



Plan of Management for the George Street Reserves, Bligh Park



18 December 2007

Prepared for

Hawkesbury City Council



Prepared by

Urban Bushland Management Consultants Pty Ltd

111 Showground Road, Castle Hill NSW 2154

Ph: 02 9894 2255 Fax: 02 9894 2215

Email: ubmc@urbanbushland.com.au

Web: www.urbanbushland.com.au



CERTIFICATION

I, Judith Rawling Managing Director of Urban Bushland Management Consultants Pty Ltd hereby state that this Plan of Management for the George Street Reserves at Bligh Park has been prepared under Section 36 of the New South Wales *Local Government Act 1993*, which states that local Councils must prepare draft plans of management for community land under their care, control and management.

This Plan of Management has also been prepared in accordance with the NSW Department of Natural Resources¹ *Urban Bushland Management Guidelines*, and their publication entitled '*How to Prepare a Vegetation Management Plan*'.

Judith Rawling
December 2007

¹ Formerly, Department of Infrastructure, Planning and Natural Resources ('DIPNR').



TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	BACKGROUND INFORMATION	1
1.2	SITE IDENTIFICATION & LAND SCHEDULE	3
1.3	PLAN AIMS & OBJECTIVES	3
1.4	SCOPE OF WORK	4
1.5	PLAN TENURE	4
2	STATUTORY & PLANNING CONTEXT	6
2.1	LAND TENURE & ZONING	6
2.2	LAND CATEGORY	6
2.3	LOCAL GOVERNMENT ACT S36 CORE OBJECTIVES - COMMUNITY LAND	6
2.4	RESTRICTIONS APPLYING TO THE USE OF COMMUNITY LAND	7
2.5	LOCAL GOVERNMENT ACT S36 CORE OBJECTIVES FOR BUSHLAND & PARK	7
2.6	COUNCIL MANAGEMENT OBJECTIVES FOR GEORGE STREET RESERVES	11
2.7	LEGAL AND PLANNING FRAMEWORK	12
3	SITE DESCRIPTION	13
3.1	LEGAL DESCRIPTION	13
3.2	LOCATION & SETTING	13
3.3	CULTURAL & HISTORIC DESCRIPTION	14
3.3.1	Pre European Heritage	14
3.3.2	European Heritage	14
3.4	PHYSICAL DESCRIPTION	17
3.5	BIOLOGICAL DESCRIPTION	18
3.6	MANAGEMENT CONTEXT	19
3.6.1	Services & Management History	19
3.6.2	Management History	20
3.6.3	Establishment of Management Zones	20
4	PLAN PREPARATION - METHODOLOGY	23
4.1	LITERATURE REVIEW	23
4.2	FIELD INVESTIGATIONS	23
4.3	FLORA FIELD SURVEY	23
4.4	FAUNA FIELD SURVEY	24
4.5	CONDITION OF BUSHLAND MAPPING	24
4.6	COMMUNITY CONSULTATION	25
5	FIELD SURVEY RESULTS	26
5.1	FLORA	26
5.1.1	Vegetation Communities	26
5.1.2	Indigenous Flora Species	30
5.1.3	Introduced/Exotic Flora Species	33
5.2	CONDITION OF BUSHLAND	34
5.3	FAUNA	38
5.3.1	Fauna Species	38
5.3.2	Habitat Types	39
5.3.3	Wildlife Corridors	39



6	MANAGEMENT ISSUES & RECOMMENDATIONS	43
6.1	REQUIREMENTS OF THE THREATENED SPECIES LEGISLATION	43
6.2	MANAGING FOR SIGNIFICANT FLORA SPECIES	44
6.3	MANAGING FOR SPECIES DIVERSITY	45
6.4	MANAGEMENT OF FAUNA HABITATS	47
6.4.1	Woodland Areas	47
6.4.2	Management for Species Not Previously Recorded in the Reserve	48
6.5	MANAGING WEED INVASION	49
6.6	MANAGING THE BUSHFIRE HAZARD	50
6.7	MANAGING EDGE SITES & INTERFACE ZONES	54
6.8	MANAGING DRAINAGE & URBAN RUNOFF	55
6.9	TRACKING, VANDALISM & INAPPROPRIATE ACTIVITIES	56
6.10	PARK INFRASTRUCTURE	57
7	BASIS FOR MANAGEMENT OF URBAN BUSHLAND	60
7.1	GUIDING PRINCIPLES	60
7.2	BUSH REGENERATION	60
7.3	POTENTIAL FOR REGENERATION – ECOSYSTEM RESILIENCE	61
7.4	CHOOSING THE MOST EFFECTIVE STRATEGY	62
7.5	WEED ECOLOGY	62
7.5.1	Definition	62
7.5.2	Keystone (Target) Weeds	63
7.5.3	Secondary Weeds	63
7.6	PRIORITY OF BUSH REGENERATION WORKS	63
7.7	WEED CONTROL	65
7.8	REVEGETATION	65
8	IMPLEMENTATION & REVIEW	67
8.1	POLICY & PERFORMANCE	67
8.2	REVIEW	67
8.3	WORK PRIORITIES	67
8.4	PROTOCOLS FOR WEED CONTROL	72
8.5	PROTOCOLS FOR REVEGETATION	72
8.5.1	Site Preparation	72
8.5.2	Selection of Appropriate Flora Species	73
8.5.3	Densities and Spatial Arrangement	73
8.5.4	Planting Aids	74
8.5.5	Irrigation	75
8.5.6	Revegetation Methods	75
8.6	WORKS PROGRAM	76
8.6.1	Licences and Permits Required	76
8.6.2	Implementation and Timing of Works	77
8.6.3	Site Maintenance	77
8.7	LABOUR AND RESOURCES	77
8.7.1	Contractors	77
8.7.2	Community Volunteers	78
8.7.3	On-Site Supervision	78
8.8	MONITORING AND ASSESSMENT	78
8.9	PERFORMANCE INDICATORS	79



9	REFERENCES.....	83
10	APPENDICES	85

LIST OF APPENDICES

APPENDIX 1: FINAL DETERMINATIONS	
APPENDIX 2: FLORA SPECIES RECORDED IN THE GEORGE STREET RESERVES	
APPENDIX 3: LISTED NOXIOUS WEEDS WITHIN HAWKESBURY RIVER COUNTY COUNCIL	
APPENDIX 4: TARGET WEEDS RECORDED & RECOMMENDED CONTROL METHODS	
APPENDIX 5: A GENERIC GUIDE TO MONITORING PROGRESS OF WORKS IN BUSHLAND REHABILITATION PROGRAMS	
APPENDIX 6: LIST OF INDIGENOUS SPECIES RECOMMENDED FOR ENRICHMENT PLANTING	
APPENDIX 7: BUSHLAND REHABILITATION - EXPERIMENTAL TRIALS	
APPENDIX 8: GLOSSARY	
APPENDIX 9: DEFINITION OF TERMS UNDER LOCAL GOVERNMENT ACT 1993	
APPENDIX 10: PLATES	

LIST OF FIGURES

FIGURE 1.1: SUBJECT LAND LOCATION	2
FIGURE 1.2 SITE DETAILS	5
FIGURE 1.2(A) RESERVE 116 CATEGORIES UNDER LOCAL GOVERNMENT ACT 1993	9
FIGURE 1.2(B) RESERVE 256 CATEGORIES UNDER LOCAL GOVERNMENT ACT 1993	10
FIGURE 3.1: PARISH MAP SHOWING HISTORICAL CONTEXT.....	16
FIGURE 3.2A MANAGEMENT ZONES – RESERVE #116.....	21
FIGURE 3.2B MANAGEMENT ZONES – RESERVE #256.....	22
FIGURE 5.1: MAPPED NATIVE VEGETATION COMMUNITIES (NPWS 2002).....	27
FIGURE 5.2A: VEGETATION COMMUNITIES – RESERVE #116.....	28
FIGURE 5.2B: VEGETATION COMMUNITIES – RESERVE #256.....	29
FIGURE 5.3A: LOCATION OF THE THREATENED SPECIES <i>DILLWYNIA TENUIFOLIA</i> – RESERVE #116.....	31
FIGURE 5.3B: LOCATION OF THE THREATENED SPECIES <i>DILLWYNIA TENUIFOLIA</i> – RESERVE #256.....	32
FIGURE 5.4A: CONDITION OF BUSHLAND MAP – RESERVE #116	35
FIGURE 5.4B: CONDITION OF BUSHLAND MAP – RESERVE #256	36
FIGURE 5.5A: HABITAT MAP – RESERVE #116	40
FIGURE 5.5B: HABITAT MAP – RESERVE #256.....	41
FIGURE 5.6 CONNECTIVITY & LINKAGES	42
FIGURE 6.1: BUSHFIRE PRONE LAND MAP	53
FIGURE 6.2: EXISTING TRACK NETWORK	59
FIGURE 8.1: PROPOSED TIMETABLE OF WORKS	81

LIST OF TABLES

TABLE 2.1: GUIDELINES FOR CATEGORISATION OF COMMUNITY LANDS & CORE OBJECTIVES.....	7
TABLE 2.2: SUMMARY OF POLICIES, PLANNING & LEGISLATIVE REQUIREMENTS.....	12
TABLE 3.1: SUMMARY OF LEGAL DESCRIPTION	13
TABLE 3.2: PHYSICAL FEATURES OF THE SUBJECT SITE & ENVIRONS	17
TABLE 3.3: BIOLOGICAL CHARACTERISTICS	18
TABLE 3.4: SUMMARY OF SERVICES AND MANAGEMENT HISTORY	19
TABLE 5.1: REGIONAL SIGNIFICANCE OF FLORA SPECIES WITHIN THE SUBJECT LAND (NPWS 1997) ..	33
TABLE 5.2: WEED SPECIES, ABUNDANCE AND ID CODE	37
TABLE 5.3: INCIDENTAL SIGHTINGS OF FAUNA SPECIES	38
TABLE 7.1: LIST OF MAIN WEEDS & INTRODUCED PLANTS IDENTIFIED IN THE GEORGE STREET RESERVES	64
TABLE 8.1: SUMMARY OF MANAGEMENT ISSUES, STRATEGIES AND ACTIONS - GENERAL GUIDES	69



1 INTRODUCTION

1.1 BACKGROUND INFORMATION

Urban Bushland Management Consultants Pty Ltd (**UBMC**) has been retained by Hawkesbury City Council (**Council**) to prepare a Plan of Management for three (3) land parcels in Bligh Park.

The George Street Reserve (Reserve #116) is Crown Land under the care and control of Council, while the adjoining George Street Reserve & Bushfire Headquarters (Reserve #256) is community land owned by Council. As the subject land supports remnant native vegetation of State and National conservation significance, Council has requested that a single Plan of Management be developed which addresses the management of the two (2) reserves as an integrated unit.

The *Local Government Act 1993* (**the LG Act**) defines community land as public land which is vested in or under the control of a council. Under Section 36 of the *Act*, local councils must prepare draft plans of management for community lands.

Under Section 36(3), a plan of management for community land must identify the following:

- a. the category of the land;
- b. the objectives and performance targets of the plan with respect to the land;
- c. the means by which the council proposes to achieve the plan's objectives and performance targets; and
- d. the manner in which the council proposes to assess its performance with respect to the plans objectives and performance targets;

.....and may require the prior approval of the council to the carrying out of any specified activity on the land.

The *LG Act* places specific obligations on Local Government in the management and administration of public land classified as community land under their ownership, or community land under the ownership of other State or Commonwealth departments or agencies, but with care, control and management vested in the local council.

Under the *LG Act*, community land is required to be categorised according to the land use, attributes or specific characteristics of the land. Lands are to be evaluated on the basis of their conservation value in terms of natural or cultural environmental heritage to the local, regional or National context, and to prepare a plan of management to manage the lands appropriately.

Both reserves support remnant native vegetation and are categorized under the *LG Act* as **Natural Area (Bushland)**. The community tennis courts in Reserve #116 are categorised as **General Community Use**, while in Reserve #256, one (1) section is categorized as a **Park**.

This draft Plan of Management (**the PoM**) establishes the framework for the effective management of the George Street Reserves in accordance with the requirements of the *LG Act*.

The regional positioning of the George Street Reserve (#116) and adjoining George Street Reserve & Bushfire Headquarters (#256) (hereafter collectively the subject land - **the George Street Reserves**) is shown in Figure 1.1.



Figure 1.1
Subject Land Location





1.2 SITE IDENTIFICATION & LAND SCHEDULE

Name	Address	Lot Number / DP	Co-ordinates (Size/ha)
Reserve #116 George Street Reserve	2 Colonial Drive/720 George Street, Bligh Park	Lot 89 DP 709025 and Lot 385 DP 723627	56 96900 / 62 75300 (4.1096 ha)
Reserve #256 George Street Reserve & Bushfire Headquarters	724 George Street/ 19 Wetherill Crescent/ Thorley Street, Bligh Park	Lot 453 DP 749371	56 294700 / 62 75700 (2.813 ha)

1.3 PLAN AIMS & OBJECTIVES

A plan of management for a bushland reserve is an important document as it serves to clarify the goals and objectives of management and the restoration program, and clearly sets out the proposed actions and their general sequence. Other tasks not necessarily related to bushland restoration may also be included. For example, infrastructure works, track construction, fencing, signage, soil erosion and remedial drainage works form an integral part of any such plan (DIPNR 2003).

The essential role of a plan of management is to identify appropriate goals and objectives, to determine best-practice management strategies, and to provide guidelines for on-going assessment and review. The plan will also serve as a vehicle for agreement between all stakeholders.

The aims and objectives of the PoM for the George Street Reserves have been developed to ensure the on-going development of open space strategies and administrative policies within Council to effectively protect and conserve the natural areas included within this Plan. Strategies for the management of other open space/recreational areas within the Reserves are also identified.

Within the context of the continued provision of Council services to the community regarding these lands, this PoM identifies the significant natural areas of bushland, and establishes the means of managing the environmental values of the land.

Note that this PoM does NOT constitute a detailed 'works plan' for undertaking of on-ground works. Works plans (or action plans) are most often prepared by the contractors employed to undertake the bushland restoration program, and as these determine on-grounds works and provide a timetable of works and a costing, they will need to be updated as the work program progresses.

Works plans should be set within the context and framework of the adopted plan of management for the subject land.



1.4 SCOPE OF WORK

This PoM has been prepared in accordance with the requirements of the *Local Government Act 1993*. The scope of works for the preparation of such plans has been defined by the *LG Act* and is set out as follows:

- Comprehensive review and updating of information and other baseline data held by Council relating to the geophysical and biological resources and values of the subject land;
- Identification and mapping of ecological communities, plant associations and location of threatened species occurring on the subject land;
- Review of local planning, State and Commonwealth government policies and legislative requirements and their relevance to the subject land, with Council's role and responsibilities clearly defined;
- Defined vision, goals, objectives and strategies for management of the George Street Reserves for nature conservation, passive recreation, education, landscape enhancement and other values (as appropriate).
- Rehabilitation and management strategies, including remedial measures for existing impacts and recommend strategies to ameliorate potential future threats;
- Infrastructure requirements, including signage, pathways, seating and other public amenities (if appropriate), and where appropriate;
- Community participation – including review of existing roles/contribution, recommendations for role enhancement, educational opportunities etc.

1.5 PLAN TENURE

This PoM for the George Street Reserves has been prepared to cover the next five (5) year period; commencing from the date of its adoption by Council.

Under Section 42 of the *LG Act*, a plan of management for community land may remain in force unless the plan is revoked by Council, or the land is reclassified as 'operational land', or if the land is not owned by Council the land ceases to be controlled by Council.

However as this PoM deals with the restoration and management of remnant native bushland – which is a dynamic process - after five (5) years the PoM should be reviewed, the progress of works assessed using the Performance Indicators identified, and relevant management strategies and actions amended as required.

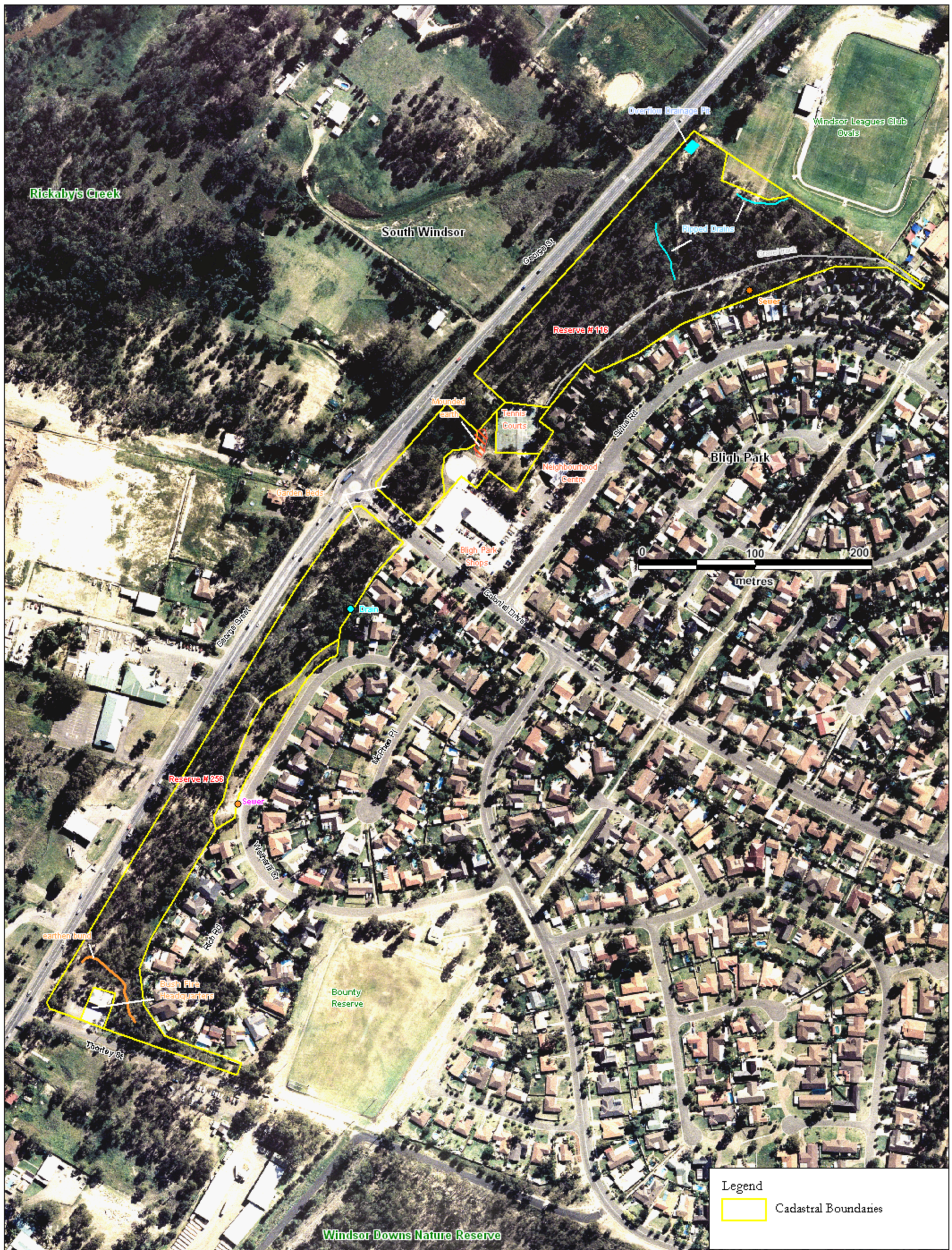


Figure 2.1
Site Details



2 STATUTORY & PLANNING CONTEXT

2.1 LAND TENURE & ZONING

The subject land – the George Street Reserve (#116) and George Street Reserve & Bushfire Headquarter (#256) – is managed by Council. Under *Hawkesbury Local Environment Plan 1989* (as amended August 2005), in Reserve #116 Lots 89 and 358 are zoned as Housing (Crown Land), and in Reserve #256 Lot 453 zoned as 6(a) Open Space Existing Recreation.

2.2 LAND CATEGORY

Reserve # 116 George Street Reserve, is categorised as a Natural Area under Section 36(4) of the *LG Act*. Under Section 36(5), that part of the Reserve categorised as a Natural Area is further categorised as 'Bushland'. The community tennis courts located within the Reserve are categorised as General Community Use (Section 36 [I])

Reserve #256 George Street Reserve & Bushfire Headquarters, is categorised as a Natural Area (Bushland), with one (1) section categorised as a Park under Section 36(4) of the *LG Act*.

The *LG Act* section 361 provides for the management of community land as follows.

“The core objectives for management of community land categorised as general community land are to promote, encourage and provide for the use of the land, and to provide facilities on the land, to meet the current and future needs of the local community and of the wider public:

- (a) In relation to public recreation and the physical, cultural, social and intellectual welfare or development of individual members of the public; and
- (b) In relation to the purposes for which a lease, licence or other estate may be granted in respect of the land (other than the purposes of public utilities and works associated with or ancillary to public utilities).”

2.3 LOCAL GOVERNMENT ACT S36 CORE OBJECTIVES - COMMUNITY LAND

The greater part of the subject land has been categorized as Natural Area (Bushland), with an area of General Community Land in Reserve #116, and one (1) part of Reserve #256 also being categorised as a Park.

As prescribed under section 36E of the *LG Act*, all Councils are required to manage Community Land categorised as Natural Area in accordance with the following core objectives.

- To conserve biodiversity and maintain ecosystem function in respect of the land, or the feature or habitat in respect of which the land is categorised as a Natural Area; and
- To maintain the land, or that feature of habitat, in its natural state and setting; and
- To provide for the restoration and regeneration of the land; and
- To provide for community use of and access to the land in such a manner as will minimise and mitigate any disturbance caused by human intrusion; and
- To assist in and facilitate the implementation of any provisions restricting the use and management of the land that are set out in a Recovery Plan or Threat Abatement Plan prepared under the *Threatened Species Conservation Act 1995* or the *Fisheries Management Act 1994*.

The PoM for the George Street Reserves, Bligh Park has been prepared to fulfil each of the core objectives set out above.



2.4 RESTRICTIONS APPLYING TO THE USE OF COMMUNITY LAND

Restrictions on the use of Community Land accord with Chapter 6, Part 2 of the *LG Act*, which states that:

Community land must not be sold, leased or licensed for more than 21 years and may only be leased or licensed for more than five (5) years if public notice of the proposed lease or licence is given and, in the event that an objection is made to the proposed lease or licence, the Minister's consent is obtained.

Further, the *LG Act* states that for Community Land for which a plan of management has been developed, its use must not change until the plan is adopted, and its use and management must be in accordance with:

- The plan of management adopted by Council; and
- Provisions of any relevant law.

Restrictions on the sale or lease of community land for which a plan of management has been adopted are as set out for community land, above.

2.5 LOCAL GOVERNMENT ACT S36 CORE OBJECTIVES FOR BUSHLAND & PARK

The *Local Government (General) Regulation 2005* prescribes clear guidelines for the categorising community land. The definitions provided by the *LG Regulation*, and core objectives for the relevant categories of General Community Use, Bushland and Park are provided in Table 2.1, below.

