys Development Agreement.	9.1	Low
Consider applications to conduct commercial tours and activities in the Park on merit, and licence as appropriate.	9.3	Low
Exclude encroachments from the Park.	9.6	Low

*** High** priority activities are those imperative to achievement of the objectives and desired outcomes. They must be undertaken in the near future to avoid significant deterioration in natural, cultural or management resources.
Medium priority activities are those that are necessary to achieve the objectives and desired outcomes but are not urgent.
Low priority activities are desirable to achieve management objectives and desired outcomes but can wait until resources become available.

The Department is obligated under the St Marys Development Agreement (2002) to ensure that this plan will:

- Identify a set of priority works which are essential to the achievement of the objectives of the Plan of Management.
- Assess the relative priority of identified works in relation to short- and long-term objectives of the Plan of Management.
- Be accompanied by a realistic and pragmatic budget and timeframes to undertake those works.

The priority works are essential to achieve the management objectives of this plan of management, and have been outlined in the table above in the high priority section. These works are essentially those activities that are considered critical to the establishment of the Park and include significant stages of planning. The St Marys Development Agreement also specifies that the infrastructure works and access for the Park must coincide with the progress of the neighbouring development areas. Table 7 outlines a realistic and pragmatic budget and timeframe for these works and other associated works over a seven-year period.

Table 7. Budget and timeframes for works to occur over a seven-year period.

Amount*	**Activity^**	**Timeframe~**
$950,000	Establishment of the regional park (e.g. flora and fauna surveys, conservation management plan, master plan etc), statement of interim management intent, plan of management, and community reference group.	2003 - ongoing

$1,099,413	Construction of capital works, including detailed design and environmental assessment, and other park management priorities.	Once PoM adopted and to be paid in instalments once eastern precinct works have commenced (approx 2011-2016)
$2,075,060	Construction of capital works, including detailed design and environmental assessment, and other park management priorities.	Once PoM adopted and to be paid in instalments once western precinct works have commenced (approx 2010-2014)
$2,775,527	Construction of capital works, including detailed design and environmental assessment, and other park management priorities.	Once PoM adopted and to be paid in instalments once central precinct works have commenced (approx 2014-2020)

* Amounts are based on 2002 values. Final amounts will be subject to indexation as set out in Clause 1.15 of the St Marys Development Agreement (please note the above table is an overview of this clause).

ˆ Commencement of activities will be dependent on gazettal of each section of the Park and relevant planning outcomes, such as environmental assessment.

˜ This is the approximate timeframe for receiving capital payments.

DEFINITIONS

Biodiversity is biological diversity, namely the variety of life forms: the different plants, animals and micro-organisms, the genes they contain, and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecosystem.

Bioregion is a complex land area characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. They capture the large-scale geophysical patterns across Australia. These patterns in the landscape are linked to fauna and flora assemblages and processes at the ecosystem scale, thus providing a useful means for simplifying and reporting on more complex patterns of biodiversity.

Bushfire hazard reduction work is the establishment or maintenance of fire breaks on land, by reduction or modification of available fuels. Fuel reduction may be achieved by the controlled application of fire, manual removal, slashing or other means.

Bushfire risk management plan is a plan of operations to prevent, detect and suppress unplanned fires and to reduce bushfire hazard, prepared by a Bushfire Management Committee, constituted under the *Rural Fires Act, 1997* for coordinated fire management and operations within a rural fire district.

Conservation is the processes and actions of looking after a place (such as protection, maintenance, management, sustainable use and restoration) so as to retain its natural and cultural significance.

Conservation Management Plan is a non-statutory document that outlines the significance of an item and how the item is to be managed.

Cultural heritage is the value people give to items through their associations with them. It can be tangible (i.e. have physical manifestation in the form of art, buildings etc.) or intangible (i.e. spiritual or social associations, songs, stories and cultural practices). Cultural significance includes values that are social, spiritual, aesthetic, historic and scientific. When natural resources acquire meaning for a particular group, they become cultural resources as well.

Ecological community is an assemblage of species occupying a particular area.

Ecological processes are all those processes that occur between organisms, and within and between population and communities, including interactions with the non-living environment.

Endangered ecological community is an ecological community specified in Part 3 of Schedule 1 of the TSC Act.

Endangered is a species, population or ecological community that is listed in Schedule 1 of the TSC Act as in danger of becoming extinct.

Endemic means it is restricted to a specified region or locality.

Erosion Hazard is a measure of the susceptibility of an area of land to prevailing agents of erosion, and is determined by the factors of climate, topography, soil erodibility and landuse. Each landuse has its own erosion hazard. The development of residential housing was the landuse used by Bannerman and Hazelton (1990).

For urban areas annual loss of surface soil during the first year of residential development have been grouped into five categories:

Slight	0-10 tonnes/ha/y
Moderate	10-30 t/ha/y
High	30-50 t/ha/y
Very high	50-80 t/ha/y
Extreme	>80 t/ha/y

Fauna means under the NPW Act, any mammal, bird, reptile or amphibian. The Department has responsibility for the conservation of fauna. Note this definition excludes fish or invertebrates.