Table 2.1: Guidelines for Categorisation of Community Lands & Core Objectives

Category	Description	Core Objectives
General Community Use	Is a category of land that should be applied where the land may be available for use for any purpose for which community land may be used, whether by the public at large or by specific sections of the public. It includes land that does not fall into the categories of natural area, sportsground, park or area of cultural significance.	<ul style="list-style-type: none">▪ To promote, encourage and provide for use of the land, and to provide facilities on the land, to meet the current and future needs of the local community and the wider public;▪ (a) in relation to public recreation and the physical cultural, social and intellectual welfare or the development of individual members of the public; and▪ (b) in relation to purposes for which a lease, licence or other estate may be granted in respect of the land (other than the provision of public utilities and works associated with or ancillary to public utilities).
Bushland	Under Section 36(5) of the Act, the term bushland is assigned to land that contains primary native vegetation, and vegetation that is: (a) The natural vegetation or a reminder of the natural vegetation of the land, or (b) Although not the natural vegetation of the land, is still representative of the structure or floristics, or structure and floristics, of the natural vegetation in the locality.	<ul style="list-style-type: none">▪ To ensure the ongoing ecological viability of the land by protecting the ecological biodiversity and habitat values of the land, the flora and fauna (including invertebrates, fungi and micro-organisms) of the land and other ecological values of the land, and▪ To protect the aesthetic, heritage, recreational, educational, and scientific values of the land, and



Category	Description	Core Objectives
	<p>Such land includes:</p> <ul style="list-style-type: none"> - bushland that is mostly undisturbed with a good mix of tree ages, and natural regeneration, where the understorey is comprised of native grasses and herbs or native shrubs, and which contains a range of habitats for native fauna (such as logs, shrubs, tree hollow and leaf litter), or - moderately disturbed bushland with some regeneration of trees and shrubs, where there may be a regrowth area with trees of even age, where native shrubs and grasses are present in the understorey even though there may be some weed invasion, or - highly disturbed bushland where the native understorey has been removed, where there may be significant weed invasion and where dead and dying trees are present, where there is no natural regeneration of trees or shrubs, but where the land is still capable of being rehabilitated. 	<ul style="list-style-type: none"> ▪ To promote the management of the land in a manner that protects and enhances the values and quality of the land and facilitates public enjoyment of the land, and to implement measures directed to minimising or mitigating any disturbance caused by human intrusion and ▪ To restore degraded bushland, and ▪ To protect existing land forms such as natural drainage lines, watercourses and foreshores, and ▪ To retain bushland in parcels of a size and configuration that will enable the existing plant and animal communities to survive in the long term, and ▪ To protect bushland as a natural stabiliser of the soil surface.
Park	<p>Is land that is or is proposed to be, improved by landscaping, gardens or the provision of non-sporting equipment and facilities, for use mainly for passive or active recreational, social, educational and cultural pursuits that do not unduly intrude on the peaceful enjoyment of the land by others.</p>	<ul style="list-style-type: none"> ▪ To encourage, promote and facilitate recreational cultural, social and educational pastimes and activities, and ▪ To provide for passive recreational activities or pastimes and for the casual playing of games, and ▪ To improve the land in such a way as to promote and facilitate its use to achieve the other core objectives for its management.

This PoM for the George Street Reserves, Bligh Park has been prepared to fulfil each of the core objectives set out above.

See Appendix 9 for *Definition of Terms* under the *LG Act*.



HAWKESBURY CITY COUNCIL

P.O. Box 145, Windsor NSW 2755
Website: www.hawkesbury.nsw.gov.au
Email: council@hawkesbury.nsw.gov.au
Hours: Monday to Friday 9.00am - 5.00pm
(Closed 12 Dec 2016)



Figure 1.2(a) Reserve 116 Categories Under Local Government Act 1993





2.6 COUNCIL MANAGEMENT OBJECTIVES FOR GEORGE STREET RESERVES

The protection of remnant bushland within the City of Hawkesbury is a high priority of Council. The ecological values of bushland on public land are considered of significance to the community, and any development of recreation of community facilities on such sites can only occur where it can be demonstrated that the site's ecological values are not threatened.

This PoM establishes a framework for the management of the George Street Reserves in accordance with the requirements of the *LG Act*.

Vision Statement – the George Street Reserves will be conserved as a valuable remnant of two (2) significant ecological communities - Cumberland Plain Woodland and Shale-Gravel Transition Forest - and will be managed jointly by Council and the community for their natural conservation values. The Reserves will also continue to be available to the local community for passive recreational usage, and where designated, for active recreation.

In order to achieve this Vision, a series of management objectives are proposed. These incorporate the core objectives set out in the *LG Act* (see Table 2.1), and include a number of supplementary objectives.

These supplementary objectives are set out as follows:

- To develop proactive land management policies for the remnant Cumberland Plain Woodland and Shale-Gravel Transition Forest ecological communities within the subject land;
- To establish practical and cost effective management strategies to assist in the conservation, regeneration and/or restoration of remnant native bushland within the subject land;
- To manage the bushland regeneration process to ensure the retention of suitable habitat for those threatened and/or significant flora and fauna species present in the subject land;
- To provide a means of managing the Reserves in order to retain the natural values inherent in the flora, fauna and landscape elements, and their relationship to the local community;
- To provide a means for the monitoring the environmental management of the Reserves;
- To protect adjoining residents from potential hazards arising from the retention of bushland on residential boundaries, including bushfire;
- To provide for community access and usage, including establishing areas for passive recreation and environmental education; and
- To provide a timetable of works and to establish a protocol for the review for the POM within five (5) years of adoption by Council.



2.7 LEGAL AND PLANNING FRAMEWORK

A number of local planning policies, as well as State and Commonwealth acts and policies apply to the management of remnant native vegetation (bushland) within Hawkesbury LGA. The most relevant of these are listed in Table 2.2, below.

Table 2.2: Summary of Policies, Planning & Legislative Requirements

Government Level	Relevant Policy /Legislation	Relevance to Subject Site
Local	<i>Hawkesbury Local Environment Plan 1989, Amended August 2006</i>	Under the LEP, Reserve #116 is zoned Housing (Crown Land), while Reserve #256 is zoned 6(A) Recreation.
State	<i>Local Government Act 1993, incorporating Community Lands Amendment Act 1998</i>	Section 36 of the Act requires all local councils to prepare draft plans of management for community land under its care, control and management.
	<i>Threatened Species Conservation Act 1995</i>	Two (2) endangered ecological communities occur - Cumberland Plain Woodland and Shale Gravel Transition Forest (see Appendix 1). The threatened shrub – <i>Dillwynia tenuifolia</i> – occurs in the subject land. No other threatened flora species listed under the Schedules of the <i>TSC Act</i> are known to occur in the subject land. No threatened fauna species are known to occur in the subject site.
	<i>Noxious Weeds Act 1993</i>	There were eight (8) noxious weed species recorded for the subject land (see Appendix 3). As the landowner, Council has a legal responsibility to control and prevent weed spread to adjoining land.
	<i>Rural Fires Act 1997 / Amendment Act 2002</i>	Council's Bushfire Risk Management Plan (see Figure 6.1) defines the bushfire risk within the subject land and surrounding areas for a distance of >100 metres as 'minor' due to the extensive rural residential and residential development surrounding the site (Conacher Travers 2004). Overall, the fire risk in this bushland is classed as 'low' on a local scale, but fire within the Reserves would potentially impact on reserve infrastructure (signage, fencing) and on private property adjoining. The Hazard Reduction Program prepared for the Reserves recommends hazard reduction at the interface to be achieved by slashing a 6-metre wide strip to reduce the fuel load in the understorey (i.e. creation of an Asset Protection Zone).
	<i>State Environmental Planning Policy No 19 – Bushland in Urban Areas</i>	As community land, the aims, objectives and requirements of SEPP-19 applies only to land zoned as Open Space. Therefore land in Reserve #116 (as Crown Land) does not fall under the protection of this SEPP. Clause 9 of the Policy requires development on adjoining land to be cognisant of the aims of SEPP-19. This is relevant to any development or redevelopment on adjoining land (residential or commercial).
Federal	<i>Environment Protection and Biodiversity Conservation Act 1999</i>	One endangered ecological community - Cumberland Plain Woodland - occurs within the subject land. The threatened shrub – <i>Dillwynia tenuifolia</i> – occurs in the subject land. No other threatened flora species listed under the Schedules of the <i>EPBC Act</i> are known to occur in the subject land. No threatened fauna species listed under this Act are known to occur within or utilise the resources of the subject land.



3 SITE DESCRIPTION

3.1 LEGAL DESCRIPTION

Table 3.1 below, summarises the legal description of the subject land – the combined George Street Reserves.

Table 3.1: Summary of Legal Description

Title Information	Reserve # 116 George Street Reserve Lot 89 DP 709025 & Lot 385 DP 723627 Reserve #256 George Street Reserve & Bushfire Headquarters Lot 256 DP 749371
Ownership	Crown Land and Hawkesbury City Council, respectively
Location	Reserve # 116 - 2 Colonial Drive/ 720 George Street, Bligh Park. Reserve #256 – 724 George Street, 19 Wetherill Crescent and Thorley Street, Bligh Park Collectively, extending from Thorley Street (south) to Rifle Range Road (north). Bisected by Colonial Drive. Entry points at each of above named streets, with rights of way at Golden Grove and Charlotte Place. Contiguous with Agnes Banks Nature Reserve via road reserve on Thorley Street.
Total Area	Reserve # 116 - 4.1096 ha Reserve #256 - 2.813 ha Total 6.923 hectares (69,226 sq metres)
Zoning (LEP 1989, Amendment 2006)	Reserve #116 - Housing (Crown Land) Reserve #256 - 6(A) Open Space Existing Recreation
Classification (LGA)	Reserve #116 -Crown Land & Reserve #256 - Community Land
Categorisation (LGA)	Reserve #116 Natural Area (Bushland) and General Community Use (tennis courts) Reserve #256 Natural Area (Bushland) and Park
Land Use and Public Purpose	Reserves #116 and #256 - conservation and passive recreation Reserve #116 – tennis courts (General Community Use) A small parcel has been excised from the reserves for the Sydney Water Pumping Station. <u>Note:</u> portion of Windsor Leagues Club oval has been constructed on northern portion of Reserve #116.

3.2 LOCATION & SETTING

The George Street Reserves form part of a vegetated corridor running between Rickabys Creek (west) and the 331 hectare Windsor Downs Nature Reserve to the south-east. To the south and south-west, the site links with bushland along The Driftway and the Agnes Banks Nature Reserve.

Together the George Street Reserves form an area some 6.923 hectares in size, which includes both woodland and open (managed grassland) areas. Community tennis courts are located in Reserve #116, near the Bligh Park Shopping Centre, while the Hawkesbury Bushfire Headquarters is located at George & Thorley Streets, at the southern end of Reserve #256.

Sydney Water WPS 130 (Toorah) is located close to the southern end of Reserve #116, near the Bligh Park Neighbourhood Centre and Shops on land which has been excised from the Reserve.

The Reserves are bounded to the east by suburban development in Bligh Park, by commercial development on George Street (west), Thorley Street (south), and the Windsor Leagues Club Oval and Playing Fields to the north.



A number of other reserves and bushland remnants in Bligh Park and South Windsor are clustered in the immediate vicinity of the George Street Reserves. These include

- Windsor Downs Nature Reserve (east and south-east)
- Bushland along Rickabys Creek (west); and
- Bushland along The Driftway (south-west)

Nearby Bounty and Colonial Reserves are managed by Council and although they retain some native vegetation on the perimeters, they are maintained as sporting facilities (open-space).

3.3 CULTURAL & HISTORIC DESCRIPTION

3.3.1 Pre European Heritage

Several Aboriginal sites have been identified for the local area (see Aboriginal Heritage Information Management System – DEC website). A number of Aboriginal relicts, including three (3) open camp sites have been identified within the Rickabys Creek Corridor, which is located nearby, north to north-east of the subject land (from Conacher Travers 2004).

It is not known if any such Aboriginal sites are located on the land now occupied by the George Street Reserves. As there are no rock outcrops anywhere within the subject land, and the sites has been extensively disturbed over a period of many years, initially by grazing and latterly by suburban development, it would seem unlikely that such relicts would occur.

3.3.2 European Heritage

The area known as Bligh Park was part of the original Richmond Common², an area some 5000 acres in size declared in 1804 by Governor King to provide common grazing land. The Common was declared even before the townships of Richmond and Windsor were established by Governor Macquarie, although there were a number of farming properties along nearby South Creek at that time (see Figure 3.1)

At some stage, the Common reverted to Crown Land, and various parcels were progressively excised: first for the town of Richmond, then for Glebe land (St Matthews), the railway (1864), a racing track (1868), a rifle range, and Hawkesbury Agricultural College (1892), followed by an airfield (1911) (H. Proud foot, in preparation.

Although South Windsor was laid out as part of Macquarie's plan for Windsor in about 1810, the suburb was not really developed until the 1850s, with Ham Street next to the present day South Windsor Industrial Area forming the southern boundary of the new suburb. Apart from scattered farms along South and Rickabys Creeks, there was no residential development south of Ham Street

George Street, which runs from Richmond Road north to Macquarie Street at South Windsor, and Windsor Road at the South Creek Bridge, forms the western boundary of the George Street Reserves. Although it is not well documented in local histories, it seems likely that a rough track existed between Richmond Road (built 1819) and Windsor – if only to serve the settlers along South Creek. This track would have passed through the southern part of the Common, next to or through the subject land at present day Bligh Park.

² From around 1835, it was also known as Ham Common.



As the area is known to be flood prone, George Street was reconstructed by the Roads & Traffic Authority and raised on a causeway to protect housing in Bligh Park. It has existed in its present alignment since the mid 1980s (date not determined).

It is significant that the grazing tradition in this part of the Hawkesbury extends back some two (2) hundred years. For example, nearby Windsor Downs (south-east of George Street) was developed (circa 1990) on grazing land once owned by the Angliss Meat Company, with the 332 hectares of CPW now reserved in Windsor Downs Nature Reserve having formed part of Richard Rouse's Jericho Farm Grant.

Anecdotal evidence suggests that the subject land along George Street continued to be used for stock grazing (possibly on a lease basis) until the early 1980s, when the Bligh Park Estate was proposed by the State Government, with 200 hectares (2,200 Lots) being released for housing in 1982. Developed on land known as The Rifle Range and Temporary Common, and bounded to the north by Rifle Range Road, the Bligh Park Estate was developed as a joint venture between Hawkesbury City Council and Lancom, with construction starting in 1985. Bligh Park saw enormous growth between 1991 and 1995, with the growth rate being five (5) times faster than the average growth rate across the Hawkesbury (The Gazette, November 29, 2000).

The land forming the George Street Reserves was subsequently retained by the Crown (#116) and by Council (#256), with care and control of the Crown Land portion vested in Council. The land itself remains in the ownership of the Crown.



3.4 PHYSICAL DESCRIPTION

The physical characteristics of the subject sites – the George Street Reserves, and the immediate locality have been summarised in Table 3.2, below.

Table 3.2: Physical Features of the Subject Site & Environs

FEATURE	DESCRIPTION
Co-ordinates	Reserve #116 – 56 96900 62 75300 Reserve #256 – 56 294700 62 75700
Topography	Locality - dissected, gently undulating low rises on the Tertiary terraces of the Hawkesbury Nepean River System. Generally flat terrace tops dissected by present day channels and narrow drainage lines (Bannerman & Hazelton 1990). Subject land (Reserve #116 & #256) – comprises gently sloping land, with upslopes of between 1-5°, with cross slopes in some areas.
Geology	Tertiary alluviums and colluviums resulting from three (3) depositional phases: St Marys; followed by the Rickabys Creek Gravels, and topped by the Londonderry Clay formation.
Soil Landscape Unit	The subject land is mapped as the Berkshire Park Soil Landscape Unit (a fluvial landscape). Berkshire Park soils are weakly pedal orange heavy clays and clayey sands, often mottled. Ironstone modules are common, with large silcrete boulders occurring in the sand/clay matrix. Limitations of this soil type include very high wind erosion if cleared; gully, sheet and rill erosion on dissected areas. Water logging, impermeable subsoils and low fertility. (Bannerman & Hazelton 1990).
Local Hydrology	The subject land is part of the greater Hawkesbury-Nepean Catchment and the Rickabys Creek sub-catchment. The area is known to be flood prone. As a result parts of George Street have been constructed on a raised causeway to protect houses in Bligh Park from flooding. No permanent drainage lines are present, although some ephemeral swales occur, generally running east/west. At least two (2) of these swales have been subject to 'drainage works' in recent years to carry water away from the Oval and direct it into a large stormwater overflow pit constructed at the north-western corner of Reserve #116. A series of stormwater drains have been constructed behind houses on the eastern boundary in order to intercept runoff water after heavy rain. A sewer main has been laid behind houses in Sirius Road and Wetherill Crescent.
Climatic Details	The mean daily maximum temperature is 23.7°C, with highest temperatures recorded in December, January and February. The mean daily minimum temperature is 10.9°C, with lowest temperatures recorded in June, July and August. Mean annual rainfall is 810.3 mm; with January, February and March recording the highest mean levels (Bureau of Meteorology 2005, Richmond RAAF #067033).



3.5 BIOLOGICAL DESCRIPTION

The biological description of the subject land is discussed in detail in Section 5 of the PoM.

Table 3.3: Biological Characteristics

Item	Descriptive	Status
Native Community	Shale Hills Woodland (Cumberland Plain Woodland)	Endangered ecological community – listed under the Schedules of the NSW <i>TSC Act</i> & Federal <i>EPBC Act</i>
	Shale-Gravel Transition Forest	Endangered ecological community – listed under the Schedules of the NSW <i>TSC Act</i>
Threatened Species	<i>Dillwynia tenuifolia</i>	Listed as threatened under the Schedules of the NSW <i>TSC Act</i> & Federal <i>EPBC Act</i>
Regionally Significant Species	22 flora species are listed as inadequately conserved (see Table 5.1)	Inadequately represented in conservation reserves in Western Sydney (NPWS 1997)
Noxious Weeds in Hawkesbury River Local Control Area	8 species present: three (3) woody weeds and five (5) herbaceous species (see Section 5.1.3)	<i>Noxious Weeds Act 1993</i> , Amendment 2005



3.6 MANAGEMENT CONTEXT

3.6.1 Services & Management History

Reserves services and infrastructure are detailed in Table 3.4, below, while the maintenance regime for the George Street Reserves (as made available by Council) has been summarised below.

Table 3.4: Summary of Services and Management History

Services & Infrastructure	<p>Reserve # 116 - a walking track has been installed from the main entrance (near the Shops & tennis courts, running behind houses on Sirius Street and Golden Grove; exiting at a right of way to Charlotte Place (see Figure 2.1). A number of informal (dirt) tracks have been created, which are utilised by pedestrians and bicycles. There are no picnic facilities or seating.</p> <p>The walking track is maintained and grassed edges are slashed by Council. A mown grassed fire break is maintained between bushland and adjoining residential properties, however this has been allowed to regenerate and/or has become overgrown in places (see Section 6.6).</p> <p>Reserve #256 - there is no formal walking track, although numerous tracks (and clearings) have been created throughout the bushland (see Figure 6.2). The Park area at Wetherill Crescent is defined and separated from the bushland by a raised bund and by treated logs installed at ground level. The bund has been appropriated by local children as a bicycle jump, with the 'circuit' extending into the bushland behind.</p> <p>Residential property fencing (timber and 'colour bond' metal construction) serves as the eastern boundary of both Reserves. The western boundary (fronting George Street) is unfenced. There is nothing to prevent vehicular access to either Reserve.</p> <p>There is no locational, interpretative or directional signage in either of the Reserves.</p> <p>Landscaping (utilising native species) has been undertaken on both sides of the road at the Colonial Avenue/George Street intersection. Signage identifying Bligh Park has been installed on the landscaped mounds raised at this intersection.</p>
Lighting & Solar Access	<p>There is no installed lighting in either of the Reserves. Lights from the Bligh Park Shopping Centre and community tennis courts impact on the adjacent bushland in Reserve #116.</p> <p>Street lighting adjacent to Reserve #256 impacts on some parts of the bushland, particularly next to the Park section adjacent to Wetherill Crescent.</p>
Current Grounds Maintenance	<p>Council is responsible for managing the firebreak, parkland and mown grasslands and other public areas, and for maintaining any park infrastructure. Slashing is carried out monthly in the summer growing season: less frequently in winter.</p> <p>Council is also responsible for the care and upkeep of the community tennis courts, with repairs to one of the courts having been recently undertaken.</p> <p>Students from the Richmond College of TAFE have undertaken bush regeneration activities in Reserve #116 periodically over the past three (3) years.</p>



3.6.2 Management History

The land forming the combined George Street Reserves was retained by the Crown (#116) and by Council (#256), with care and control of the Crown Land vested in Council. The site persisted as a treed reservation, and the understorey in both Reserves was regularly slashed until about 1994 (P. Mobbs, pers comm.). It has also been suggested that the undergrowth was kept in check by regular burns, although this has not been substantiated.

It is possible that this management regime has been, at least in part, responsible for the decline and displacement of many of the indigenous native understorey species, and for the invasion of weeds and pasture grasses such as African Love Grass (*Eragrostis curvula*). The high level of soil compaction which occurs in some areas may also be attributed to the slashing regime and to incursion by trucks and other machinery over a period of years.

The declaration of the Cumberland Plain Woodland ('CPW') as an endangered ecological community and its listing under the Schedules of the *TSC Act* in 1997 (see Appendix 1), and the identification of stands of the threatened shrub *Dillwynia tenuifolia* in the subject land have encouraged Council to review its management regime.

Slashing in the core bushland was discontinued about 1994, but the firebreak in Reserve #116 is maintained by slashing on a roughly monthly basis in the summer growing season (S. Perry HCC, pers comm).

Students from the NSW TAFE at Richmond have periodically worked in a number of small areas in Reserve #116, and it is understood that Hawkesbury River County Council – a single purpose weed authority established to control noxious weeds – has from time to time undertaken herbicide spraying to control Mother of Millions (*Bryophyllum delagoense*) (M. Engelhard, HCC pers comm.).

3.6.3 Establishment of Management Zones

For the purposes of the PoM, the subject land has been divided into a number of separate Management Units or Zones, according to the characteristic vegetation type, physical attributes such as their location within the subject land, and the management strategies proposed to achieve the Zone's categorised land use (i.e. Bushland, Park or General Community Use).

In order to provide consistency, attempts have been made to match Management Zones to the Weed Polygons illustrated in Table 5.2. Accordingly, Management Zones have been determined as follows (see Figure 3.2).

Reserve # 116 George Street Reserve

- Zone 1 – Commercial/Recreational Precinct (Colonial Drive/Sirius Road)
- Zone 2 – Residential Boundaries
- Zone 3 – George Street Embankment & Environs
- Zone 4 – Core Bushland

Reserve #256 – George Street Reserve & Bushfire Headquarters

- Zone 5 – Residential Boundaries
- Zone 6 – Bushfire Headquarters & Environs
- Zone 7 - George Street Interface
- Zone 8 – Core Bushland
- Zone 9 – Park Wetherill Crescent

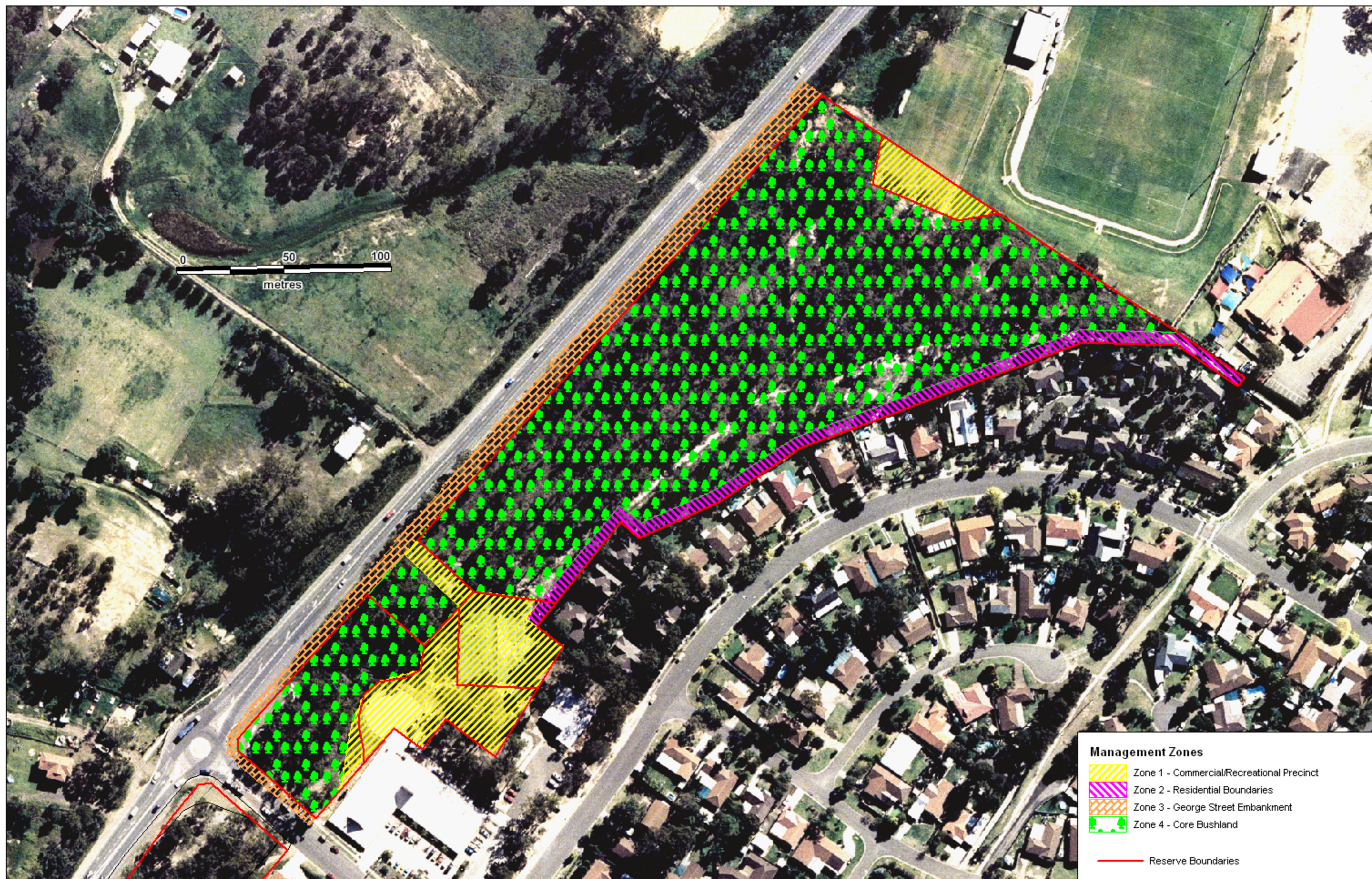


Figure 3.2 (a)
Management Zones - Reserve #116



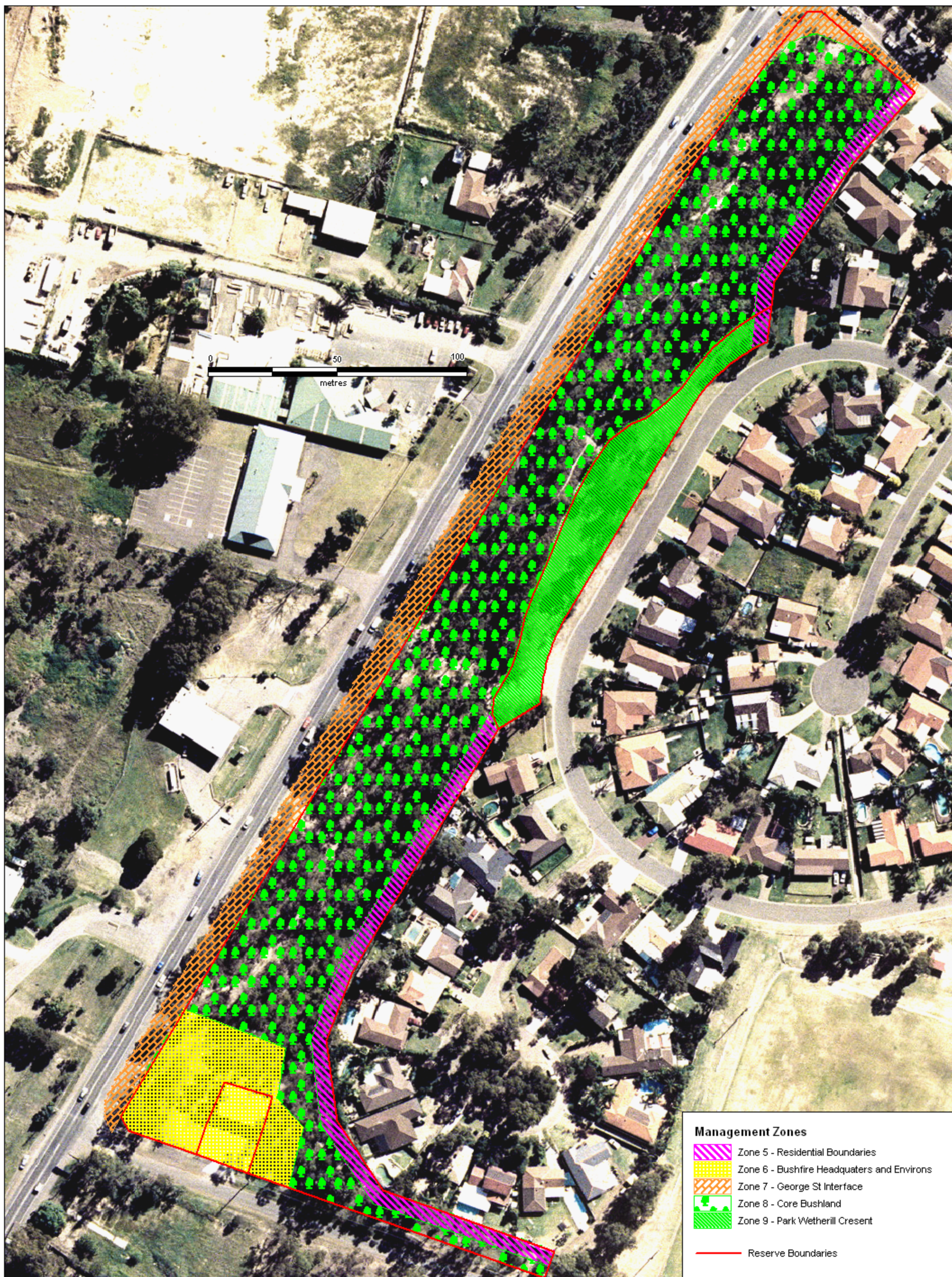


Figure 3.2 (b)
Management Zones - Reserve #256





4 PLAN PREPARATION - METHODOLOGY

4.1 LITERATURE REVIEW

During the preparation of this PoM, relevant Council files were accessed, previous studies and investigations for general locality, and local history sources were consulted. As the Plan is intended to serve as a 'stand alone' document, data and other background information has been sourced from these documents, and where appropriate incorporated into the PoM.

The main documents referenced were:

- Western Sydney: Urban Bushland Biodiversity Survey (NSW NPWS 1997).
- Native Vegetation of the Cumberland Plain (NPWS 2002);
- Hazard Reduction Program & Environmental Assessment for George Street Reserves, Conacher Travers 2004a and 2004b.
- EcoLogical Pty Ptd - Vegetation Mapping for Hawkesbury Local Government Area (draft 2005)

In addition, the *Environment Protection and Biodiversity Conservation Act* ('EPBC Act') Online Database (Department of the Environment and Heritage 2007; search area five (5) km radius around the subject land) and the NPWS Atlas of New South Wales Wildlife Database (Department of Environment and Conservation 2006; search area 10 km x 10 km centred on the subject land) were accessed to identify previous recordings of flora and fauna species of conservation significance within the region.

4.2 FIELD INVESTIGATIONS

Field survey and weed mapping was undertaken by Karen Visman (B. Env.Sc [Hons]) Toby Eastoe (BNatRes GradCertEnvMan), Judith Rawling ((BA, DipEd, DipEnvStud, MEnvStud) on 29 March 2007, with supplementary investigations carried out on a number of occasions in March and April.

Field investigations were undertaken to map vegetation communities and to prepare a list of native and introduced flora and fauna occurring within the subject land. Habitat assessment was also documented; as were the presence of linkages and connectivity to other bushland areas

Management issues common to both Reserves were identified; while a range of remedial actions and management strategies were considered. Methods used to undertake the flora and fauna surveys and to carry out the condition of bushland (weed) mapping are described below.

4.3 FLORA FIELD SURVEY

Karen Visman (B. Env.Sc [Hons]) conducted a botanical survey of the subject land on 29 March 2007 to map the native vegetation communities present, and to identify the flora species present. Approximately 5.5 hours was spent surveying the subject land.

Vegetation community classifications were consistent with NPWS (2002). Vegetation community boundaries were drawn on an aerial photograph. Where boundaries were indistinct on the aerial photograph, a GPS unit (Thales MobileMapper) was utilised to log the boundary location.

The distribution of *Dillwynia tenuifolia* was mapped with the MobileMapper. Points were recorded for clumps of individuals that were restricted to an area of approximately 15 square metres.



Polygons were recorded if the species occupied an area greater than 15 square metres. A stem count or estimate was undertaken for the species at each point and polygon.

The survey for *Dillwynia tenuifolia* was not undertaken during the peak flowering season of the species (which generally occurs in September). This species has a fairly sparse habit, and when it is not in flower can easily be overlooked. Further, due to the dense cover of African Love Grass (*Eragrostis curvula*) that is present through most of the site, individuals of the threatened plant were likely to have been obscured from sight. Consequently it is expected that the stem count provided in this PoM is an underestimate of the true population size.

4.4 FAUNA FIELD SURVEY

Field survey was undertaken by Toby Eastoe (BNatRes GradCertEnvMan) on 29 March 2007. Weather conditions during the survey were overcast, with little to no breeze and moderate temperatures (18°C-24°C).

An opportunistic diurnal fauna survey and a targeted search for likely threatened fauna species was carried out. Approximately 4.5 hours were spent opportunistically surveying the subject land for fauna occurring and evaluating the habitat. It is considered that this length of time was sufficient to determine the diversity of habitat present and its value to fauna species observed or likely to occur within the subject land. No nocturnal investigations were undertaken; and only incidental sightings of fauna were recorded as this is in line with the scope of this study.

Habitat assessment was carried out by surveying the entire study area on foot, using an adaptation of the Random Transect Method described by Cropper (1993). In areas of potential habitat for threatened species, this technique allows for greater coverage than plot-based surveys. This technique was used to ensure that all fauna habitat types were thoroughly investigated.

The diversity, structure and value of habitats for recorded or potentially occurring species was documented with reference to threatened species (*EPBC Act* and *TSC Act*). Targeted searches were made to identify habitat features such as ground debris including leaf litter, fallen logs or urban refuse; known feed trees, mature trees with hollows, connectivity of fauna corridors, aquatic environments and other habitat features important to the life cycle needs of threatened species known, or likely to occur in the study area.

A targeted search was also conducted during the survey for the threatened Cumberland Plain Land Snail *Meridolum corneovirens* which has been recorded (NPWS 1999) in the 10.8km² Windsor Downs Nature Reserve, centred about 1.5km from the subject land.

4.5 CONDITION OF BUSHLAND MAPPING

Field survey and supplementary weed mapping was undertaken by Judith Rawling (BA, DipEd, DipEnvStud, MEnvStud) and Toby Eastoe (BNatRes GradCertEnvMan), on 18 April 2007.

A Thales MobileMapper GPS unit was used to log data in the field, with locations being recorded in three (3) second increments. The MobileMapper is a hand-held unit, accurate of up to three (3) metres, and allowing for rapid translation of data into a Geographical Information System (GIS). Weed Polygons and Weed Points were defined to provide a logical basis for the sequence of weed management.

Isolated weed individuals were recorded as 'Weed Points'. Infestations that covered an area larger than 10 sq metres in size were recorded as 'Weed Polygons'.

The location of each Weed Polygon and Weed Point was recorded using the Thales MobileMapper. The boundaries of each Weed Polygon either walked or traversed using a 4WD vehicle; with the



MobileMapper logging in three (3) second increments. The location (easting, northing recorded in MGA) for each Weed Point was also collected on the MobileMapper.

The data recorded was downloaded from the MobileMapper into a GIS (MapInfo version 8.0) and additional field notes were added. This data was then used for the analysis and assessment of condition of vegetation, development of priority of works and map presentation.

For **Weed Polygons**, the abundance of each dominant target weed and the overall weed abundance of the polygon were recorded and mapped using the MobileMapper and hand-written field notes.

For **Weed Points**, the individual target weed was mapped (mostly for larger species).

Composition of Weed Polygons and Weed Points are presented in Table 5.2 and their position shown on Figure 5.4.

For grassed areas which are regularly mown, no weed mapping has been assigned. Such areas are described as 'non-bushland' and are labelled as such (e.g. Park off Wetherill Crescent)

4.6 COMMUNITY CONSULTATION

A public meeting was held at the Bligh Park Community Centre, Colonial Drive on 7 November 2006 in order to present the outcomes of the Community Lands Categorisation Project (UBMC for Council, 2007). At this meeting, the categories recommended by the consultants – i.e. Natural Area (Bushland) and General Community Use were adopted for Reserve #116 and Natural Area (Bushland) and Park for Reserve #256 (the George Street Reserves) were confirmed by the Community.

Subsequently, Council determined to prepare a PoM for the George Street Reserves. In accordance with the *LG Act 1993*, the draft PoM will be exhibited by Council for a minimum period of 28 days, and public comment will be invited.



5 FIELD SURVEY RESULTS

5.1 FLORA

5.1.1 Vegetation Communities

Previous Mapping

The subject land lies on the Penrith Sheet of the 1:100 000 vegetation map series (Benson 1992). Benson mapped the subject land as 'cleared'. Shale Gravel Transition Forest is mapped within one (1) kilometre of the southern boundary of the subject land.

The NPWS has produced a series of vegetation maps for the Cumberland Plain (NPWS 2002). The NPWS (2002) mapped the vegetation within the subject land as Shale Plains Woodland and Shale Gravel Transition Forest (see Figure 5.1). Shale Plains Woodland is a component of Cumberland Plain Woodland, which is listed as threatened under the *TSC* and *EPBC Acts*. Shale Gravel Transition Forest is listed as threatened under the *TSC Act*, but not under the *EPBC Act*.

Current Survey

The current field survey generally supports the NPWS mapping (2002). However, the boundaries between the Cumberland Plain Woodland and Shale Gravel Transition Forest have been slightly altered. A map of the communities identified during the current survey is provided in Figure 5.2.

A description of the native vegetation communities located in the subject land, and the dominant plants within each vegetation layer (or stratum), is provided below.

1. Cumberland Plain Woodland

Structure

Moderate cover of canopy trees, up to approximately 20 m in height. The sub canopy is generally sparse, reaching up to approximately eight (8) m in height. The shrub layer is generally moderate density, reaching up to approximately two (2) m in height. The groundcover density is generally moderate to dense, and reaches up to approximately 0.8 m in height.

Common Species (* denotes exotic species)

Canopy: Dominated by Grey Box (*Eucalyptus moluccana*).

Sub-canopy: Dominated by *Melaleuca decora*.

Shrubs: Dominated by Blackthorn (*Bursaria spinosa* subsp. *spinosa*), *Dillwynia sieberi*, *Melaleuca decora* Native Cherry (*Exocarpos cupressiformis*), *Dodonaea viscosa* subsp. *cuneata* and Gorse Bitter Pea (*Daviesia ulicifolia*). The threatened shrub species - *Dillwynia tenuifolia* – occurs fairly frequently throughout this community.

Ground layer: Dominant species include African Lovegrass (*Eragrostis curvula**), Mother of millions (*Bryophyllum delagoense**), Purple Burr-Daisy (*Calotis cuneifolia*), *Opercularia diphylla*, Three awn Speargrass (*Aristida vagans*), Vanilla Lily (*Arthropodium milleflorum*), *Austrodanthonia tenuior*, Creeping Saltbush (*Atriplex semibaccata*), Kangaroo Grass (*Themeda australis*), *Paspalidium distans*, Berry Saltbush (*Einadia hastata*), Blue Trumpet (*Brunoniella australis*), Native Wandering Jew (*Commelina cyanea*), *Murdannia graminea*, *Cheilanthes sieberi* subsp. *sieberi*, *Lomandra confertifolia* subsp. *rubiginosa*, Whiteroot (*Pratia purpurascens*) and *Goodenia hederacea* subsp. *hederacea*.

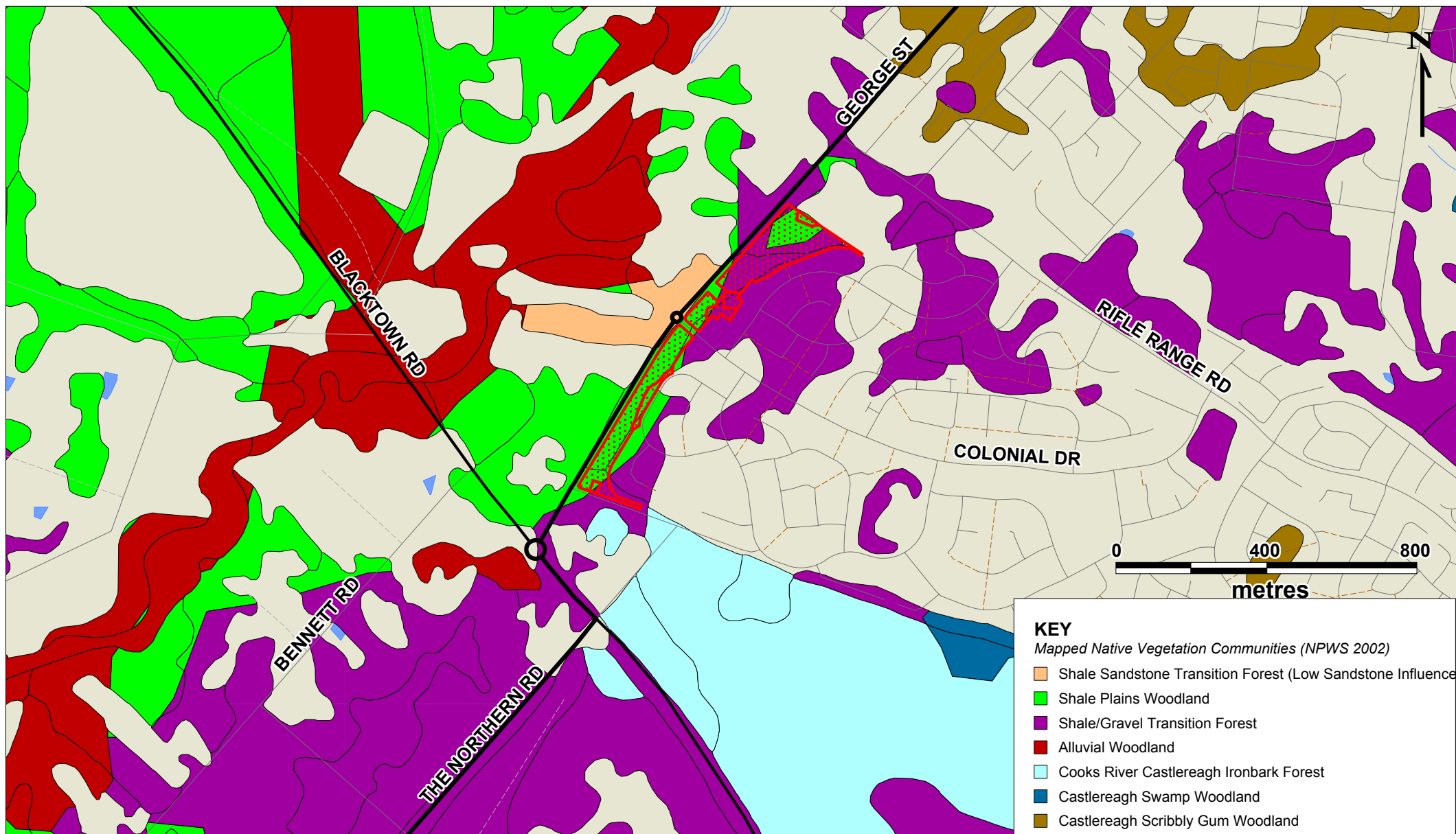


Figure 5.1
Mapped Native Vegetation Communities (NPWS 2002)

URBAN BUSHLAND
MANAGEMENT CONSULTANTS PTY LTD





Figure 5.2 (a)
Vegetation Communities - Reserve #116





Figure 5.2 (b)
Vegetation Communities - Reserve #256





2. Shale Gravel Transition Forest

Structure

Moderate cover of canopy trees, up to approximately 20 m in height. The sub canopy is moderate to absent, reaching up to approximately eight (8) m in height. The shrub layer is generally moderate to sparse, reaching up to approximately three (3) m in height. The groundcover density is highly variable (dense where there is an African Lovegrass infestation, and absent in areas that have been inflicted with severe disturbances), and reaches up to approximately 0.8 m in height.

Common Species (* denotes exotic species)

Canopy: Dominated by Red Ironbark (*Eucalyptus fibrosa*) and Grey Box (*Eucalyptus moluccana*).

Sub-canopy: Dominated by *Melaleuca decora*.

Shrubs: Dominated by Blackthorn (*Bursaria spinosa subsp. spinosa*), *Dillwynia sieberi* and Gorse Bitter Pea (*Daviesia ulicifolia*).

Ground layer: Dominant species include African Lovegrass (*Eragrostis curvula**), Purple Burr-Daisy (*Calotis cuneifolia*), Three awn Speargrass (*Aristida vagans*), Common Couch (*Cynodon dactylon**), Creeping Saltbush (*Atriplex semibaccata*), Kangaroo Grass (*Themeda australis*), Barbed Wire Grass (*Cymbopogon refractus*), *Paspalidium distans*, *Pomax umbellata*, Berry Saltbush (*Einadia hastata*), Native Wandering Jew (*Commelina cyanea*), Kidney Weed (*Dichondra repens*), *Cheilanthes sieberi subsp. sieberi*, Whiteroot (*Pratia purpurascens*) and *Goodenia hederacea subsp. hederacea*.

5.1.2 Indigenous Flora Species

A list of plant species recorded is provided in Appendix 2, along with their estimated relative abundance.

The threatened plant – *Dillwynia tenuifolia* – occurs widely throughout the subject land (see Figure 5.3 for distribution). *Dillwynia tenuifolia* is listed as ‘vulnerable’ under the *TSC Act* and the *EPBC Act* (Final Determination is provided in Appendix 1). It is estimated that approximately 85 individuals of this species are present within the subject land³.

Table 5.1 lists the native species recorded which are considered to be ‘inadequately represented’ in conservation reserves in Western Sydney, and therefore are of regional conservation significance (NPWS 1997).

³ This count is expected to be an underestimate of the true population size due to the reasons outlined in Section 4.3.



Figure 5.3 (a)
Location of the threatened species *Dillwynia Tenuifolia* - Reserve #116





Figure 5.3 (b)
Location of *Dillwynia tenuifolia* - Reserve #256



**Table 5.1: Regional Significance of Flora Species within the Subject Land (NPWS 1997)****KEY:****REG** = regionally significant**V1** = All regionally significant taxa and/or rare (5 or less records) taxa; **V2** = Vulnerable taxa which are uncommon (6-10 records); **V3** = Common to widespread taxa (>10 records). (NPWS 1997)

SCIENTIFIC NAME	SIGNIFICANCE	SCIENTIFIC NAME	SIGNIFICANCE
<i>Acacia fimbriata</i>	REG V1	<i>Dodonaea viscosa subsp. cuneata</i>	V3
<i>Amyema gaudichaudii</i>	V3	<i>Einadia trigonos</i>	V3
<i>Arthropodium milleflorum</i>	V3	<i>Eremophila debilis</i>	V3
<i>Atriplex semibaccata</i>	V3	<i>Eriochloa pseudoacrotricha</i>	V3
<i>Bothriochloa macra</i>	V3	<i>Glossogyne tannensis</i>	V3
<i>Calotis cuneifolia</i>	V3	<i>Melia azedarach</i>	V3
<i>Carex inversa</i>	V3	<i>Murdannia graminea</i>	REG V1
<i>Chenopodium ?pumilio</i>	REG V1	<i>Oxalis perennans</i>	V3
<i>Chloris ventricosa</i>	V3	<i>Portulaca oleracea</i>	V3
<i>Cyperus gracilis</i>	V3	<i>Sporobolus creber</i>	V3
<i>Dillwynia tenuifolia</i>	REG	<i>Vittadinia cuneata</i>	V3

5.1.3 Introduced/Exotic Flora Species

The following eight (8) species listed as ‘noxious plants’ in the Hawkesbury River Local Control Area were all recorded within the subject land:

- African Boxthorn (*Lycium ferocissimum*);
- Bridal Creeper (*Asparagus asparagoides*);
- Johnson Grass (*Sorghum halepense*);
- Mother of Millions (*Bryophyllum* spp);
- Oxalis (*Oxalis* sp);
- Prickly Pear (*Opuntia* sp);
- Privet (Broad leaf) (*Ligustrum lucidum*); and
- Privet (Narrow-leaf/Chinese) (*Ligustrum sinense*).

Of these, the Mother of Millions is the most widespread. The required actions for noxious weed control are outlined in Appendix 4. Noxious weed control is the responsibility of the landowner – in this case Hawkesbury City Council (*Noxious Weeds Amendment Act 2005*).