Feral species are domesticated species that have become wild.

Fire authorities are organisations (including land management authorities such as NPWS) vested by the *Rural Fires Act, 1997* with the responsibility to suppress fires.

Fire hazard is fuel conditions with the potential to sustain bushfire behaviour, which is detrimental to life and property or natural resources being managed.

Fire Management includes all activities associated with the use and control of fire.

Historic places are landscapes, sites, buildings or other works, together with pertinent contents and surroundings, which contain historic resources. Places can include structures, ruins, archaeological sites and areas.

Historic resources include all evidence of post-European invasion of NSW, physical, oral and documentary.

Historic sites are lands reserved as a historic site under the NPW Act.

Indicator species is a species whose presence or absence is indicative of a particular habitat, community or set of environmental conditions.

Introduced species is a species occurring in an area outside its historically known natural range as a result of intentional or accidental dispersal by human activities. Also known as exotic or alien species.

Joint Venture Partnership means the partnership between the Lend Lease Development Pty Ltd and ComLand Ltd.

Key threatening process is a process that is listed in Schedule 3 of the TSC Act, which adversely affects the survival or evolutionary development of two or more species, populations or ecological communities.

Landscape limitations are landform properties which may restrict urban or rural development. The degree of severity will vary with site conditions and the proposed land use (Bannerman and Hazelton 1990).

Management trail is an access trail constructed and maintained expressly for park management purposes. Public vehicle access is not permitted to these trails.

Modified natural area is an area of land where the native vegetation cover has been substantially modified or removed by human activity (other than activity relating to bushfire

management or wildfire management) and that is defined in a plan of management as not being appropriate or capable of being restored.

Noxious Weed Categories:

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

Partly Confined Discontinuous Floodplain is a moderately narrow valley with a channel that abuts the valley margin (hillside) between 10% and 90% of its length. There is no floodplain where it abuts the valley margin and therefore, the floodplain is in discontinuous segments, each one cut off by the valley margin. This type of floodplain is relatively common in New South Wales.

Policy is a statement of attitude and course of action, directed toward the attainment of the corporate goals and/or objectives of the National Parks and Wildlife Service.

Recovery plan is a document prepared under the TSC Act that identifies the actions to be taken to promote the recovery of a threatened species, or endangered population or ecological community.

Regeneration is the recovery of natural integrity following disturbance or degradation. This can be achieved through totally natural processes or an assisted process, where human intervention (through removing weeds or planting seedlings) accelerates recovery (Australian Natural Heritage Charter).

Register of the National Estate (RNE) land means that part of the St Marys Property which is listed on the Register of the National Estate under the Australian Heritage Commission Act 1975.

Residual Register of the National Estate land means those parts of the RNE land within the St Marys Property identified separately from the Regional Park in the St Marys Development Agreement (2002).

Restoration includes returning existing habitats to a known past state or to an approximation of the natural condition. This can be achieved by repairing degradation, by removing introduced species or by reintroduction of one or more species or habitat elements that are known to have existed there naturally at a previous time (Australian Natural Heritage Charter).

Soil Erodibility is the susceptibility of a soil to erosion and is based on soil properties. Slope gradient, slope length, landform element and rainfall characteristics were not included in Bannerman and Hazelton's assessment of soil erodibility. It is recommended that on erodible soils disturbance should be minimised and vegetation cover maintained (Bannerman and Hazelton 1990).

Soil limitations are soil properties that may restrict urban or rural development. The degree of severity will vary with site conditions and the proposed land use (Bannerman and Hazelton 1990).

St Marys Property means the land formerly known as the Australian Defence Industries (ADI) munitions manufacturing site at St Marys.

Surface movement potential is an estimate of the potential soil shrink and swell movements that may occur with changes in soil moisture content. Surface movement can cause damage to inappropriately designed buildings, roads and underground services (Bannerman and Hazelton 1990).

Reactivity classification classes are defined as follows:
Stable. Non-cohesive or non-plastic soils or <15% finer than 76 micron soils, or >2m of rock.
Slightly reactive. Less than 0.5m clay over rock (or non-cohesive soils over 2 m deep). Expected maximum surface movement <15mm.
Moderately reactive. Expected maximum surface movement 15 to 40mm.
Highly reactive. Expected maximum surface movement 40 to 60mm.
Extremely reactive. Expected maximum surface movement >60mm.

The Park means the land comprising the land in the Regional Park zone under *Sydney Regional Environmental Plan – 30 St Marys* and identified as the Regional Park (including Part A and Part B) under the *St Marys Development Agreement* (2002) that is to be or is reserved or dedicated under the NPW Act. It also may include relevant land Residual RNE land.

Traditional owners are a local descent group of indigenous people who have common spiritual affiliations to an area and primary spiritual responsibility for sites in that area.

Weeds of National Significance (WONS) means introduced species that have been identified as a significant threat as part of Australia's National Weed Strategy.

Wildlife means under the NPW Act, fauna and native plants.

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