Hawkesbury is one of four (4) constituent councils forming the Hawkesbury River County Council (**‘HRCC’**), a single-purpose council responsible for undertaking noxious weed control on public lands. HRCC is funded in part by the NSW Department of Primary Industry and in part by its constituent councils. As such, HRCC is responsible for undertaking noxious weed control on public land within the LGA, including the George Street Reserves at Bligh Park.

In addition to the noxious weeds listed above, there are a number of environmental weeds present: the dominant species being African Lovegrass (*Eragrostis curvula*) – a pasture species introduced into the Hawkesbury for stock grazing purposes.



A full list of noxious and environmental weeds has been presented as Table 7.1 (Section 7). Weed invasion as a management issue is discussed in Section 6.5 of the PoM, with weed ecology and weed control methods outlined in Section 7.5 and 7.7 respectively.

5.2 CONDITION OF BUSHLAND

Figure 5.4 and accompanying Table 5.2 illustrates the general condition (or health) of the bushland by identifying areas of weed infestation.

As anticipated, with the exception of African Love Grass and Mother of Millions– which are widespread in the understorey - most weed infestations occur on edge sites, particularly at the interface between bushland and adjoining residential development (see George Street, Bainbridge Crescent & Acropolis Drive boundaries).

Dumping and storage of unwanted materials (timbers, bricks etc) behind property fences creates a significant weed problem for the adjoining bushland and impacts negatively on local landscape values. Sites at lower elevations and in drainage lines where soils are wetter also have higher weed densities than bushland located on drier soils.

Note the condition of bushland map (Figure 5.4) does not provide an indication of floristic diversity or structural integrity for the bushland, but it only illustrates the % of introduced (or weed) species occurring within each Reserve.



Figure 5.4 (a)
Condition of Bushland- Reserve #116





Figure 5.4 (b)
Condition of Bushland- Reserve #256



Table 5.2: Weed Species, Abundance and ID code

Polygon	A	B	C
WEEDS	WeedsAbundance(%)	WeedsAbundance (%)	WeedsAbundance (%)
	Kikuyu Grass100	Mt Morgan Wattle4 individuals	Wandering Jew100 Prickly Pear2 individuals
Overall Weeds	100		100
Polygon	D	E	F
WEEDS	WeedsAbundance (%)	WeedsAbundance (%)	WeedsAbundance(%)
	Mother of Millions60	Kikuyu Grass80 Sedges20 Grasses20 Herbaceous Weeds20	Kikuyu Grass100
Overall Weeds	60	100	100
Polygon	G	H	I
WEEDS	WeedsAbundance (%)	WeedsAbundance (%)	WeedsAbundance (%)
	Mother of Millions60	Pelagonium2 individuals Mother of Millions50 Sedum3 individuals Silky Oak2 individuals Daisy20	Bridal Creeper3 individuals Pelagonium3 individuals
Overall Weeds	60	60	

Individual Weeds	
Common Name	Abb. On Map
Mother of Millions	MM
African Love Grass	AL
Senna	SEN
Mt Morgan Wattle	MMW
Silky Oak	SO
Jaccaranda	J
Privet	P
Blackberry	BB
Kikuyu Grass	K
Bridal Creeper	BC
Asparagus Fern	A
Wandering Jew	WJ
Daisy Osteospermum	DAI
Cypress Sedge	CS
Prickly Pear	PP
Watsonia	W
Chlorophytum comosum	CH
Passionfruit	PAS
Pelagonium	PEL
Sedum/Succulent	SED
Madeira Vine	MV
Heartleaf Ice Plant	HI



5.3 FAUNA

5.3.1 Fauna Species

The opportunistic fauna survey conducted on the 29th March 2007 identified 13 diurnal bird species, one (1) species of reptile, and one (1) introduced mammal (presented in Table 5.3).

Table 5.3: Incidental Sightings of Fauna Species

- indicates species listed under the *EPBC Act* or *TSC Act*.

* - indicates introduced species.

	COMMON NAME	FAMILY and SCIENTIFIC NAME
MAMMALS		Felidae
	* Cat	<i>Felis catus</i>
BIRDS		Accipitridae
	Whistling Kite	<i>Haliastur sphenurus</i>
		Artamidae
	Australian Magpie	<i>Gymnorhina tibicen</i>
		Campephagidae
	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>
	White-winged Triller	<i>Lalage tricolor</i>
		Columbidae
	Crested Pigeon	<i>Ocyphaps lophotes</i>
	Common Bronzewing	<i>Phaps chalcoptera</i>
	* Spotted Turtle-Dove	<i>Streptopelia chinensis</i>
		Dicruridae
	Magpie-lark	<i>Grallina cynoleuca</i>
		Halcyonidae
	Laughing Kookaburra	<i>Dacelo novaeguineae</i>
		Hirundinidae
	Welcome Swallow	<i>Hirundo neoxena</i>
		Meliphagidae
	Noisy Minor	<i>Manorina melanocephala</i>
		Psittacidae
	Eastern Rosella	<i>Platycercus adscitus eximius</i>
	Rainbow Lorikeet	<i>Trichoglossus haematodus</i>
REPTILES		Lampropholis
	Dark-flecked Garden Sun-skink	<i>Lampropholis delicata</i>

All bird species and the reptiles observed are listed as “protected” by the NSW *National Parks and Wildlife Act* (1974). However, no species observed during the current survey are listed as ‘threatened’ under the Schedules of the NSW *TSC Act* or the Commonwealth *EPBC Act*.

The targeted search for the Cumberland Plain Land Snail *Meridolum corneovirens* involved overturning and searching among 12 logs, five (5) debris-heaps, and among thick leaf litter at the bases of trees across the site. No live individuals or shells were found in the 4.5 hour survey.



5.3.2 Habitat Types

The current field survey (April 2007) identified the primary habitat as Eucalypt Woodland, some disturbed areas and some areas of grassland. A map of the different habitat types present within the two (2) Reserves is presented in Figure 5.5.

Two (2) habitat types were identified during the field investigations. These habitat types have been identified as providing different habitat opportunities for a variety of native fauna.

Seven (7) hollow bearing trees suitable for the sheltering or roosting needs of native species were recorded during the field survey (Figure 5.5). One (1) hollow was considered to be active for birds as it had feathers and refuse around the opening. The other hollows are expected to provide shelter for bird and microchiropteran bat species.

Habitat types within the Reserves were generally characterised by Eucalyptus Woodland communities, with some native understorey and differences in ground covers and amount of leaf and debris litter present.

5.3.3 Wildlife Corridors

The dimensions of the subject land form a vegetated corridor along the length of George Street between Richmond Road (south) and the outskirts of South Windsor (north). Bird species with larger (flying) ranges were noted to be traversing the site along this corridor during the opportunistic fauna survey undertaken concurrently with the flora survey.

Major reserves in the locality include the 331 hectare Windsor Downs Nature Reserve 100 metres to the south-east, bushland along Rickabys Creek 400 metres to the west, and Clarendon Paddocks 800 metres to the west of the subject land. All other areas have vegetation which has been disturbed and fragmented due to the establishment of roads, residential developments and other land use practices

Based on a review of topographic maps and aerial photographs, combined with a visual assessment undertaken during the field investigation, the subject land forms part of a corridor between the bushland to the west and the Nature Reserve to the south east that could be used for birds and highly tolerant species during their dispersal.

The subject land is bounded to the west by George Street; and in the south between the site and the Windsor Downs Nature Reserve by Richmond Road. Both of these main roads provide significant obstacles to fauna traversing the corridors by land. The only fauna expected to be traversing the corridor by land are those that are adapted to negotiating open spaces and urban infrastructure such as main and suburban roads.

The bushland within the subject land offers connectivity but this is restricted mainly to birds traversing between the Windsor Downs Nature Reserve and bushland along Rickabys Creek. Birds with large to medium ranges - such as Rainbow Lorikeets (*Trichoglossus haematodus*) and the Whistling Kite (*Haliastur sphenurus*) (observed during the field survey) - are expected to use the tree canopy for their primary dispersal route.

Figure 5.6 shows the major bushland areas within the locality and the likely corridors used for native faunal movement.



Figure 5.5 (a)
Fauna Habitat Types - Reserve #116





Figure 5.5 (b)
Fauna Habitat Types - Reserve #256



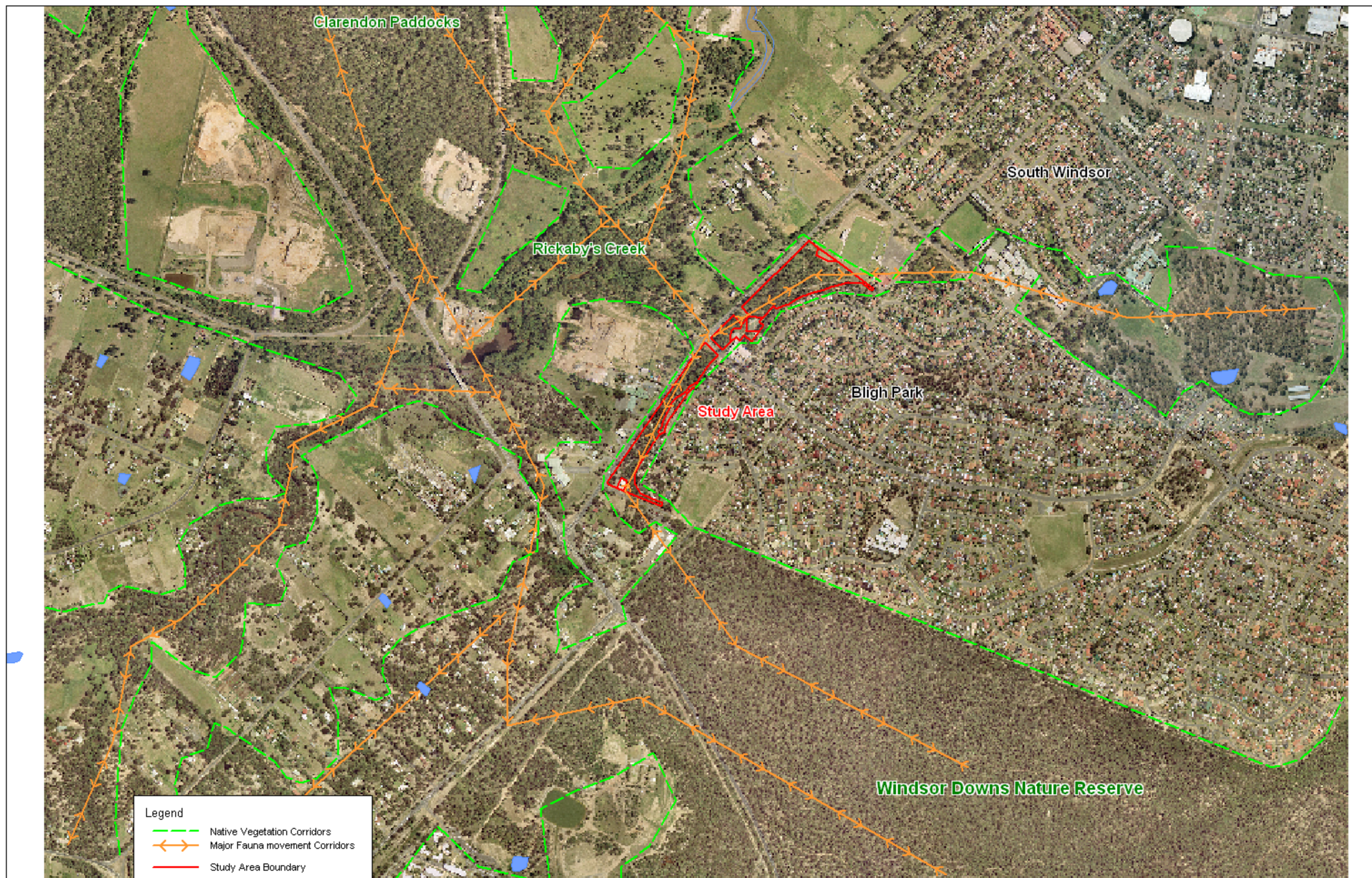


Figure 5.6
Connectivity and Linkages



6 MANAGEMENT ISSUES & RECOMMENDATIONS

6.1 REQUIREMENTS OF THE THREATENED SPECIES LEGISLATION

The George Street Reserves support an important remnant⁴ of the Cumberland Plain Woodland ('CPW') – an ecological community listed as 'threatened' under the Schedules of both the NSW *TSC Act* and the Commonwealth *EPBC Act*. As a threatened ecological community, CPW has high conservation value at local, regional, State and National levels of significance.

The subject land also supports areas of a second threatened ecological community – Shale Gravel Transition Forest ('SGTF'), which is listed under the *TSC Act*, but not under the *EPBC Act*.

In addition, 85 individuals of a threatened flora species, *Dillwynia tenuifolia*, were recorded within the subject land. A number of regionally significant flora species also occur.

Management objectives for the combined George Street Reserves include:

- i) The development of proactive land management policies for the remnant Cumberland Plain Woodland and Shale-Gravel Transition Forest ecological communities within the subject land; and
- ii) The establishment of practical and cost effective management strategies to assist in the conservation, regeneration and/or restoration of remnant native bushland (see Section 2.6).

Under the terms of the environmental legislation, local government must assess the impacts of any activity proposed which might adversely impact on any threatened ecological communities, species or populations, and where these are likely to occur it must identify strategies to minimise such impacts. Unless carefully managed, even routine management activities such as grass mowing, weed control, bushfire hazard reduction, planting or infrastructure works, could have a detrimental effect on the conservation of these items.

In addition, development on adjoining land may also have a significant impact on the bushland's natural values, so that such activities must be carefully assessed by Council prior to development consent being granted.

Previously, under the terms of the *TSC Act*, the NPWS Division of DEC was required to prepare Recovery Plans for species, populations and endangered ecological communities within five (5) years of gazettal of the Final Determination. These Plans were designed to assist consent and determining authorities in the assessment of impacts on these entities, and for members of the public interested in becoming involved in conservation activities.

In 2004, reforms the *TSC Act* were made to better integrate threatened species management with land use planning, and improve the development assessment process. As part of the reform, the Threatened Species Priorities Action Statement ('PAS') was introduced. The PAS is currently in draft form, and can be viewed at www.threatenedspecies.environment.nsw.gov.au. The PAS lists

⁴ Remnant in this context referring to a regrowth form of the original native vegetation community.



priority actions for threatened ecological communities, populations and species that should be considered when determining appropriate management activities for the subject land.

Recommendations:

1. Design and implement weed control and other management strategies which take the presence of all significant species, populations and ecological communities into account, and avoid unnecessary damage to habitat.
2. Prior to undertaking weed clearance (whether hand clearing, machine clearing or herbicide application) in areas known to support threatened species or populations, a targeted search should be carried out, plant locations identified using a GPS, plants tagged (albeit temporarily) and protective measures set in place⁵.
3. Such locations are to be marked on a site map, and this map updated as required. All personnel undertaking on-grounds works should be inducted to the site and provided with relevant information (species descriptions, location maps). It will be the responsibility of the contractors (though Council) undertaking works on the site to ensure that all personnel are fully informed.
4. Where unavoidable damage is likely to occur, contractors are to consult with Council's Manager, Land Management. Any work likely to result in damage to threatened species, populations or their habitats must not be undertaken without written permission from Council.
5. Bush regeneration strategies must also consider the need to maintain (or create) suitable habitat for those native flora and fauna species known to occur within the Reserves. Where the (unchecked) growth of thicket-forming shrubs as *Bursaria spinosa* (for example) threaten the integrity of such habitats, culling should be used to restore suitable site conditions (see Section 6.2).

6.2 MANAGING FOR SIGNIFICANT FLORA SPECIES

Management objectives for the George Street Reserves (see Section 2.6) include:

- i) The management of the bushland regeneration process to ensure the retention of suitable habitat for those threatened and/or significant flora and fauna species present in the subject land.

Table 5.1 lists 22 species occurring within the Reserves considered to be inadequately reserved in reserves in Western Sydney, and therefore of regional conservation significance (NPWS 1997).

Of these, only *Dillwynia tenuifolia* is listed as 'threatened' under the Schedules of the NSW *TSC Act* and Commonwealth *EPBC Act*. *Dillwynia tenuifolia* is a small spreading shrub 40-100 cm high, uncommon in the area. It is found in the Castlereagh Woodlands, and on shale soils on the Cumberland Plain west of Sydney (Robinson 1991). In common with other significant species listed (Table 5.1) *Dillwynia tenuifolia* appears to favour open woodlands with a moderate amount of filtered sunlight. It is therefore imperative that unchecked regeneration of thicket forming shrubs (such as *Melaleuca decora* or *Bursaria spinosa*) does not 'swamp' and displace these significant species.

⁵ Mapping of *Dillwynia tenuifolia* be undertaken during the flowering season (usually in early spring - September) to increase accuracy of identification.



Figure 5.3 shows the location of *Dillwynia tenuifolia* mapped in the George Street Reserves.

Recommendations:

1. Cull *Bursaria spinosa* or other thicket-forming shrubs where they threatened the survival of *Dillwynia tenuifolia* or other significant CPW species. Selective culling is to be used to maintain the open habitat favoured by these plants. Monitor shrub regrowth and remove unwanted seedlings as required.
2. In core bushland, maintain some shrub thickets for fauna habitat, but create large to medium discrete blocks, preferably in a circular or oval shape; avoiding long narrow thickets with a small core to edge ratio.
3. Refrain from planting anything other than ground covers or low shrubs (eg < 1m) in the habitat of light-demanding flora species such as *Dillwynia tenuifolia*.
4. Actively manage native plant regeneration to maintain a *diversity of habitats* within the subject site, e.g. woodland, open grassland with a few shrub thickets, drainage lines and soaks (albeit these are man-made). In other words, manage the bushland restoration process to achieve a set of goals or objectives (as set out in Section 2.6).

6.3 MANAGING FOR SPECIES DIVERSITY

The *LG Act* S36 core objectives for natural areas (see Section 2.4) include “the conservation of biodiversity and maintenance of ecosystem function in respect of the land, or the feature or habitat in respect of which the land is categorised as a natural area”; while

S36 core objectives for community land categorised as ‘bushland’ must “ensure the ongoing ecological viability and habitat values of the land, the flora and fauna (including invertebrates, fungi and micro-organisms) of the land and other ecological values of the land”.

On the Cumberland Plain, native floristic diversity and density is most pronounced in the ground stratum of grasses and forbs. This is characteristic of CPW, but this is also where weed species are most prolific. Woody weeds (although occurring) are usually present in lower densities than (say) on sandstone soils, although they can be invasive in moister gullies, river flats and riparian areas (DIPNR 2003).

Successional processes are also different in plant communities on clay-based and sandstone soils. On sandstone, disturbance events (such as fire) result in rapid regeneration of shrubs, but these thin out and die as canopy dominance develops. In contrast, the shrub layer in CPW is generally sparse but persistent, reflecting the more open canopy (DIPNR 2003).

A number of workers (Benson & Howell 1990, Benson & von Richter 2006, Morris 2006, and Watson 2005) have studied floristic composition and ecosystem functioning in CPW. There is a general consensus that (pre-disturbance), the ratio of trees, shrubs and ground covers was typically in the order of 20:20:60. Of course, this ratio would have varied according to site topography, aspect, and local hydrology. However, the given ratio provides a generic framework for bushland regeneration and restoration projects in CPW communities.

Within the subject land at Bligh Park, past land uses and recent management practices have encouraged a dense growth of African Love Grass (*Eragrostis curvula*) which because of its highly



competitive nature and propensity to seed freely over a long growing season, has displaced many of the locally indigenous ground covers.

Fire regimes that encourage a balance between trees and shrubs, and open patches dominated by forbs and grasses may hold the key to maintaining species diversity in many CPW communities. Watson (quoted in DEC 2005) suggests that open grassy woodland with obligate seeder⁶ shrubs is best maintained using variable intervals between fires of between four (4) and 12 years, with inter-fire periods being long enough to allow regeneration of these shrub types.

Further, studies carried out on fire-dependent species such as Kangaroo Grass (*Themeda australis*) (Prober *et al* 2004, Lunt & Morgan 1999, Watson 2005) suggest that this significant CPW grass species loses vigour if the inter-fire period exceeds 12 years. Conversely, research carried out on indigenous shrubs such as *Bursaria spinosa* (Watson cited in DEC 2003) has shown that the frequency and dominance of this species increases as the fire frequency decreases. The dominance of *Bursaria spinosa* in long unburnt bushland in Western Sydney significantly impacts on local biodiversity values, and not infrequently leads to the loss of open grassy areas and the 'patchiness', which is a hallmark of CPW plant communities.

Management of CPW within the Georges Street Reserves could be significantly improved (serving to achieve a number of objectives) if fire was re-introduced to the bushland. In order to do this effectively, a site specific Fire Management Plan would be required to establish the optimal fire regime for the bushland. It is suggested that the use of strategic 'ecological burns' would be beneficial in managing the regeneration process, and carefully timed, could also be used to control unwanted weed grasses.

It should be noted that a Hazard Reduction and Environmental Assessment Report has been prepared by Conacher Travers (C-T 2004) – see Section 6.6. This Report has rejected the use of fire because of the close proximity of the bushland to residential development, and the potential for damage to CPW species to occur (although the latter is not substantiated). However, unless some fire is re-introduced to the bushland (albeit as small spot fires, less than 10m in diameter), there will be an incremental loss of native floristic diversity and an increase in the density of introduced grasses and other weeds, compounding the loss of habitat for native flora and fauna.

The fire history of the George Street has not been well documented, but anecdotal evidence suggests that a few areas have been subject to spot fires – these perhaps being limited to two (2) or three (3) occasions over the last decade or so. It is also noted that the perceived bushfire hazard presented by the long grass in the Reserves is of concern to most of the adjoining residents.

Recommendations:

* are similar and complementary to those provided for the management of the CPW ecological community (Section 6.2).

1. Actively manage native plant regeneration to maintain a diversity of habitats within the Reserves, e.g. woodland, open grassland with some areas with dense shrub thickets, drainage lines and soaks (see Section 6.4).
2. Given Council's obligation to manage the Reserves for their conservation and biodiversity values, consider re-introducing fire as a management tool to control both weed grasses and

⁶ That is, species which shed their seed after fire.



unwanted shrubs, and to stimulate the natural regeneration of native grasses and ground covers (see Section 6.6).

3. Revisit the C-T Bushfire Hazard Reduction Plan with a view to identifying the optimal fire regime for the regeneration of the CPW and SGTF communities and the significant species found in the Reserves. Such a review should be carried out by a qualified Restoration Ecologist with experience in managing bushland in Western Sydney.
4. Any new Bushfire Hazard Reduction Plan prepared for the Reserves' bushland must identify the known or expected fire response of those threatened and significant flora species occurring, and design the fire regime accordingly.
5. Consult widely with the local community in order to clearly explain the reasons for the recommendations made in the PoM, and to explain why the re-introduction of limited fire events would be of benefit not only in promoting native plant regeneration, but in controlling the rampant growth of introduced grasses.
6. Indigenous revegetation - where natural regeneration is slow to occur (or absent), for example on compacted, disturbed or introduced fill soils, undertake a selective enrichment planting program (see Appendix 8), utilising only those indigenous species characteristic of the vegetation community.
7. At present the woodland provides mainly for canopy dwelling bird species. Regeneration of the Eucalypt Woodlands natural shrub layer will be important in increasing bird species diversity and colonisation of other fauna species.

6.4 MANAGEMENT OF FAUNA HABITATS

6.4.1 Woodland Areas

Canopy

It is recommended that large trees, especially those recorded having hollows, be protected as important refuge for native fauna. Hollows within the canopy strata are an important resource for microchiropteran bats and bird species.

Of the bird species recorded during the field survey, most would only utilise the canopy of the Eucalypt Woodland. It is anticipated following bushland rehabilitation that other habitats will open up and be utilised by new species and those currently utilising the resources of the Reserves.

Note that it is important to maintain and promote a range of age classes and structural diversity within the bushland in order to cater for a range of native fauna species.

Shrub Layer

The shrub layer of the Eucalypt Woodland is described as 'sparse' in Reserve #116 and was in competition with a variety of weed species throughout. Reserve #256 contained a moderate shrubby habitat layer but was again in competition with exotic species. Both Reserves contain many tracks (see Figure 6.2) that criss-cross the bushland and fragment the shrub layer. It is recommended that the shrub layer be re-established consistent with the structure of Eucalypt Woodland, although not to the extent that it shades out or overwhelms light-demanding ground covers.

It is also suggested that some small open grassland areas within the Reserves be promoted internally (i.e. maintained as grassland and not planted out), thus providing any of the smaller bird species migrating into the Reserves with some refuge sites while foraging. Internal spaces are important for ground-feeding birds as they create 'patchiness', which enhances habitat niches.



Ground Cover

The Cumberland Plain Land Snail (*Meridolum corneovirens*) has been recorded in the Windsor Downs Nature Reserve (NPWS 2005) which comes to within 100 metres of the subject land in the south. The Snail is known to shelter under leaf litter, rocks, logs and debris. Therefore, excessive removal of leaf litter fallen branches, logs and rocks should be avoided, except where litter build up constitutes a fire hazard.

While no live individuals or shells were found during the targeted search, it was noted that the leaf litter and debris particularly in Reserve #256 was considered to constitute suitable habitat for the Cumberland Land Snail.

In general, small fallen timbers and leaf litter should be maintained while bushland rehabilitation works are conducted. The use of fire as a management tool (if such is adopted) should be carried out in a mosaic fashion so that not all areas of the bushland are affected at any one time.

One (1) ground nest of a native duck was recorded in the grassland at the northern end of Reserve #116. While the duck itself was not sighted, it is noted that the grassy understorey provides good habitat for ground-nesting birds and small ground-based fauna. The duck nest was within two (2) metres of an irrigated sporting oval, which also provides forage opportunities for duck species.

It is important to maintain structural diversity in the ground cover stratum (principally native grasses and forbs), and when enrichment planting, to create dense clumps or islands to provide shelter/protection for ground-dwelling fauna. Structural diversity within this stratum should be encouraged, and this should include the retention of leaf litter and fallen branches. Household garbage and other rubbish should, however be removed as plastic and ring-pulls from drink cans are harmful to native fauna if ingested.

6.4.2 Management for Species Not Previously Recorded in the Reserve

Even together, the George Street Reserves are considered to be too small and isolated from major bushland areas to provide adequate habitat opportunities for native non-flying mammals, other than urban-tolerant species such as Ringtail (*Pseudocheirus peregrinus*) and Brushtail Possums (*Trichosurus vulpecula*), which are able to negotiate the urban and peri-urban infrastructure.

Recommendations:

- To protect the (potential) habitat of the Cumberland Land Snail, area of leaf litter around trees and other organic debris in core bushland is to be retained. Similarly, care should be taken when slashing in the fire break or on track edges. Hand weeding is recommended around the bases of trees, around fallen timbers and in areas with deep leaf litter.
- Ensure that a diversity of fauna habitats is maintained (or created) throughout the Reserves, and that appropriate management practices are integrated into bush regeneration and other management processes.
- Protect large and hollow bearing trees from removal (where these do not pose a safety issue).
- Maintain or create (where appropriate) some discrete areas of dense shrubbery: planting shrubs in large patches or clumps with a circular or oval shape.
- Reinforce any native regeneration occurring through enrichment planting – particularly in the understorey - thus helping to improve corridor values.
- Where possible given the segmented nature of the bushland, create linkages through the ground cover stratum (as above) to provide passage for non-arboreal species. This can



be achieved by closing some unwanted tracks and clearings, and promoting access via a formal pathway that does not fragment the shrub layer and ground cover.

- Wherever possible, and where this does not constitute a fire hazard or interfere with the walking track network, also maintain some areas of uncut /untidy native grass to provide foraging opportunities for birds and small reptiles. Preferably these will be located in the core bushland, surrounded by shrubbery or trees.
- Retain (or create) specialised fauna habitat sites e.g. retain fallen logs, habitat trees, while recognising the need to manage for public safety and bushfire hazard.
- Local landscaping (adjoining suburban streets etc) should endeavour to utilise locally occurring native trees and shrubs to enhance corridor values and provide some habitat for local fauna.

6.5 MANAGING WEED INVASION

Of a total of 169 flora species recorded, 86 species (51%) are introduced (horticultural) species or weeds. Of these, 21 species are woody weeds (or introduced natives), four (4) are vines or scramblers, and the remainder (58) are herbaceous species (grasses and flowering forbs (see Appendix 2).

As the George Street Reserves formed part of a large grazing lease (Ham Common) for many years, pasture grasses and agricultural weeds are well represented, with African Love Grass (*Eragrostis curvula*) being the dominant herb form; while turf grasses such as Kikuyu *Pennisetum clandestinum* commonly occur at the bushland: suburban interface and in drainage lines. Common Couch (*Cynodon dactylon*) – although its designation as a weed is debatable –occurs throughout the subject land (and locality generally), and while not strictly a CPW species, it provides a protective cover for the highly dispersible native soils found in this locality.

Woody weeds are represented primarily by garden escapes such as Mt Morgan Wattle (*Acacia podyriformis*) and Privets (*Ligustrum* spp), while widespread herbaceous weeds include Ground (or Fern) Asparagus (*Asparagus aethiopicus*) and Mother of Millions (*Bryophyllum delagoense*). Agricultural introductions are represented by a range of introduced grasses, particularly African Love Grass (*Eragrostis curvula*), Paspalum (*Paspalum dilatatum*), and forbs such as Thistles (*Cirsium vulgare*, *Sonchus oleaceus*) and Fireweed (*Senecio madagascariensis*).

Eight (8) species occurring are listed as ‘noxious plants’ for the Hawkesbury River County Council Control Area (see Section 5.1.3). However, no significant occurrences of Weeds of National Significance (**WONS**) were recorded during recent field surveys.

Recommendations for targeted weed control have been made for native bushland and for those areas which function as a firebreak or ‘buffer’ between residential properties and the bushland. Target weeds are identified as those species declared as noxious weeds in the Hawkesbury River Local Control Area, as well as keystone environmental weeds (see Sections 7.5.2 & 7.5.3).

The condition of bushland within the subject site is described as ‘Good’ overall, except where there are dense infestations of African Love Grass and Mother of Millions. The condition of bushland is considered to be only ‘Fair’ along the western George Street boundary and along residential boundaries (given the high level of clearing and/or illegal dumping encountered).

Weed invasion is scattered in the core bushland (except for African Love Grass and in some locations, Mother of Millions), but this increases where soils are deeper and wetter (eg in drainage lines, below the George Street embankment particularly with Kikuyu Grass (refer to Figure 5.4).

Recommendations:



1. Prioritise areas/management zones for targeted weed control. Consider first, the need to gain community support by working along residential boundaries and in high profile public areas); second to consolidate and extend areas worked by TAFE students, and then focus efforts on the reinstatement of habitat for significant species such as *Dillwynia tenuifolia*.
2. As a priority eradicate the small number of woody weeds and apply appropriate control methods to substantially reduce the keystone weeds (see Appendix 6), while at the same time considering the need to protect habitat for threatened species and maintain biodiversity.
3. Undertake a Bush Regeneration program, undertaking targeted weed control over all sites (as per priorities in Section 8.3).
4. Council is asked to address significant edge site impacts (eg dumping, disposal of lawn clippings, kitty litter, dog droppings etc) which encourage weed growth and devalue local landscape values. A letter drop is recommended in the first instance, with contact through Council's compliance section if this does not achieve the desired results.
5. Local distribution of Council's publication 'Weed All About It' is highly recommended.
6. Further attempts should be made to establish a Bushcare Group to work in the Bligh Park area. Possibly local schools, girls guide and scout groups could become involved as well. Regular attendance by Bushcare volunteers to support primary weeding carried out by contactors employed by Council would be highly beneficial. Culling unwanted plants, seed collection, planting in cleared/degraded sites, and maintenance weeding are also integral parts of this bushland restoration project, and as they do not require the use of herbicide or power tools, are suitable for community volunteers.
7. Where this can be done without damaging the threatened shrub *Dillwynia tenuifolia* (see Figure 5.3), establish a regular slashing routine to control African Love Grass (*Eragrostis curvula*) and other free seeding herbs (eg Fleabanes *Conyza* spp, Cobbler's Pegs *Bidens pilosa*) at the bushland/residential interface (firebreak), and on track edges. Slashing should be undertaken monthly from late spring to mid-autumn, when this grass is seeding freely.
8. Control of African Love Grass in core bushland is best carried out by hand (removing seed and digging out tussocks) to avoid damaging the native understorey, but an alternative and cost-effective approach would be to apply a grass-selective herbicide such as Fusilade as a foliar spray. Fusilade should not be used where native grasses are growing amongst the weed grass, and the need for regular maintenance to control new seedlings is emphasised.

6.6 MANAGING THE BUSHFIRE HAZARD

A *Hazard Reduction Program & Environmental Assessment* has been prepared for each of the subject sites – i.e. the George Street Reserves north and south of Colonial Drive (Conacher Travers 2004).

The C-T Report states that the Environmental Assessment was prepared in accordance with operational and environmental guidelines issued by the NSW Rural Fire Service (2003a & 2003b), while the Hazard Reduction Program was prepared on behalf of Council, with the intention of reducing the bushfire risk to adjoining residential properties in Bligh Park.

The C-T Report (see Figure 6.1) identifies the bushfire risk for the subject land and surrounding areas for a distance greater than 100 metres as 'minor' because of the close proximity of extensive residential development. The Report also states that the bushfire risk is however, increased by the presence of native bushland on adjacent land, including the extensive area of bushland in Windsor Downs Nature Reserve to the south-east, and large tracks of bushland to the south-west along The Driftway, on military land at Londonderry, and in Agnes Banks Nature Reserve.



Both subject Reserves are known to have a 'fire history', although in 2004 it was stated in C-T 2004 that the majority of the bushland had not been subject to fire for about six (6) years (+/- 2)⁷. However, the C-T Report rejected the use of fire as a management tool because of the Reserves' long narrow shape, directly adjoining residential development, and because overly frequent burns would almost certainly reduce local biodiversity values⁸. Instead, the C-T Report recommends slashing a six (6) metre wide strip of understorey vegetation along the Reserves' eastern boundaries, out from the residential fence lines. Trees and large shrubs would be left *in situ*.

For the George Street Reserves, given the creation of such a firebreak between bushland and adjoining residential properties, the risk of a major bushfire impacting on the built environment in the immediate locality is considered to be 'low'. Any bushfire arising in the woodland or grassland would be rapidly contained, although it is recognised that strong winds could bring sparks and embers into nearby residential areas. Some minor damage to fencing and other structure could be experienced. However, with residential properties located generally within 10 metres of the bushland, and particularly where dense weed growth occurs, existing and potential fire hazard needs to be addressed for the safety of residents and their properties.

However, a general lack of maintenance and the dumping of flammable waste in some of the established fire breaks is cause for concern, particularly the dense growth of African Love Grass (*Eragrostis curvula*) which occurs throughout both Reserves. This grass provides a considerable source of fuel, particularly in the hotter summer months when the biomass is at its maximum.

The Reserves' proximity to George Street; and the potential for fires to be started by drivers disposing of cigarette butts from their vehicles cannot be overlooked.

Recommendations:

- 1) The recommendations of the C-T Report (2004) should be adopted with respect to the bushland/residential interface (although alternative methods are recommended for core bushland – see Sections 6.3 and 6.5, above).
- 2) Firebreaks should be set in place between bushland and private property, and these areas are to be managed for bushfire hazard in accordance with the guidelines set out in *Planning for Bushfire Control* (NSW Rural Fire Service 2001).
- 3) Council, in consultation with NSW Bushfire Brigades, should monitor fuel loads in the bushland over time and where necessary, take appropriate action to reduce hazards in the interests of public safety (this is likely to be via targeted control using a lawn mower or hand selective clearing where threatened flora species occur).
- 4) The presence of the threatened shrub *Dillwynia tenuifolia* (often difficult to see in long grass) is a constraint to slashing (especially #256 – see Figure 5.3). Firebreak maintenance must take the presence of this threatened species into account when planning on-ground works.
- 5) Although it is recognised that long grass in core bushland presents a fire hazard in the bushfire season, the retention of some areas of 'unkempt' grass (over time replacing the weedy species with native grasses) is recommended to provide fauna habitat in the ground

⁷ Recent (2007) investigations support this view, although it was noted that some 'spot fires' had occurred at various sites throughout the Reserves (e.g. bonfires).

⁸ The latter is not substantiated, and this conclusion is disputed by the authors of the PoM)



cover stratum. However, these habitat features should be kept strictly away from built structures and residential property boundaries.

- 6) Bushcare volunteers and contractors alike should be discouraged from planting trees and large shrubs directly behind boundary fences, and any planting works undertaken should ensure that a *minimum* six (6) metre width is maintained as a firebreak between property fences and the bushland.
- 7) Residents should be made aware of the dangers of dumping garden waste and of storing flammable materials behind their property fences: parking and blocking the firebreak by placement of trampolines, cubby houses or parked cars is not acceptable, and where this occurs Council should take immediate action.



Figure 6.1
Bushfire Prone Land Map (HCC 2007)





6.7 MANAGING EDGE SITES & INTERFACE ZONES

The interface zone is described as the (often)) narrow strip of land between bushland and adjoining development –often a slashed firebreak, a boundary fence and/or a walking track. It is this interface zone that is most vulnerable to the impacts of urbanisation. Such impacts include weed invasion and colonization by introduced (exotic) garden plants, stormwater runoff, tracking and mower creep. Rubbish dumping and the disposal of garden waste and lawn clippings are commonplace in the interface zone, while remnant or planted trees are often damaged by mowers and slashers.

Interface zones are often by default considered to be *de facto* bushland, but their management regimes should be different to those applied to the conservation areas (i.e. core bushland). For example, the interface zone may be under-scrubbed or mown as a firebreak, maintained as open parkland by removing shrubs or small trees, or it may be landscaped with non-invasive ‘fire retardant’ species (at least those which are known to be less flammable). Bushland should never be encouraged to grow unchecked up to built structures or boundary fences.

The interface zone may vary in width, depending on adjoining land uses. For example, it may contain a walking path or bicycle track, or include a picnic area or car park (say, behind shops or sporting facilities). Hard edges should always be established at the interface (eg sleepers or logs) to delineate the boundary and to prevent inadvertent ‘mower creep’.

Wherever possible, any paved area at the interface should be graded so that water drains away from the bushland. If this is not possible, track edges will require a high level of maintenance as increased runoff from the paving will encourage weed growth. Alternatively, a dense edge of disturbance tolerant native grasses or sedges may be planted to absorb the extra water. Whatever landscape treatment is adopted, it must be recognised that the interface zone will have a high edge to core ratio, thus presenting an extended front (or edge) to the impacts of urbanisation.

The following recommendations are made on the assumption that the recommended six (6) metre wide firebreak (i.e. Asset Protection Zone) will be maintained along the residential boundary (see Section 6.6, above).

Recommendations:

- 1) Interface zones should be maintained so that unwanted garden debris (prunings, lawn clippings) and dumped rubbish (dog droppings, timbers etc) are removed quickly, as a matter of priority. Residents are to be made aware of the negative aspects of current dumping practices, including increasing the fire risk and encouraging vermin.
- 2) Following on from the above, land adjacent to property boundaries and in public view should be maintained for local landscape and amenity values, thus ensuring that the bushland is better valued and cared for by local residents. An annual letter drop from Council to residents to this effect would be advantageous.
- 3) Remove selected (dead or damaged) trees from the interface zone to allow better access for mowers, thereby reducing the risk of machine damage to nearby native canopy trees. Recent inspection indicates that only about six (6) trees would be affected – some of these trees have already been severely lopped.
- 4) Avoid planting trees and shrubs in firebreaks or in open grasslands in a configuration which precludes access for grass slashing and other maintenance activities.
- 5) To provide a buffer to edge impacts, consider planting the first few metres of the interface zone with a dense cover of small shrubs (< 1 metre) and/or hardy native grasses. This will provide a rudimentary ‘filter’ to trap windblown rubbish and weed seed spread by water.



- 6) Plant edge sites more densely (where more light is available) than core sites, using fast-growing shrubs and hardy grasses to create an attractive visual buffer between the bushland restoration and public recreational areas. This is a 'bush landscaping' approach which may go some way to encouraging community support for the retention of this bushland.
- 7) The erection of permanent barriers (eg treated logs or bollards) to provide a 'spray or mowing edge' is strongly recommended at the bushland /grassland interface (eg. along track edges). Where practical, introduced turf grasses on edge sites should be eradicated (foliar spray), and replaced with native ground covers or (in the short term) by a band of chipped eucalyptus mulch (as above).
- 8) Where edge sites are paved or gravelled, they are to be graded so that water drains away from the bushland, and runoff is directed into a catch drain.

6.8 MANAGING DRAINAGE & URBAN RUNOFF

As the track system for both Reserves is not controlled, the surface runoff has removed ground cover and debris from around the tracks, forming swathes of bare earth which have eroded on the surface or 'washed', thus removing the topsoil. There is a major drainage concern in the north-eastern corner of Reserve #116 where inappropriate management of overland runoff and piped runoff around the adjacent sporting ovals poses a threat to the stability of the landform and possibly the George Street embankment.

A high volume overflow pit is situated in the corner of Reserve #116 (Figure 2.1). Input comes from a pipeline along the western side of the adjacent oval, with the western exit pipe located under the George Street embankment. As the George Street embankment has been constructed across the natural flow path, overflow from the drainage pit flows into this corner of the Reserve.

Drainage ditches ("catch drains") have been created along the northern boundary of the Reserve in any attempt to drain the adjacent ovals and direct overland flow into the stormwater pit (Figure 2.1). One drainage ditch runs along the border between the Reserve and the ovals, and the other runs downslope from the centre of the Reserve towards the drainage pit. Both ditches end before reaching the pit, which forces the water to travel below the soil surface, thus creating 'pipes' or tunnels. This subsurface drainage patterns has created depressions and holes and is a public safety risk. These flows are also destabilising the George Street embankment, creating erosion along its edges and contributing to tree death and fall.

Recommendations:

1. The use of this corner of Reserve #116 as a makeshift detention basin for overland and piped flow from the ovals and runoff from the northern section of the reserve needs to be reconsidered. Water flows must be managed in such a way that runoff off is not directed onto these highly erodible soils.
2. Short term management options include fencing off the unstable land with a permanent fence and erecting signage. The drainage pit, pipes and channels should be maintained so that the outlets do not block up and overflow into the Reserve. Creation of new catch drains and/or deposition of fill soil to fill depressions should not be used as a temporary solution as these actions have quite clearly exacerbated the erosion problem.
3. Long term management options will necessarily include investigations by an appropriately qualified hydrologist and/or soil scientist with experience in managing urban runoff on dispersible soils. A permanent solution will almost certainly require the reconstruction of the drainage pit and associated drainage pipes.



6.9 TRACKING, VANDALISM & INAPPROPRIATE ACTIVITIES

Tracking and damage to vegetation is a major problem as both Reserves are dissected by a network of informal tracks. Most of these tracks are long-standing, and the soils are bare and highly compacted. Visual evidence suggests that some residents park illegally behind their properties, while in Wetherill Crescent (Reserve #256) well worn tracks suggest that some vehicles use the bushland as a 'short cut' to access George Street.

Motor cycles and BMX bikes continue to be a problem in some areas (eg. Reserve #256 near the Park section where jumps have been established) particularly on weekends, while other inappropriate activities such as dumping, setting spot fires, and the consumption of alcohol are reported by local residents – the latter being mainly after dark.

Dumping is a significant problem behind houses along the Reserve boundaries, particularly in Reserve #256 at the rear of houses in Wetherill Crescent and near the Bushfire Headquarters in Thorley Street (Management Zone 6). Most of this dumped material comprises garden debris (prunings, lawn clippings) and unwanted construction material (timber, bricks, fill soil), but when combined with the high number of garden escapes and weeds on this boundary, a major management problem has been created. It must also be recognised that in some areas the firebreak has not been maintained, and this is considered to present a potential fire risk.

Graffiti is a major problem, with residential property fences, buildings, and even some trees being marked with aerosol applied paint. This is especially prevalent in Reserve #116.

Dog walking is a popular activity and there is no objection to this activity continuing provided that owners control their pets and carry plastic bags to pick up droppings.

Recommendations:

- 1) Council to consider forming a Park Committee (this could be part of the proposed Bushcare Volunteer Group). The members are to have a 'park ranger' status, with authority to approach persons engaging in inappropriate activities and record names, address, licence numbers etc.
- 2) Signage should be erected at both main entry points at Colonial Drive, providing an 'after-hours' emergency telephone number to the appropriate duty officer at Council.
- 3) All residents should be made aware of this emergency telephone number – possibly through the supply of a notice or a 'fridge magnet' sent out with the rates notices. The community is entitled to expect a rapid response after the emergency number is called, so if Council's procedures are changed, signage should be altered and residents informed.
- 4) Council should remove significant graffiti as it occurs, especially in highly visible sites such as the property fences close to the walking track in Reserve #116 or near the shopping centre. Query whether local shops still sell aerosol paints tins to adolescents.
- 5) Dumping will always be a problem, with some residents refusing to co-operate. Signage will do little to change this attitude, so that if after a letter drop has been distributed and where offenders can be identified, Council should issue a 'notice' to the resident to undertake a clean up, otherwise a fine should be imposed.
- 6) The area behind the Bushfire Headquarters should be rehabilitated (Reserve #256). At the very least, the removal of stockpiled soil and construction material is to be removed from the Reserve. Plantings (garden specimens) are also to be removed.



- 7) Dog walkers are to be required to keep their pets on a leash unless otherwise specified for a special leash-off area, and strongly encouraged to pick up their pet's droppings. Signage and/or special bins for disposal of droppings may be of assistance.
- 8) Illegal use of the Reserves by bike riders or horse riders should be policed, with members of the Park Committee/Bushcare Volunteers (or perhaps shop owners) given the authority to act on behalf of Council (see Park Ranger capacity, above).
- 9) Damage to fencing, edging or other Park infrastructure to be reported to Council immediately and, if contact cannot be made, a report made to the local Police Station.

6.10 PARK INFRASTRUCTURE

A walking track has been installed through Reserve #116, providing access between the Bligh Park Shops, Neighbourhood Centre and Child Care Centre and nearby residential development. Other entry points are located at Sirius Street and Charlotte Place. The surface of the track is formed of gravel, while the network of (informal) tracks have been created by tracking through the bushland and soil compaction. Some of these tracks do not appear to serve any purpose, and should be closed.

There is no formal track system in Reserve #256, although there are numerous informal tracks, presumably created by trail bikes and larger vehicles. The bushland in both Reserves is readily accessible to vehicles, with access points at a number of locations. The Reserve is also used for the unauthorised parking of cars and trucks.

Signage is restricted to the large 'Bligh Park' sign set in a raised garden bed, located at the corner of Colonial Drive and George Street (see Plates). Garden beds have been created on both sides of Colonial Drive.

Lights – there are currently no lights installed in either Reserve.

A sewer line is located behind the residential properties in Reserve #116 and near the park section of Reserve #256. Small runoff drains are located close to the shops in Reserve #116 and behind the residential properties in Reserve #256 (see Figure 2.1).

The community tennis courts in Reserve #116 are maintained by Council. They are located close to the Bligh Park Shops and Neighbourhood Centre. The courts are fenced, although the gates are unlocked.

Parking is available at the Bligh Park Shops and street parking elsewhere. There is a second small parking lot behind the Shops which is used by delivery trucks and also by users of the Neighbourhood Centre.

Sydney Water WPS 130 (Toorah) is located off George Street (Reserve #116), close to the southern end of the Reserve, on land excised from the Reserve. The building is not fenced, and the narrow access track from George Street has been extended into the bushland to the north and north-east. It was originally sign-posted, but this sign has been vandalised.

Recommendations:

- 1) Council is to continue to maintain the walking track in Reserve #116 at current levels, and to monitor for erosion after periods of heavy rain. Track edges are to be maintained by regular slashing, and kept free from incursion by vegetation.



- 2) The walking track in Reserve #116 should be extended into Reserve #256, with entry points located at Wetherill Circuit Park and Thorley Street (see Figure 6.2 for suggested track routes).
- 3) Unwanted and informal tracks through bushland should be closed; the compacted soil cross-ripped (where this does not encourage erosion) and encouraged to regenerate. Alternatively, tubestock planting and seeding may be used to speed the recovery process⁹.
- 4) Similarly, open clearing created by BMX bikes, parking and the like should also be rehabilitated. It may be advisable to erect sturdy (although temporary) fencing around such areas while they are being rehabilitated.
- 5) Remove graffiti from boundary fences and public buildings on a regular basis (to avoid 'copy cat' actions), and periodically monitor for other damage (see Recommendation for Park Ranger program, above).
- 6) Install heavy-duty (eg metal girders, sleepers or telegraph poles) at selected locations to prevent access by unauthorised vehicles, particularly cars and trucks wanting to park behind the houses. Install bollards at rights-of-way to Reserve #116.
- 7) Lights should be installed at the rear of the Bligh Park Shops, especially around the rear car parking area. These lights should be operated on a sensor system to save energy.
- 8) Install signage at main access points, providing an emergency telephone number for both bushfire and the Council Ranger (see Section 6.9).

⁹ Ideally, brush matting would greatly assist the recovery process. However, there are very few suitable species present in the bushland at George Street, and there would be insufficient material to use this method.

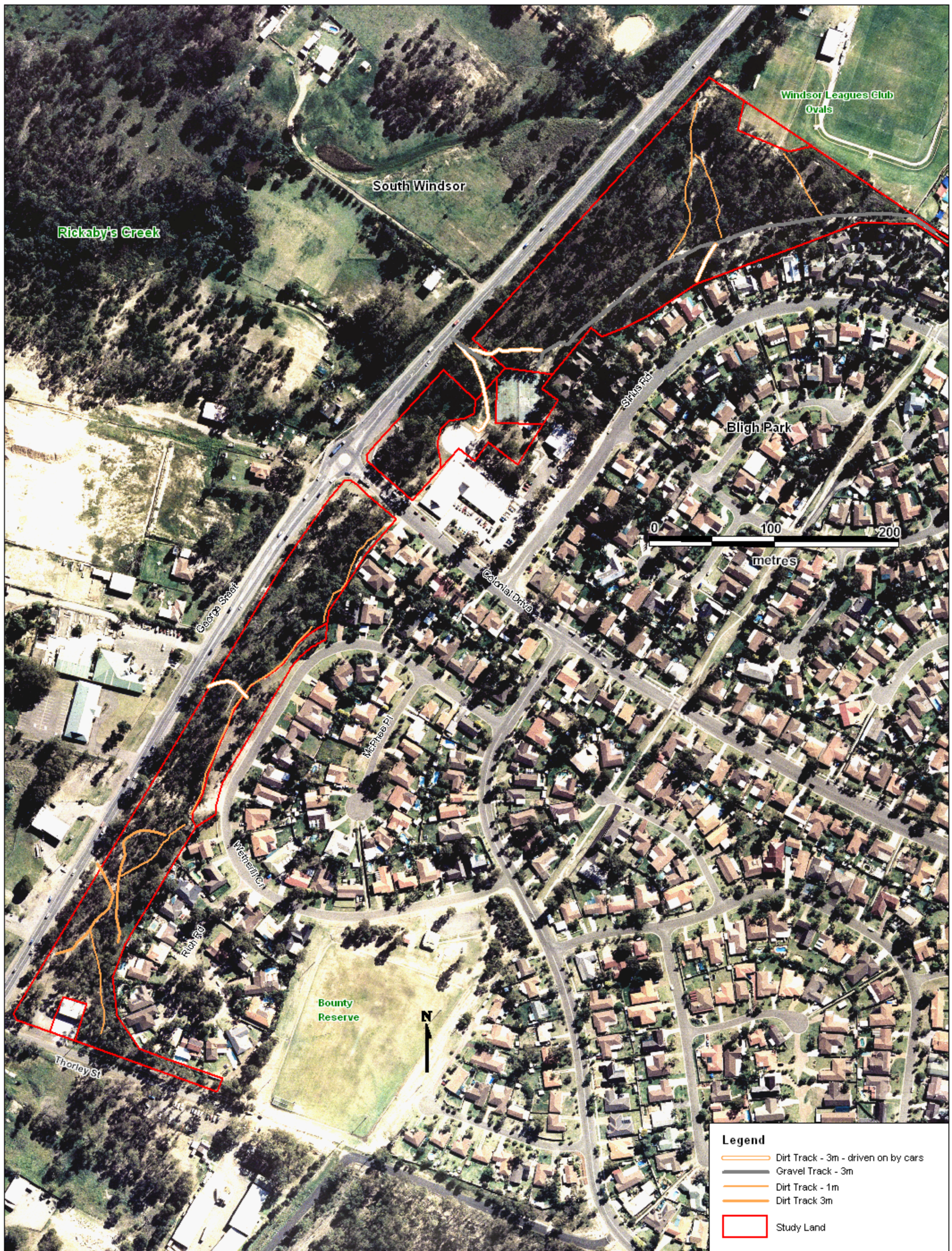


Figure 6.2
Existing Track Network



7 BASIS FOR MANAGEMENT OF URBAN BUSHLAND

The following section – Basis for Management – is largely generic in nature. It has been included in the PoM for the George Street Reserves to provide essential background information and a framework for the restoration of native bushland using a Bush Regeneration approach. Protocols for indigenous revegetation (planting) and weed control have also been included.

7.1 GUIDING PRINCIPLES

The management of any natural area should be guided by the following broad principles:

- To **protect** bushland remnants from further loss and the effects of existing and future threatening processes;
- To **identify** all biodiversity and geo-diversity elements;
- To **conserve** significant items/areas by mitigating or removing threatening process and promoting those natural processes required to ensure long-term viability;
- To **enhance** species diversity in highly simplified or degraded remnants not capable of restoration and in non-remnant areas;
- To **provide** corridors and linkages between remnants to facilitate movement and to encourage the flow of genetic material; and
- To **provide** opportunities for passive recreation in a controlled manner consistent with its ecological values.

In preparing the PoM for the George Street Reserves each of the above-listed principles has been considered and relevant management issues addressed.

7.2 BUSH REGENERATION

The most commonly used approach to the rehabilitation of native plant communities (bushland) is Bush Regeneration, which is defined by the Australian Association of Bush Regenerators (AABR) as:

...the practice of restoring bushland by focusing on reinstating and reinforcing the system's on-going natural regeneration processes (AABR, no date).

The Bush Regeneration approach (basically removing weeds and encouraging native plant regeneration from *in situ* seed sources) is suitable only for those sites the soil seed bank is intact, where mature native plants occur in sufficient numbers to provide source material, and where there is sufficient species diversity to restore the major floristic and structural components of the vegetation community (i.e. each layer or stratum).

Representative species of each stratum – i.e. the canopy, shrub and groundcover – must be present in the soil seed bank for natural regeneration to function as the primary rehabilitation process. Such bushland is described as 'structurally intact', and conforms to the definition provided by *State Environmental Planning Policy No-19 – Bushland in Urban Areas*¹⁰. Regeneration of the native plant

¹⁰ SEPP-19 definition of "bushland" means land on which there is vegetation that is either a remainder of the natural vegetation of the land or, if altered, is still representative of the structure and floristics of the natural vegetation.



community from existing seed sources cannot occur where the potential for regeneration (i.e. ‘**site resilience**’) is absent (see Section 7.3).

The Bush Regeneration approach incorporates a number of methodologies or strategies – the most commonly used are:

Natural Regeneration – which involves removing weeds; using a combination of hand weeding methods and the application of selective herbicides; then caring for the native seedlings which subsequently colonise the site.

Assisted Natural Regeneration – which combines traditional bush regeneration methods (eg. weeding) with seed collection, propagation and planting of locally indigenous tubestock to supplement natural (unassisted) regeneration.

Restoration or Reconstruction – which is used where a native plant community has been completely lost, but where the biophysical attributes of the site (eg. soil type, soil nutrient status, hydrological regime) are still within levels which remain tolerable to local native species. Reconstruction techniques centre on the planting of locally indigenous species in the proportions, range and densities similar to those present in the original (pre-disturbance) plant community.

Fabrication – which is used where the original native plant community is no longer present, and where the site’s biophysical attributes have changed to the point where the original plant community cannot be reconstructed or recreated (i.e. where site conditions have changed so dramatically that simply replanting with local native species is impractical).

Fabrication of a new plant community will necessarily take place over a long period of time (up to 10-years). The timeframe for fabrication will depend on the feasibility of ameliorating site impacts and of course, on the resources available for on-ground works.

7.3 POTENTIAL FOR REGENERATION – ECOSYSTEM RESILIENCE

Ecosystem resilience is defined as “the degree, manner and pace of restoration of the structure and function of the original ecosystem after disturbance” (Westman 1978), or more simply, as the ability of an ecosystem to recover from disturbance.

When assessing site resilience, key indicators are the standing biomass of remaining native plants (particularly naturally regenerating indigenous seedlings), and the potential reservoir of propagative material (seeds, spores, rhizomes) in the soil seed bank, although the latter is difficult to assess accurately without extensive trials.

Resilience in some parts of the subject land (eg in drainage lines and on fill bunds/mounds) is expected to be ‘low’ - because of the impact of past land uses, including excavation and deposition of fill soils, replacement of native understorey with weeds and introduced grasses, urban runoff and the suppression of the natural fire regime, with a consequent loss of viability in the soil seed bank. However, for the greater part of the subject land, especially those sites on the drier soils, resilience remains ‘high’ – as demonstrated by the good response achieved by TAFE students in a relatively short time.

Where ecosystem resilience is ‘low’ or ‘absent’, reconstruction of the native plant community through targeted weed control, followed by replacement planting will be required. If, after a period of (say) 12-18 months, natural regeneration is sparse (or absent), enrichment planting will be necessary to stabilise soils and to provide a native understorey to serve as habitat for native flora and fauna.



7.4 CHOOSING THE MOST EFFECTIVE STRATEGY

The Bush Regeneration approach usually concentrates on the rehabilitation of sites classified as ‘good to fair’ (or moderate), relying on natural regeneration from *in situ* sources (existing native plants and seeds/root or rhizome fragments in the soil). Bushland in the ‘good to fair’ categories will most likely retain sufficient regenerative potential to re-establish the native plant community once weeds have been removed.

Even in sites identified as ‘poor quality’ or ‘degraded’, located on fill soils, or where the native vegetation has been cleared for many years, there are usually a few native plants remaining. In such areas, it is likely that the soil seed bank has been severely depleted (or is absent) – thereby greatly reducing the potential for natural regeneration. For such areas, other methods must be used.

In chronically degraded or totally cleared areas, the plant community must be recreated, not regenerated. This usually involves a broad scale and often expensive, planting program. Therefore, as a matter of economics if nothing else, every attempt should be made to stimulate natural *in situ* regeneration prior to undertaking a bushland restoration program via planting.

In the subject land, Natural Regeneration will be the primary strategy used to encourage the regeneration of locally indigenous species and restore the CPW and SGTf ecological communities,

However, in sites where fill soils have been deposited, where soils have been heavily compacted or polluted by stormwater influx, or on edge sites where the impacts of urbanisation are most obvious, Assisted Natural Regeneration will be required to re-instate the floristic diversity and structural integrity of the bushland.

It is not envisaged that the abiotic traits of any area would have been altered to the extent that locally indigenous plants will not survive (thus requiring Fabrication) – assuming the instigation of an appropriate management regime.

7.5 WEED ECOLOGY

The information provided in the following section, while again largely generic in nature, has been included in the PoM for the George Street Reserves to provide guidelines for weed control, indigenous revegetation (planting), and site maintenance.

7.5.1 Definition

A plant is only a weed where it interferes with a man's use of the land for particular purposes, with his well being, or with the quality of his environment (Moore 1975).

Invasion by unwanted plants is a major constraint on the conservation and management of habitat for native flora and fauna. Unwanted plants in a natural or man-made environment are generally called ‘weeds’.

This generic term includes such diverse groups as:

- Plants harmful to agriculture, human health and the community (**‘noxious weeds’**);
- Horticultural escapes from gardens and amenity plantings (**‘environmental weeds’**);
- Plants introduced from other parts of Australia, or local native plants growing out of their normal range (**‘alien’** or **‘non-indigenous native plants’**);
- Plants commonly found in crops and pasture land (**‘agricultural weeds’**); and
- Plants that commonly grow in wasteland, on roadsides and in other disturbed areas (**‘ruderal weeds’**).



7.5.2 Keystone (Target) Weeds

Some introduced species pose serious and immediate threats to the vegetation community they invade, eventually modifying the ecosystem to such a degree that many native plants are unable to survive. These ecosystem modifiers are called 'keystone weeds' or 'primary target weeds', and they must be given priority in weed control program.

A keystone weed may have a legal designation as a 'noxious plant' (*Noxious Weeds Act 1993, Amended 2005*), or the species may be recognised as an 'environmental weed' in the local area – i.e. a plant that naturalises readily in bushland to the detriment of the native flora.

Typical keystone weeds in Western Sydney bushland, and represented in the subject site include Senna/Arsenic Bush (*Senna pendula*), Ground/Fern Asparagus (*Asparagus aethiopicus*), Mother of Millions (*Bryophyllum delagoense*), Wandering Jew (*Tradescantia fluminensis*) and African Love Grass (*Eragrostis curvula*)

7.5.3 Secondary Weeds

Not all weeds constitute a threat to the plant communities they invade. Some annual weeds or herbaceous perennials may be naturalised in the plant community, and many are hardy pioneer species that establish in the early stages of recovery (succession). They are usually short-lived, and although they produce a copious amount of seed, these pioneering species will not survive once a shading canopy is re-established.

Because they are highly visible, often grow in dense thickets, and give an 'untidy' appearance to a rehabilitation site, secondary weeds are often targeted first – unfortunately to little benefit as they quickly recolonise bare soil sites created by weeding.

Unless unlimited resources are available, secondary weeds do not warrant early treatment in the weeding schedule, as there are other, far more environmentally damaging weeds to contend with, especially when resources are limited.

Secondary weeds in the subject land include (primarily) herbaceous species such as Ribwort /Plantain (*Plantago lanceolata*), Fleabanes (*Conyza* spp), Purpletop (*Verbena bonariensis*), and introduced grasses such as Veldt Grass (*Ehrharta* spp) and Vasey Grass (*Paspalum urvelei*)

Non-indigenous natives such as Silky Oak (*Grevillea robusta*) and exotics such as Jacaranda (*Jacaranda mimosifolia*) are also considered to be secondary weeds unless they proliferate to the extent that they threatened to displace or otherwise suppress native species.

A list of keystone and secondary weeds identified in the George Street Reserves are listed in Table 7.1.

7.6 PRIORITY OF BUSH REGENERATION WORKS

Priority of works is to be determined according to the status of weeds present in each infestation. The following hierarchy is given to target weed infestations:

1. Weeds of National Significance ('WONS'); then
2. Noxious Weeds (Hawkesbury River County Council Local Control Area); then
3. Environmental Weeds – keystone species only.

A list of keystone (target) weeds present is provided in Appendix 4, along with recommended methods for the control for each species.



Table 7.1: List of Main Weeds & Introduced Plants Identified in the George Street Reserves

Botanic Name	Common Name	Location	Reason for Selection
<i>Acacia podyrifolia</i>	Mount Morgan Wattle	116, 256	Non-indigenous wattle, spreads quickly but has a limited occurrence: remove all
<i>Anredera cordifolia</i>	Madeira Vine	256	Very aggressive, invasive vine: eradicate
<i>Aranjia sericifera</i>	White Moth Plant	116, 256	Scrambling vine: potential to smother shrubs
<i>Asparagus aethiopicus</i>	Ground/Fern Asparagus	256	Noxious in some LGAs – very invasive & competitive in ground stratum
<i>Asparagus asparagoides</i>	Bridal Creeper	116, 256	WONS/Noxious Weed. As above
<i>Bryophyllum delagonesse</i> <i>B. pinnatum</i>	Mother of Millions Resurrection Plant	116, 256	Noxious weed: spreads rapidly, seed & fragmentation: drought tolerant
<i>Chloris gayana</i> . <i>C. virgata</i>	Rhodes Grasses	116, 256 (road res)	Mostly on road edges. Planted to stabilise soils but has spread into bushland.
<i>Cirsium vulgare</i>	Spear Thistle	116, 256	Limits access because of prickly nature
<i>Eragrostis curvula</i>	African Love Grass	116, 256	Dominant understorey species: highly competitive free-seeding tussock grass: control possible but not eradication
<i>Grevilla robusta</i>	Silky Oak	116, 256	Few planted, but naturalising in bushland: non-indigenous native species
<i>Jacaranda mimosifolia</i>	Jacaranda	256 (road res)	One or two plants: remove
<i>Ligustrum lucidum</i> <i>L. sinense</i>	Large-leaf & Small leaf Privet	116, 256	Noxious weed: very invasive in bushland on damp soils (eg drains)
<i>Lycium ferocissimum</i>	African Boxthorn	256	Very few plants: possible to eradicate
<i>Opuntia</i> sp.	Prickly Pear	116	Discrete infestations: possible to eradicate
<i>Osteospermum ? ecklonis</i>	South African Daisy	256	Succulent daisy: drought tolerant and spreads by fragmentation and seed
<i>Panicum maximum</i>	Guinea Grass	256	Limited occurrence: road reservation (#256)
<i>Paspalum dilatatum</i>	Paspalum	116, 256	Remove where it impact on native seedlings
<i>Paspalum urvillei</i>	Vasey Grass	116	Only in drainage line (#116)
<i>Pelargonium</i> sp.	Geranium	256	Few stands (#256): possible to eradicate
<i>Pennisetum clandestinum</i>	Kikuyu Grass	116, 256	Invasive and very competitive to new seedlings and plantings: eradicate with herbicide as foliar spray: repeat as required.
<i>Sedum</i> sp <i>Crassula tetragona</i>	Pride of London Crassula – a succulent	256	Invasive on dry soils: spread via dumped garden waste.
<i>Senecio madagascariensis</i>	Fireweed	116, 256	Widespread in grassland
<i>Senna pendula</i>	Cassia/ Arsenic Bush	115, 256	Scattered occurrence only
<i>Solanum nigrum</i>	Deadly Nightshade	116, 256	Berries are poisonous
<i>Tradescantia fluminensis</i>	Wandering Jew	116	Limited occurrence (#116): possible to eradicate
<i>Verbena bonariensis</i>	Purpletop	116	Limited to drainage line near shopping centre (#116)
<i>Wisteria sinense</i>	Wisteria	116	One occurrence (#116): remove before it spreads further



7.7 WEED CONTROL

Weed control is only one of a number of strategies required to achieve the broader goals of conserving, rehabilitating and managing native bushland. The identification of keystone (target) weeds may vary between vegetation communities and between differing land use areas.

When planning a weed control program, factors that must be considered include:

- The degree of weed infestation;
- The length of time since weed establishment;
- The substrate (fill or natural soils);
- Soil stability and the potential for slippage or erosion;
- Site and local drainage conditions (hydrology); and
- The condition (health) of nearby remnant vegetation, which will provide propagules for the natural regeneration of the site.

Weed control is only the first step to the recovery (or rehabilitation) of a more desirable plant community (whether native bushland or a plantation).

Of primary importance is the potential for the site to recover after disturbance i.e. 'site resilience'. In sites with 'low to moderate' weed density and/or those surrounded by good quality native bushland, the potential for recovery is good, with natural regeneration of natives species usually occurring from *in situ* sources (i.e. the soil seed bank) or volunteering from neighbouring bushland.

However, for those badly degraded sites or those that have suffered long-term or extensive disturbance, site resilience will usually be 'low to absent', so that attempts to achieve bush restoration will usually involve a broad-scale planting program.

Weeding to encourage the regeneration of native seedlings is the basis of the Bush Regeneration approach to the management of native plant communities. While Bush Regeneration is generally associated with the restoration of bushland remnants in the urban environment, there is some scope for some use of its low-impact methods in the rural environment, which historically has relied on grazing, slashing, burning, or the broad-scale application of herbicides to control weeds.

7.8 REVEGETATION

Revegetation in bush regeneration projects usually comprises 'enrichment' or supplementary planting in areas of low species diversity; and 'bush landscaping' on edge sites and buffer zones, or in landscaped garden beds to create an extended native habitat.

Enrichment Planting is carried out to increase existing species diversity by planting small shrubs, herbs, grasses and occasionally, new canopy trees. Enrichment planting can also be used to increase habitat for native fauna, and/or to re-introduce species which are known to have once been part of the local plant community, but for some reason have now been lost.

Bush Landscaping refers to the placement of new plants to in-fill clearings or gaps and link remnants, to establish buffer zones at the interface between bushland and developed areas, and to create complementary native gardens on adjoining sites.



Indigenous Revegetation – whether enrichment planting or bush landscaping – should attempt to utilise only plant material grown from local native species (i.e. indigenous species) in order to maintain the genetic integrity of the bushland remnant, but also to maintain ‘local character’.

Revegetation methods and techniques appropriate to George Street Reserves are discussed in Section 8.8. A list of locally indigenous plants appropriate for planting in degraded bushland has been included as Appendix 6.

The planting list has been prepared with reference to the Final Determination for the two (2) ecological communities extant on the site – CPW and Shale-Gravel Transition Forest. Local knowledge has also been used to ‘fine-tune’ the planting list.

It is not anticipated that all of the species listed will be used, but a wide range of species has been included to provide some degree of choice (especially as some of the species recommended may not produce seed regularly and/or they may be difficult to propagate).

Note that small or delicate herbaceous species have not been included in the planting list as they would not only be difficult to propagate, but would most likely not be hardy under field conditions. Species such as orchids, vetches, glycines and the smaller lilies – although desirable – would require a great deal of after care, which is unlikely to occur.

If some of the less commonly occurring species can be made available over time (as locally collected seed or tubestock), these should be used to increase biodiversity values and enhance habitat for native fauna.

Note also that threatened species such as *Dillwynia tenuifolia* should not be planted at any time.



8 IMPLEMENTATION & REVIEW

8.1 POLICY & PERFORMANCE

The policies established in this PoM provide a management framework consistent with the site's potential for bush restoration (as determined by ecological constraints), the availability of resources necessary for on-ground bush regeneration and related infrastructure works, and after consultation with the local community and Hawkesbury City Council.

The priority tasks to be carried out in the George Street Reserves (the subject land) are outlined in Section 8.3, below. Unless adequate resources are available over the lifetime of the PoM, some of the objectives listed for the George Street Reserves may not be realised.

8.2 REVIEW

This PoM for is designed to cover an initial five (5) year period. After this time, the Plan should be reviewed, outcomes of the bush regeneration program assessed using the Performance Indicators outlined in Section 8.9, and changes or adjustments made as necessary.

An updated flora survey should be commissioned, with the emphasis on identifying biodiversity values, with species densities and distribution evaluated in all Management Zones, and if applicable, actual or potential shifts in the floristic composition or structural integrity of the plant community identified or any obvious trends flagged.

A comprehensive fauna survey and evaluation of existing fauna habitats should also be undertaken at the end of the five (5) year timeframe. Analysis of survey results should be used to confirm or adjust the bushland management strategies set in place by the PoM.

8.3 WORK PRIORITIES




The following key tasks are listed in order of priority.


1. Community consultation – stakeholders to come to an agreement about the key goals and objectives for the Reserves, what can be achieved given the current level of resources, the basic strategies and actions to be undertaken, and the timeframe for achieving these goals and objectives. Community consultation should also identify the responsible body/person for carrying out strategies and actions, and all stakeholders must agree to abide by this decision.
2. After community concurrence, Council to formally adopt the PoM for an initial period of five (5) years.
3. Location and size of firebreak/buffer between bushland and adjoining development to be agreed (recommended 6-metre width), and Council to maintain this firebreak through regular slashing (as growth levels dictate).
4. Residents are to be made aware of the need to keep their rear property boundaries clean and clear. Where residents do not co-operate, Council is to take prompt action through their compliance section.
5. Council to commit resources to allow for a comprehensive Bush Regeneration Program over a period of five (5) years. Strategies and actions are to comply with the recommendation of the PoM.








6. Grant funding should be sought from a variety of external sources to assist Council to meet the cost of the Program.
7. Council's Manager, Land Management and Bushcare Officer to jointly renew efforts to establish a local Bushcare Volunteer Group. Continued liaison with the Richmond College of TAFE with a view to regularly using the subject land as a teaching tool should continue (work sites to be agreed).
8. Quantitative monitoring program set in place to assess the progress of bush regeneration works and establish trends in floristic diversity.
9. Walking track network to be upgraded and track extended for the length of both Reserves: surplus/unused tracks and clearings to be rehabilitated.
10. Site security to be upgraded. Unauthorised vehicles to be excluded: lighting to be installed in selected locations, signage to be erected with emergency telephone numbers.

Table 8.1: Environmental Management Objectives, Principles and General Guides

Management Zone	Management Issues	General Guide to Management Strategies/Actions
<u>Reserve #116 George Street Reserve</u>		
Zone 1 Commercial/Recreational (Colonial Drive/Sirius Road) 	<u>Management Issues are identified as follows:</u> <ul style="list-style-type: none">No signage / no formal entry pointVehicular access / damage to vegetationWeedy drainage swale behind Shops & Neighbourhood CentreEdge effectsWindblown rubbishRecreational facilities (tennis courts)Substation & surrounding land use	<u>Strategies and Actions</u> <ul style="list-style-type: none">Promote community access via formal pathways and erect signage at entry points.Direct foot traffic to non-sensitive areas (eg restrict access to regenerating bushland areas)Install fencing or sturdy bollards (telegraph poles, metal girders) to prevent unauthorised vehicle access, especially from rear of parking area near shops and SWC substation (currently open to all vehicles).Consider current configuration of walking tracks: unwanted or informal tracks to be closed: ripped and regenerated: fence off temporarily to protect regenerating bushland.Keep minimum six (6) metre strip of land behind shops, Neighbourhood Centre and Tennis Courts clear of bushland: slash & maintain a buffer zone.Do not allow regeneration/planting of shrubs in close proximity to public areas (safety issues).Regenerate and actively manage adjoining bushland: use only qualified bushland regeneration contractorsRehabilitation work to be based on Bush Regeneration approach <u>and</u> targeted weed removal (as required)Regenerate gaps/cleared /damaged areas (weed & rip): seed and/or plant tubestock where natural regeneration is slow or species diversity/abundance is disappointing.Weed, clear and remove silt from drainage line at rear of shops: revegetate channel using semi-aquatic native species (create a mini-wetland) to improve water quality and stabilise soils.
Zone 2 Residential Boundaries 	<u>Management Issues are identified as follows:</u> <ul style="list-style-type: none">Bushfire hazard (long grass)Safety & security issues (snakes, vandalism)Walking track and public accessEncroachmentsWeeds & garden escapesDumping	<u>Strategies and Actions</u> <ul style="list-style-type: none">Initiate weed control program, targeting woody weeds, Mother of Millions, African Love Grass and other keystone weeds.Enhance native understorey (where appropriate) by planting discrete shrub clusters to create protective habitat for native faunaAfter herbicide treatment, clear Blackberry and other weed thickets (scalp with machinery or fire debris)Where pasture grass forms a thick sward (with Thistle and other herbaceous weeds) in areas to be regenerated, scalp weeds and weedy topsoil (to 10 cm depth) and remove from siteEnsure all care is taken to avoid damage to remnant native vegetationBushland areas to be maintained at all times (short and long term) by qualified and experienced bushland regeneration contractors
Zone 3 George Street Embankment & Environs 	<u>Management Issues are identified as follows:</u> <ul style="list-style-type: none">Drainage problemsSoil erosion and subsidenceWeedsDead/dying treesFire hazard (cigarettes)Edge effects	<u>Strategies and actions</u> <ul style="list-style-type: none">Utilise bushland ‘restoration/reconstruction’ techniques (revegetation) to establish a suite of locally indigenous species¹ which will acts as a protective buffer from adjacent development areasSTC area will require broad-scale and on-going weed control and extensive replanting.Planting plant should utilise a limited suite of species initially and diversified over time.Planting program to extend over a period of 5+ years to maximise species diversityHard boundaries to between buffer and higher use areas to be promoted (eg paved pathways).Protect from excessive disturbance during construction works (fencing and signage)Bushland areas (existing and restored) to be maintained at all times (short and long term) by qualified and experienced bushland regeneration contractors

Management Zone	Management Issues	General Guide to Management Strategies/Actions
Zone 4 Core Bushland 	<u>Management Issues are identified as follows:</u> <ul style="list-style-type: none"> Threatened shrub – <i>Dillwynia tenuifolia</i> Weed invasion Loss of floristic diversity Tracking & damage to vegetation Compacted soils: potential salinity problems when soil surface is exposed Vehicular access / inappropriate uses Fire hazard (long grass – <i>Eragrostis curvula</i>) Dumping & windblown rubbish Fauna habitat values 	<u>Strategies and Actions</u> <ul style="list-style-type: none"> Design and implement weed management strategies which take the presence of all significant species, populations and ecological communities into account, and avoid unnecessary damage to habitat. Locate (GPS) threatened shrub on site map: induct all personnel working on the site: update map as required. Maintain/enhance suitably diverse habitat for native flora and fauna (eg shrubberies, open grassland, open woodland). Where the (unchecked) regeneration of shrubs as <i>Bursaria spinosa</i> (for example) threatens the integrity of such habitats, remedial measures must be undertaken to restore suitable site conditions Consider (limited) use of fire as a management tool (encourage natural regeneration and suppress weeds). Initiate weed control program, targeting keystone weeds (see Appendix 6) Dispose of weed debris and weedy topsoil (i/a) off-site When slashing at suburban interface (MZ 2) avoid damage to remnant native trees /shrubs. Revegetate degraded sites (low resilience) using locally indigenous CPW species Bushland to be maintained at all times (short and long term) by qualified bushland regeneration contractors

Management Zone	Management Issues	General Guide to Management Strategies/Actions
Reserve #256 George Street Reserve & Bushfire Headquarters		
Management Zone 5 Residential Boundaries 	<u>Management Issues are identified as follows:</u> <ul style="list-style-type: none"> Bushfire hazard (long grass) Safety & security issues (snakes, vandalism) Vehicular access No walking track / entry points Tracking, clearing and damage to vegetation Vandalism / spot fires Stormwater drains / weeds / maintenance issues Weed invasion Encroachments / storage / parking Dumping 	<u>Strategies and Actions</u> <ul style="list-style-type: none"> Utilise bushland ‘restoration/reconstruction’ techniques (revegetation) to establish a suite of locally indigenous wetland species Establish an ‘outside edge’ to tributary corridor, protect native vegetation (including regenerating trees) and undertake weed control program. Tributary No 3 corridor will require broad-scale and on-going weed control and extensive replanting. Planting plant should utilise a limited suite of species initially and diversified over time. Planting program to extend over a period of 5+ years to maximise species diversity Hard boundaries to between buffer and higher use areas to be promoted (eg paved pathways
Management Zone 6 Bushfire Headquarters & Environs 	<u>Management Issues are identified as follows:</u> <ul style="list-style-type: none"> Encroachments Fill soils and garden plants Dumping 	<u>Strategies and Actions</u> <ul style="list-style-type: none"> Approach residents with encroachments (gardens, storage, dumping & parking) and request co-operation (compliance may be required through Council). Approach Bushfire HQ management (as above), and initiate the removal of earthen mound and garden plantings. Public safety issues to be considered (eg. do not plant trees/shrubs within 6 metres of property fences or 3 metres of tracks. Structures (boardwalks, viewing platforms, perimeter tracks) to be set in place with minimal disturbance to flora and fauna species.

Management Zone	Management Issues	General Guide to Management Strategies/Actions
<p>Management Zone 7 George Street Interface</p> 	<p><u>Management Issues are identified as follows:</u></p> <ul style="list-style-type: none">▪ Vehicular access▪ Clearing, tracking & damage to vegetation▪ Soil erosion and wash▪ Weeds▪ Fire hazard (cigarettes)▪ Edge effects <p><u>Note:</u> photo taken from bushland looking west towards George Street.</p>	<p><u>Strategies and Actions</u></p>
<p>Management Zone 8 / Polygon x Core Bushland</p> 	<p><u>Management Issues are identified as follows:</u></p> <ul style="list-style-type: none">▪ Threatened species - <i>Dillwynia tenuifolia</i>▪ Weed invasion▪ Loss of floristic diversity▪ Vehicular access / inappropriate uses▪ Tracking & damage to bushland▪ Fire hazard (long grass)▪ Dumping & windblown rubbish▪ Fauna habitat values	<p><u>Strategies and Actions</u></p> <ul style="list-style-type: none">▪ Design and implement weed management strategies which take the presence of all significant species, populations and ecological communities into account, and avoid damage to habitat.▪ Locate (GPS) threatened shrub on site map: induct all personnel working on the site: update map as required.▪ Maintain/enhance suitably diverse habitat for native flora and fauna (eg shrubberies, open grassland, open woodland).▪ Where the (unchecked) regeneration of shrubs as <i>Bursaria spinosa</i> (for example) threatens the integrity of such habitats, remedial measures must be undertaken to restore suitable site conditions▪ Consider (limited) use of fire as a management tool (encourage natural regeneration and suppress weeds).▪ Revegetate degraded sites (low resilience) using locally indigenous CPW species▪ Initiate weed control program, targeting keystone weeds (see Appendix 6)▪ Dispose of weed debris and weedy topsoil (i/a) off-site▪ When slashing at suburban interface (MZ 7) avoid damage to remnant native trees /shrubs.▪ Consider (limited) use of fire as a management tool (encourage natural regeneration and suppress weeds).▪ Revegetate degraded sites (low resilience) using locally indigenous CPW species▪ Bushland to be maintained at all times by qualified bushland regeneration contractors
<p>Management Zone 9 Park Wetherill Crescent</p> 	<p><u>Management Issues are identified as follows:</u></p> <ul style="list-style-type: none">▪ Park – open space / public use▪ No signage▪ No tracks / informal track on earthen bund▪ Boundary delineation▪ Trail bike jumps & damage to vegetation▪ Dumping (minor)▪ Drainage & soil erosion issues	<p><u>Strategies and Actions</u></p> <ul style="list-style-type: none">▪ Define Park boundaries: reinstate/repair bollards & edging▪ Install signage (directional and interpretative)▪ Create walking track at rear of Park (will serve as buffer to bushland)▪ Remove trail bike jumps and disperse soil in cleared areas in bushland (after ripping) or if fill soils, dispose off-site.



8.4 PROTOCOLS FOR WEED CONTROL

All plants declared As Weeds of National Significance ('WONS'), plants declared noxious in HRCC Local Control Area, to be removed as a matter of priority – this is described as 'targeted weed control'. This is to be followed by addressing the keystone environmental weeds recorded for the Reserve.

The weeds identified in Appendix 4 have been identified as priority target weeds for the bush regeneration program in the Reserves.

Maintenance weeding will necessarily be on-going in all Management Zones after the conclusion of initial primary and follow-up weeding. The long-term nature of a bush regeneration program is stressed. Following completion of initial works, maintenance weeding will be required throughout the whole of the subject land at a *minimum* four (4) sessions/year in order to keep the bushland acceptably free of target weeds.

Management for species diversity (eg culling of dense native vegetation, selective replanting) and management of the bush fire hazard should be carried out yearly, and these tasks will require a further level of resources.

8.5 PROTOCOLS FOR REVEGETATION

The following guidelines are basically generic in nature and are included in the PoM for the George Street Reserve as an aid to implementing an indigenous planting program in bushland reserves in the urban and peri-urban environments.

8.5.1 Site Preparation

Soil Conditions

The success of any planting program is largely dictated by site conditions, and particularly the structure and chemical composition of the site soils. Prior to planting, a series of basic soil tests should be carried out using one of the proprietary soil testing kits available commercially.

Despite the costs involved in carrying out basic soil tests, the whole program could fail if the soil proves to be unsuitable for planting with native species¹¹.

If the soil pH or salinity levels are outside the 'normal' range (read product label), advice on soil remediation should be sought from a qualified horticulturalist or landscape gardener. The local office of the NSW Department of Primary Industry may also be able to offer practical advice.

If imported (or fill) soils already *in situ* on the property are suspected of being contaminated in some way, soil samples should be sent to a professional laboratory for analysis. Similarly, if site soils are thought to contain asbestos or a similar macro-pollutant, contact Council's Environment Unit or the Health Department without delay.

On the subject land, this will not apply unless the planting area is located on fill soils (mullock heaps), or where it is suspected that builder's rubble has been dumped (cement, bricks, asphalt, asbestos and the like).

¹¹ That is, soil may be too high in plant nutrients, particularly Phosphorus (P) or Nitrogen (N); too high in clay content, or it may contain micro or macro pollutants.



8.5.2 Selection of Appropriate Flora Species

In selecting species for planting in bush regeneration sites, a number of issues must be considered. The species chosen should not simply be made from a broad selection of native plants known to occur in the locality but should be:

- Representative of the locally occurring native vegetation communities – in this case CPW and Shale Gravel Transition Forest;
- Readily obtainable from a reputable plant nursery, or easily propagated by seed collected from existing local material;
- Niche-specific, i.e. suitable for planting in existing habitats and micro-habitats within the subject site;
- Hardy and tolerant of variable soil conditions, and easy to establish under open and exposed field conditions;
- Be of appropriate size (height/breadth) to achieve an appropriate balance in the proportion of trees and shrubs and groundcovers in the replicated vegetation community;
- Provide a range of habitat, foraging and shelter sites for native fauna (especially around high-usage sites such as ponds and open grasslands);
- On edges and interface sites between bushland and development, be carefully selected so as to create an effective 'buffer' between designated bush regeneration areas and private property boundaries; and when
- Planting in buffers and interface sites, should utilise only fire-retardant species (or those with reduced flammability), with planting made at reduced densities and (where appropriate) with a simplified structural form¹².

8.5.3 Densities and Spatial Arrangement

The typical ratio of canopy trees: shrubs: ground cover in a pre-disturbance CPW community is 20: 20: 60 (Watson pers. comm.)¹³. For a variety of reasons, including the absence or overuse of fire, changes to local drainage patterns and fragmentation, this ratio has been dramatically altered, with an over abundance of shrubs and a paucity of ground covers commonly observed in urban bushland reserves.

When revegetation programs are planned in urban reserves, this altered ratio is often taken as 'the norm', with the result that planting densities are skewed towards high numbers of shrubs and trees. This should not occur in a CPW restoration program where the objective is to restore (as far as possible and practicable) a semblance of the original plant community.

Planting density should be based on the final size of the relevant species used and aim to recreate a naturalistic arrangement. For example, small-sized plants (generally less than 500 millimetres in height) should be planted in groups at a density of approximately 3 to 5 units per square metre.

Larger species may also be planted in groups of three (3) to seven (7), but should be placed sufficiently close together to enable a sufficiently dense cover to form (where this is appropriate, and will not suppress light-demanding groundcovers).

¹² See publications from the Rural Fire Service or view their website (www.rfs.nsw.gov.au).

¹³ Also expressed as a % of the biomass in each stratum.



It should be noted that any planting undertaken in and around the drainage lines must consider the need to maintain access for routine maintenance. It may be necessary to access these drains with a small machine or if this is not feasible, by using a wheelbarrow to remove silt, weeds and accumulated rubbish. Therefore, the planting arrangement should take this factor into consideration. Plants should be grouped or spaced to allow access for routine maintenance.

8.5.4 Planting Aids

Plant Fertilisers

A specially formulated native plant fertiliser low in phosphorus (such as Osmocote Purple) should be used when planting native tubestock. Regular applications of dilute fertiliser should be used twice yearly (spring and early autumn) or when plants show signs of yellowing or spindly growth (at least until the plants become established and drought hardy).

The use of a plant fertiliser is recommended to assist plant establishment in the first 6-12 months of the planting program. As the vegetation cover is re-established, and organic matter is re-cycled into the topsoil, there will be less need for supplementary nutrient input.

Complete native plant fertilisers are available in granular form or as tree tablets. Soluble fertilisers are preferable to granular forms, although tree tablets (or pellets) are useful at planting time.

Water Retaining Granules/Soil Wetters

Products such as Debco, Saturaid, Terracottem (or similar) should always be used in harsh conditions and/or where post-planting watering may be a problem, and they are particularly useful in free-draining or sandy soils. In current drought conditions, no planting should be undertaken without the use of water retaining granules or soil wetters.

These products are inert, and do not react with fertilisers or herbicides. If used at planting time, watering times can be reduced by up to 50%. Experience using such granules in bush regeneration sites in the Sydney Region has allowed a greater survival rate than previously achieved.

Mulching and Weed Matting

Mulch is crucial to the success of most planting projects as it keeps the soil cool and moist and suppresses weed growth. Mulching around planted tubestock can utilise chipped eucalypt mulch or if costs allow, commercial 'leaf mulch' may be used.

Chipped or mulch from woody weed sources are never acceptable. All imported mulch must be of known provenance and free of weeds. Alternatively, it is possible to foliar spray dense weed grasses with a selective herbicide (eg Fusilade) and to leave the dead thatch in place as mulch¹⁴.

Mulch must be applied at the time of planting, after thorough soil wetting. When planting in large open areas, plants should be grouped to allow mulch to be applied around each 'planting island' or cluster. This reduces the edge effect (weed invasion, drying) and makes plant maintenance easier.

Weed Matting (such as Jutemaster, Enviromat, coconut fibre) is useful for retaining soil moisture and suppressing weed growth. Individual weed mats may be used around each plant at planting

¹⁴ A systemic herbicide such as glyphosate is not recommended as a foliar spray to control grasses where other native plants are growing as this product is non-specific.



time, or broad-scale weed matting can be placed over a large area. If the latter approach is used, the matting must be firmly anchored with long metal pins.

Note that weeds will grow in most types of mulch and on the surface of weed matting, but seeds beneath are prevented from germinating. Most grasses and bulb species have sharp leading shoots (new growth) that can pierce loosely spun weed mats and grow through them.

Mulch should never be used in bushland sites where natural regeneration from the soil seed bank is anticipated – i.e. where site resilience is moderate to high. Thick mulch will suppress the germination of many locally indigenous species, which in the main are sclerophyllous (hard-leaved), while favouring only those species with largest seed – these generally being native gully or mesic species such as Sweet Pittosporum (*Pittosporum undulatum*). If used over a long period of time, the placement of thick mulch can impact on site floristics and encourage a shift to a mesic vegetation type, and inadvertently create optimal conditions for the growth of shade tolerant weeds such as Privet (*Ligustrum* spp)

Note also the importance of leaving bare soil on sites where natural regeneration is anticipated

8.5.5 Irrigation

It may not be possible to water the planting sites over a long period, therefore the planting program should be planned to coincide with the period of maximum (and regular) rainfall. In the Western Sydney Region, optimal planting time is mid to late autumn.

It is also important to ensure adequate watering at planting, applying 1-1.5 litres of water to each new plant. Additionally, the use of a water-retaining compound and some form of surface mulch are strongly recommended to retain soil moisture and decrease the need for on-going watering.

Plants should be soaked for at least 30 minutes prior to planting (before being removed from their pots), watered thoroughly at planting and thereafter, watered once each week for a period of 4 weeks (weather conditions dictating frequency). After this period, watering comprising one (1) litre of water / plant each month will be required until the plants have established.

If current drought conditions prevail, a permanent watering period may have to be extended to ensure plant survival. A drip irrigation system is best and (unless regulations change) complies with Sydney Water restrictions on watering gardens. Watering is best carried out in the early morning (watering at dusk encourages fungal attack in some species).

Alternatively, as plant establishment is dependent on good follow-up rains, it may be prudent to delay any planting until such time as climatic conditions improve.

8.5.6 Revegetation Methods

Tubestock Planting

Planting 'forestry tubes', hykos (small tubes) and/or advanced tubestock is the most reliable method of establishing woody native plants (trees, shrubs), and is also useful in establishing most of the native tussock grasses (eg. *Themeda australis*, *Echinopogon* spp, *Poa* spp.).

Bushland restoration in degraded areas, in bare sites or in large clearings (> 10 sq metres) will generally rely on the placement of tubestock, wherever possible supplemented by other methods of revegetation. Other methods that can be used include hand broadcasting of seed, brush layering and transplanting seedlings and or leaf litter from nearby bushland areas. Such supplementary methods may also be used to 'fill in the gaps' between planted tubestock.

On the subject land, the planting of tubestock or advanced tubestock is strongly recommended, as these will establish rapidly with minimal care. Advanced plant stock (8" or 12" pots) may be used



for specimen trees or shrubs in order to create an 'instant effect'. However, this approach is best reserved for landscaped areas (such as the garden beds or the Park), and not used where natural bush is being encouraged to regenerate naturally.

Hand Sowing

Seed of hardy pioneer species such as Wattles (*Acacia* spp) and *Dodonaea* spp (Hop Bush) may be collected from local bushland and scattered on bare (prepared) soil between tubestock plantings¹⁵. As hand sowing (or direct seeding) is wasteful of seed, seed collected from most other species should be propagated as tubestock.

If native grass seed is available, hand sowing between tubestock planting may also be used. Grasses such as Blady Grass (*Imperata cylindrica*), Longhair Plume Grass (*Dichelachne crinita*), Bordered Panic (*Entolasia marginata*), and sedges with large sized seed such as Knobby Club-rush (*Isolepis nodosa*), some of the local Cyperaceae, and *Juncus usitatus* (Soft Tussock Rush) would also be suitable for hand sowing. However, grasses with more precise germination requirements such as Kangaroo Grass (*Themeda australis*) are best established via tubestock or transplanting.

Brush Layering (Brush Matting)

The use of mulched timber as a soil cover and to provide microhabitat is a cheap and effective way of re-establishing vegetation if sufficient source material is available. If a source of local brush is available, it is strongly recommended that brush layering be used (possibly in addition to tubestock planting) as it provides a large amount of seed very cheaply and the brush itself provides extra protection for the new seedlings.

If brush layering is used, then plants must bear ripe fruit/cones, and the branches must be cut and spread over bare (prepared) soil before the seed drops. The stress of cutting will release seed, so that cut brush cannot be stored for long period of time. Brush is best used on the day it is cut.

The potential to use brush layering in most CPW communities is limited because few appropriate species occur. Exceptions are *Leptospermum* (Teatree) and *Melaleuca* (Paperbarks), which retain hard seed capsules on the parent plant unless released by fire or damaged (felled or cut).

8.6 WORKS PROGRAM

8.6.1 Licences and Permits Required

The undertaking of works in an endangered ecological community (weed control, seed collection, planting or other works) requires the issuing of a Section 132C licence from the NPWS Division of the NSW Department of Environment and Conservation.

Research or related studies which potentially impact on a threatened species, population or ecological community or their habitats (*TSC Act*), or on any protected species listed under the *National Parks & Wildlife Act* (1974) may only be carried out by suitably qualified workers holding a current Section 132C Scientific Licence from the DEC. The obtaining of a Scientific Licence is the responsibility of the individual worker. Workers seeking to trap, capture or collect native fauna are also required to obtain an Ethics Licence from Department of Primary Industry.

¹⁵ *Acacia* seed must be treated prior to sowing. ~50% of the seed should be treated by pouring boiling water over it. Seeds should be soaked for 1-2 minutes, drained and allowed to dry.



8.6.2 Implementation and Timing of Works

The long-term nature of a bush regeneration project is strongly emphasised. Priority actions set out in the Plan have been limited to a five (5) year timeframe, with a recommendation for review (and adjustment) at this time. However, after this period of time the bushland should continue to be managed in accordance with the principles and guidelines set out in this PoM.

Timing of on-ground works are summarised in Figure 8.1 (Gantt chart). This provides an indication of both the duration and the chronology of *each* item listed within the initial five (5) year program.

8.6.3 Site Maintenance

A regular maintenance program will be required for all planted areas after the completion of initial works. If professional bush regeneration contractors are used for initial primary weeding, and perhaps site preparation and planting, the Bushcare group can be of great assistance in taking on the maintenance phase of the project. However, if there are members of the community willing to undertake other tasks as well, then these can be built into the timetable of works.

Actions embedded within the maintenance program are:

- Regular weeding to remove competitive exotic plant species and control invasive natives;
- Care of planted areas (including watering, disease control, application of native plant fertilisers and replacement of lost or failed plants);
- Maintenance of plant bags and stakes (with removal once plants overtop the bags); and
- Rubbish removal and care of edges and buffer zones.

Monitoring, evaluation and reporting are integral parts of the site maintenance program (see Section 8.8 and Appendix 5).

8.7 LABOUR AND RESOURCES

8.7.1 Contractors

Trained bush regenerators should continue to be used to work in environmentally sensitive areas where threatened species or remnant native vegetation could be harmed. A trained bush regenerator is one who has successfully completed the accredited Bushland Weed Control Certificate course offered by NSW TAFE (or interstate equivalent), and who has completed at least 350 hours in the field.

However, community volunteers are playing an increasingly important role in bushland management, and many councils (including Hawkesbury) successfully use a combined contractor/volunteer approach to bush regeneration. The joint effort undertaken by these groups have frequently achieved dramatic results within a relatively short time.

Long-term bush regeneration programs are usually carried out on a yearly contract basis. There are several dozen professional contractors operating in the Sydney area alone. Using a professional bush regeneration supervisor to train and co-ordinate the work of volunteers and employed grounds staff improves the quality of work, and allows the job to move forward far more quickly than would be the case if only untrained volunteers are used.



8.7.2 Community Volunteers

Hawkesbury City Council has an active community Bushcare Volunteer Program in place, incorporating a range of activities. However, it is understood that to date, no Bushcare groups have been formed in the Bligh Park area

Where such groups are established, it must be stressed that the community volunteers must be trained in bush regeneration techniques and be equipped with the right tools for the job. Good quality tools allow for more efficient and rewarding work.

The volunteers must also have good on-site supervision and adequate back-up facilities (e.g. help with planning, access to expert advice, regular rubbish collection, supply of herbicides (if applicable) and replacement of tools and materials). Volunteers should never be left to work on site alone; set to work in chronically degraded areas, or in sites with little potential for regeneration as the group may eventually lose its enthusiasm, and goodwill will be lost.

It is also stressed, that for maximum efficiency a regular Bushcare works program should be established and maintained. Without this regular attendance on-site, weeds can seed freely and invade areas which have recently been worked, or new weed invasions can escape notice.

Regular attendance (say monthly) also allows for volunteers to familiarise themselves with local flowering and seeding patterns, so that seed collection for the future propagation of tubestock can be maximised.

8.7.3 On-Site Supervision

The appointment of a supervising Project Manager within Council with experience in rehabilitating native landscapes is strongly recommended. It is anticipated that the Project Manager will be the Land Management Officer. The Project Manager will be the first point of contact for the matters relating to bushland issues.

The Project Manager will be responsible for implementation of each element of the PoM, for the review and assessment of methods and techniques employed, and will be responsible for 'sign off' at each stage (milestone) of the program.

8.8 MONITORING AND ASSESSMENT

A simple monitoring program is recommended to assess the success of the bushland restoration program. The bush regeneration contractor employed to carry out on-ground works should undertake monitoring, to the direction of the Project Manager. Monitoring should continue for a period *at least* equal to the lifespan of the current PoM. However, if reliable quantitative data is to be gained from the monitoring program, it should continue for a period of at least 10 years.

Monitoring procedures should be simple and straightforward, as well as inexpensive to implement. Monitoring should provide both qualitative (visual/photographs) and quantitative (statistical/quadrats) assessment. Reports should provide findings in a manner that is readily interpreted by all stakeholders.

Monitoring procedures, frequency and duration of survey, and reporting format should be agreed between the contractor and the client at the outset of the restoration project. Should the rehabilitation project itself extend beyond an initial five (5) year lifetime of the PoM, procedures should be reviewed and updated as required.

Assessments should preferably be quantitative in nature (although photo-points will also form part of the monitoring process) and these must be measured against the Performance Indicators set out in Section 8.9. Should monitoring and review indicate that the performance measures are



not being met in a timely fashion, the strategies set out in the POM should be reviewed, and the strategies set out in the Plan amended as necessary.

A generic guide to monitoring progress in bushland restoration projects has been included as Appendix 5.

8.9 PERFORMANCE INDICATORS

Performance Indicators are used to demonstrate that the program of implementation for the strategies outlined has been achieved. Among its primary goals, the PoM lists the enhancement of species diversity and provision of habitat for native flora and fauna.

Site-specific (or Zone focused) indicators should be set out in a detailed 'works plan' or 'action plan, prepared at tender contracting stage. The works plan will set out individual tasks/area or site, provide a timetable of works over a designated period, and identify final implementation costs.

The bush regeneration contractor, in consultation with the Project Manager will prepare the works plan, which will include a basic monitoring program.

In the meantime, the following Performance Indicators have been developed to serve as a general guide to monitoring the progress of the bushland rehabilitation program.













1. An increase in the cover of indigenous vegetation in each layer or stratum (quantified via quadrat sampling –see Appendix 5).
2. An increase in floristic diversity in the combined Reserves, measured by quadrat sampling.
3. No net loss of any indigenous plant species recorded, measured by quadrat sampling (particularly of ground cover species).
4. Natural regeneration of seedlings of each indigenous plant species recorded in the combined Reserves.
5. Flowering and fruiting of each indigenous plant species recorded in the combined Reserves.
6. No net loss of threatened, vulnerable or other significant flora species recorded in the combined Reserves.
7. Increase in the diversity of fauna habitat types and niches available within the combined Reserves (qualitative assessment suitable).
8. Floristic and structural diversity created and/or maintained in each habitat type (see Section 5.3.2).
9. Increase in the number of native fauna species recorded or observed within the combined Reserves (optimum levels to be determined).
10. Increase in the number of small passerine birds utilising the Reserve bushland (measured via consecutive biennial fauna surveys).



























11. Where bush regeneration contractors are employed, a decrease in the number of hours performing follow-up weed control and maintenance activities in each Management Zone (minimum level to be determined).
12. A decrease in the effect of each negative impact or threatening process (eg weed invasion and unwanted growth of vegetation, feral animal predation, soil erosion, dumping etc) recorded within the site overall (optimum levels to be determined).



Figure 8.1: Proposed Timetable of Works

Item / Task	Year 1	Year 2	Year 3	Year 4	Year 5
<u>Planning & Administration</u>					
PoM Adopted by Council:					
Liaison with Neighbours (potential) Park Ranger /Bushcare Programs Established					
Resources Allocated for 5-year Program					
Call for tenders: Appoint Bush Regeneration Contractor					
<u>Infrastructure & Related Works</u>					
Establish firebreak (APZ) and clean up residential boundaries					
Install Signage, Fencing & Bollards To Exclude Vehicles, Lighting (if possible)					
Identify Future Track Network & Allocate Resources for New Track (#256)					
Determine Planting Needs & Organise for Indigenous Seed Collection & Propagation of Tubestock (12-18 months lead time)					
Drainage Issues – Consult with RTA & Council Engineers					
<u>Bush Regeneration Program</u>					
Primary Weeding i) Target woody weeds ii) Target weeding of MofM and ALG around <i>Dillwynia tenuifolia</i>					



Item / Task	Year 1	Year 2	Year 3	Year 4	Year 5
Primary Weeding (other) i) Residential Boundaries ii) Core Bushland		 			
Secondary/Follow-up Weeding (all sites, as required (include 2 x yearly foliar spray of MoM and ALG)					
Maintenance Weeding					
Enrichment Planting <i>*dependent on natural regeneration (2 x year planting program)</i>					
Plant Maintenance Program (care of plants, watering, weeding, replacement planting)					
Other					
Monitoring Program & Annual Reporting					
Review of POM & Revision/Extension of BR Program (a/r)					

Note: annual blocks are divided into 6 month increments.

Note also: primary and follow-up and maintenance weeding will usually be undertaken concurrently, depending on the number of sites being regenerated.



9 REFERENCES

- Bannerman, S.M. and Hazelton, P.A. (1990). *Soil Landscapes of the Penrith 1:100 000 Sheet*. Soil Conservation Service of NSW, Sydney.
- Benson, D.H. (1992). The Natural Vegetation of the Penrith 1:100 000 Map Sheet, in *Cunninghamia* 2 (4) 541-596.
- Benson D. and Howell J. (1994). *Taken for Granted: the bushland of Sydney and its Suburbs*. Royal Botanic Gardens Sydney, Kangaroo Press, Kenthurst, NSW.
- Benson D.H. & von Rickter, L. (2006). Discover the biodiversity and ecology of CPW at Mount Annan. Review of Science & Public Programs, Botanic Gardens Trust, Sydney. Paper presented at Symposium Conservation & Restoration of The Cumberland Plain, held at UWS Werrington South Campus, 19 July 2006.
- Briggs, J. and Leigh, J. (1996). *Rare or Threatened Australian Plants*. CSIRO Publishing, Collingwood.
- Bureau of Meteorology Online (2006). *Climate Averages for Australian Sites: Prospect Dam #067019*. http://www.bom.gov.au/climate/averages/tables/cw_067019.shtml. [Accessed October 2006].
- Clark, N.R and Jones, D.C (eds.) (1991). *Penrith 1:100 000 Geological Sheet 9030*. NSW Geological Survey, Sydney.
- Conacher Travers Bushfire & Environmental Consultants (February 2004a). *Hazard Reduction Program & Environmental Assessment at Lot 453 DP 749371 George Street Reserve, South of Colonial Drive, Bligh Park*. Unpublished report prepared for Hawkesbury City Council.
- Conacher Travers Bushfire & Environmental Consultants (February 2004b). *Hazard Reduction Program & Environmental Assessment at Lot 89, DP 709025 George Street Reserve, North of Colonial Drive, Bligh Park*. Unpublished report prepared for Hawkesbury City Council.
- Department of Infrastructure, Planning and Natural Resources (NSW) (2003). *Bringing the Bush Back to Western Sydney: best practice guidelines for bush regeneration on the Cumberland Plain*. DIPNR, Sydney.
- Department of Environment & Conservation (NSW) (2005). *Recovering Bushland on the Cumberland Plain: Best practice guidelines for the management and restoration of bushland*. DEC, Sydney.
- Department of the Environment and Heritage (2005). *Environment Protection and Biodiversity Conservation Act Online Databases*. <http://www.environment.gov.au/epbc/db/index.html> [Accessed October 2006].
- Department of Infrastructure, Planning and Natural Resources (NSW) (2003). *Bringing the Bush Back to Western Sydney: best practice guidelines for bush regeneration on the Cumberland Plain*. DIPNR, Sydney.
- Harden, G.J. (1990-1992). *Flora of New South Wales*: vols 1-4. Royal Botanic Gardens Sydney.
- Hawkesbury Gazette, Bligh Park in the Spotlight. Newspaper article Wednesday November 29, 2000
- James, T. A. *et al.* (1990) *Rare Bushland Plants of Western Sydney*. Royal Botanic Gardens, Sydney.



- Lunt, I. D. & Morgan, J.W. (1999). Vegetation changes after 10 years of grazing exclusion and intermittent burning in a *Themeda triandra* (Poaceae) grassland reserve in south-eastern Australia, in *Aust. Journal of Botany*, 47: 537-52.
- Morris, C. (2006). Soils seed bank. 1. Species composition in pasture, revegetation, remnants. Paper presented at *Symposium Conservation & Restoration of The Cumberland Plain*, held at UWS Werrington South Campus, 19 July 2006.
- Nichols, M (2004). *Hawkesbury—a Pictorial History*. Kingsclear Books, Sydney.
- NSW Department of Lands. *Parish Map Preservation Project* @ www.parishmaps.lands.nsw.gov.au/mrsid/show.pl. Accessed, 8 April 2006.
- NSW Heritage Office Website. Listing Heritage Items – State Heritage Register @ www.heritage.nsw.gov.au/07_subnav_02_2.cfm?itemid=50-54842 . Accessed October 2006.
- NSW National Parks and Wildlife Service (1997). *Western Sydney: Urban Bushland Biodiversity Survey*. National Parks and Wildlife Service, Hurstville.
- NSW National Parks and Wildlife Service (2002). *Native Vegetation of the Cumberland Plain*. NSW NPWS, Hurstville.
- NSW National Parks and Wildlife Service (2005). *Atlas of NSW Wildlife Database*. <http://wildlifeatlas.npws.gov.au> [Accessed October 2006].
- NSW Scientific Committee (various dates). *Final Determinations*. NSW Scientific Committee.
- Proudfoot, H. (nd). *Thematic History of the Hawkesbury Heritage Study*. Report currently being prepared for Hawkesbury City Council by H. Proudfoot for Lester Troopman & Associates.
- Robinson, L. (1991). *A Field Guide to the Native Plants of Sydney*. Kangaroo Press, Sydney.
- Prober, S, Lunt, I. & Theile, K (2004). Restoring ecological function in woodland: is *Themeda australis* a key to restoring nitrogen cycles and resistance to annual exotics in grassy understoreys? In, *Abstracts Booklet: Proceedings of Ecological Society of Australia Conference*, held in Adelaide December 2004: Sander, V, Potter, J. & Facellii, J. (eds). pp 90-91
- Watson, P. (2005). Fire frequencies for Western Sydney's woodlands : indications from vegetation dynamics. Thesis submitted to the University of Western Sydney in fulfilment of a Doctorate. Online at <http://library.uws.edu.au/adt-NUWS/public/adt-NUWS20060706.152023/index.html>
- Westman, W. E. (1978). Measuring the inertia and resilience of ecosystems. *Bioscience* 28: 705-710.



10 APPENDICES



APPENDIX 1: FINAL DETERMINATIONS

A Cumberland Plain woodland - endangered ecological community listing

The Scientific Committee, established by the Threatened Species Conservation Act has made a Final Determination to list the Cumberland Plain Woodland as an ENDANGERED ECOLOGICAL COMMUNITY on Part 3 of Schedule 1 of the Act. Listing of Endangered Ecological Communities is provided for by Section 12 of the Act.

Any submissions received following advertisement of the Preliminary Determination have been considered by the Scientific Committee.

The Scientific Committee has found that:

1. The Cumberland Plain Woodland is the accepted name for the plant community that occurs on soils derived from shale on the Cumberland Plain.

2. The Cumberland Plain Woodland is characterised by the following assemblage of plant species:

<i>Acacia decurrens</i>	<i>Acacia falcata</i>	<i>Acacia implexa</i>
<i>Acacia parramattensis</i>	<i>Aristida ramosa</i>	<i>Aristida vagans</i>
<i>Arthropodium milleflorum</i>	<i>Asperula conferta</i>	<i>Brunoniella australis</i>
<i>Bursaria spinosa</i>	<i>Cheilanthes sieberi</i>	<i>Chloris truncata</i>
<i>Chloris ventricosa</i>	<i>Commelina cyanea</i>	<i>Cyperus gracilis</i>
<i>Daviesia ulicifolia</i>	<i>Dianella longifolia</i>	<i>Dianella revoluta</i>
<i>Dichelachne micrantha</i>	<i>Dichondra repens</i>	<i>Dillwynia sieberi</i>
<i>Echinopogon caespitosus</i>	<i>Echinopogon ovatus</i>	<i>Entolasia marginata</i>
<i>Eragrostis leptostachya</i>	<i>Eremophila debilis</i>	<i>Eucalyptus crebra</i>
<i>Eucalyptus eugeniioides</i>	<i>Eucalyptus fibrosa</i>	<i>Eucalyptus maculata</i>
<i>Eucalyptus moluccana</i>	<i>Eucalyptus tereticornis</i>	<i>Exocarpos cupressiformis</i>
<i>Glycine clandestina</i>	<i>Glycine tabacina</i>	<i>Goodenia hederacea</i>
<i>Hardenbergia violacea</i>	<i>Hibbertia diffusa</i>	<i>Hypericum gramineum</i>
<i>Hypoxis hygrometrica</i>	<i>Indigofera australis</i>	<i>Lepidosperma laterale</i>
<i>Lissanthe strigosa</i>	<i>Lomandra filiformis</i>	<i>Lomandra multiflora</i>
<i>Melaleuca decora</i>	<i>Microlaena stipoides</i>	<i>Oplismenus aemulus</i>
<i>Oxalis exilis</i>	<i>Panicum simile</i>	<i>Phyllanthus filicaulis</i>
<i>Pratia purpurascens</i>	<i>Solanum pungetium</i>	<i>Themeda australis</i>
<i>Tricoryne elatior</i>	<i>Vernonia cinerea</i>	<i>Wahlenbergia gracilis</i>

The total list of plant species which occur in the community is much larger, with many species occurring in one or a few sites, or in very low abundance. Not all species listed above occur in every single stand of the Community.

3. The Cumberland Plain Woodland sites are characteristically of woodland structure, but may include both more open and more dense areas, and the canopy is dominated by species including one or more of the following: *Eucalyptus moluccana*, *Eucalyptus tereticornis*, *Eucalyptus crebra*, *Eucalyptus eugeniioides* and *Eucalyptus maculata*.



4. The understorey is generally grassy to herbaceous with patches of shrubs, or if disturbed, contains components of indigenous native species sufficient to re-establish the characteristic native understorey.

5. The Cumberland Plain Woodland includes regrowth which is likely to achieve a near natural structure or a is seral stage towards that structure.

6. The Community has been reported as occurring in the local government areas of Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly.

The Scientific Committee noted that a more detailed description of the community is provided in:

- Benson (1992). The natural vegetation of the Penrith 1:100,000 map sheet. See particularly p. 556-7, p. 558, p. 566-575.

In addition, general information on the Cumberland Plain Woodland is also provided in:

- Benson, D. & Howell, J. 1990. 'Taken for Granted - The Bushland of Sydney and its Suburbs'. Kangaroo Press, Kenthurst
- Benson, D., Howell, J., and McDougall, L., 1996, Mountain Devil to Mangrove: a guide to the natural vegetation in the Hawkesbury-Nepean Catchment. Royal Botanic Gardens, Sydney

The Scientific Committee has found that:

7. The Community, as defined by the proposal, satisfies the definition of an Ecological Community under the Act, i.e. an assemblage of species occupying a particular area.

8. Only 6% of the original extent of the community remained in 1988 (Benson, D. & Howell, J. 1990 Proc. Ecol. Soc. Aust. 16, 115-127) in the form of small and fragmented stands. Although some areas occur within conservation reserves, this in itself is not sufficient to ensure the long term conservation of the Community unless the factors threatening the integrity and survival of the Community are ameliorated.

9. Threats to the survival of the community include clearance for agriculture, grazing, hobby and poultry farms, housing and other developments, invasion by exotic plants, and increased nutrient loads due to fertiliser run off from gardens and farmland, dumped refuse or sewer discharge.

10. In view of the substantial reduction in the area occupied by the Community, its fragmentation and the numerous threats to the integrity of the Community, the Scientific Committee is of the opinion that the Cumberland Plain Woodland is likely to become extinct in nature in New South Wales unless the factors threatening its survival cease to operate.

Dr Chris Dickman
Chairperson Scientific Committee
Gazetted: 13/6/97



B: Shale Gravel Transition Forest- endangered ecological community listing

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list Shale Gravel Transition Forest in the Sydney Basin Bioregion, as an ENDANGERED ECOLOGICAL COMMUNITY on Part 3 of Schedule 1 of the Act. Listing of Endangered Ecological Communities is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. Shale Gravel Transition Forest in the Sydney Basin Bioregion is the name given to the ecological community characterised by the species assemblage listed in paragraph 2. All sites are within the Sydney Basin Bioregion.

2. Shale Gravel Transition Forest is characterised by the following assemblage:

<i>Acacia falcata</i>	<i>Eucalyptus fibrosa</i>	<i>Paspalidium distans</i>
<i>Acacia parramattensis</i>	<i>Eucalyptus moluccana</i>	<i>Pomax umbellata</i>
<i>Aristida vagans</i>	<i>Eucalyptus tereticornis</i>	<i>Poranthera microphylla</i>
<i>Austroanthonia tenuior</i>	<i>Euchiton sphaericus</i>	<i>Pratia purpurascens</i>
<i>Brunoniella australis</i>	<i>Glycine clandestina</i>	<i>Themeda australis</i>
<i>Bursaria spinosa</i>	<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	<i>Tricoryne elatior</i>
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	<i>Hardenbergia violacea</i>	<i>Vernonia cinerea</i> var. <i>cinerea</i>
<i>Daviesia ulicifolia</i>	<i>Hydrocotyle peduncularis</i>	<i>Wahlenbergia gracilis</i>
<i>Desmodium varians</i>	<i>Hypericum gramineum</i>	<i>Opercularia diphylla</i>
<i>Dianella longifolia</i>	<i>Laxmannia gracilis</i>	<i>Oxalis perennans</i>
<i>Dianella revoluta</i> var. <i>revoluta</i>	<i>Lepidosperma laterale</i>	<i>Panicum simile</i>
<i>Dichelachne micrantha</i>	<i>Lissanthe strigosa</i>	<i>Paspalidium distans</i>
<i>Acacia falcata</i>	<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	<i>Pomax umbellata</i>
<i>Acacia parramattensis</i>	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	<i>Poranthera microphylla</i>
<i>Aristida vagans</i>	<i>Melaleuca decora</i>	<i>Pratia purpurascens</i>
<i>Dichondra repens</i>	<i>Microlaena stipoides</i> var. <i>stipoides</i>	<i>Themeda australis</i>
<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	<i>Opercularia diphylla</i>	<i>Tricoryne elatior</i>
<i>Echinopogon ovatus</i>	<i>Oxalis perennans</i>	<i>Vernonia cinerea</i> var. <i>cinerea</i>
<i>Entolasia stricta</i>	<i>Panicum simile</i>	<i>Wahlenbergia gracilis</i>

3. The total species list of the flora and fauna of the community is considerably larger than that given in 2 (above), with many species present in only one or two sites or in very small quantity. The community includes invertebrates many of which are poorly known, as well as vertebrates. In any particular site not all of the assemblage listed above may be present. At any one time, some species may only be present as seeds in the soil seed bank with no above-ground individuals present. Invertebrate species may be restricted to soils or canopy trees and shrubs, for example. The species composition of the site will be influenced by the size of the site and by its recent disturbance history. The number of species and the above-ground composition of species will change with time since fire, and may also change in response to changes in fire frequency.

4. Shale Gravel Transition Forest is predominantly of open-forest structure, usually with trees of *Eucalyptus fibrosa* sometimes with *E. moluccana* and *Eucalyptus tereticornis*. *Melaleuca decora* is frequently present in a small tree stratum. A sparse shrub stratum is usually present with species



such as *Bursaria spinosa*, *Daviesia ulicifolia* and *Lissanthe strigosa*. Ground-layer species include *Microlaena stipoides* subsp. *stipoides*, *Cheilanthes sieberi* subsp. *sieberi*, *Themeda australis*, *Opercularia diphylla*, *Lomandra multiflora* subsp. *multiflora*, *Aristida vagans*, *Pratia purpurascens* and *Wahlenbergia gracilis*.

5. Shale Gravel Transition Forest occurs primarily in areas where shallow deposits of Tertiary alluvium overlie shale soils but may also occur in association with localised concentrations of iron-indurated gravel. Shale Gravel Transition Forest grades into Cumberland Plain Woodland as alluvial and ironstone influences decline. On thicker deposits of Tertiary alluvium it grades into Cooks River/Castlereagh Ironbark Forest or Castlereagh Scribbly Gum Woodland. South of the Tertiary alluvial deposits at Holsworthy, this community forms complex mosaics with shale/sandstone transitional communities.

6. Shale Gravel Transition Forest is described in NSW NPWS (2000a&b) which lists diagnostic plant species for the community. These species provide a guide to identification of the community, but care should be taken in the application and interpretation of diagnostic plant species because of sampling limitations; the reduction in species diversity in degraded sites; and the fact that some species may only be present at a site at some times as a soil seedbank or as dormant bud/tubers.

7. Shale Gravel Transition Forest is or has been known to occur in the Auburn, Bankstown, Baulkham Hills, Blacktown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta and Penrith Local Government Areas, but may occur elsewhere in the Sydney Basin Bioregion.

8. Disturbed Shale Gravel Transition Forest remnants are considered to form part of the community including where the vegetation would respond to assisted natural regeneration, such as where the natural soil and associated seedbank is still at least partially intact.

9. Shale Gravel Transition Forest has been cleared for agriculture and rural development. About 36% of the original distribution of about 7000 ha remains (NSW NPWS 2000a) and much of this is in a degraded state.

10. Shale Gravel Transition Forest occurs in Agnes Banks Nature Reserve, Castlereagh Nature Reserve, Scheyville National Park and Windsor Downs Nature Reserve. The area in these reserves is about 3% of the original distribution.

11. Much of the remaining area of Shale Gravel Transition Forest has been disturbed by clearing, tracks, weeds invasion and soil disturbance. Continuing threats include invasion of exotic species, illegal dumping, unauthorised access, fragmentation and clearing for urban, rural residential recreational and industrial development.

12. In view of the originally restricted distribution of this community, its inadequate representation within conservation reserves, the extensive disturbance and weed invasion that has occurred, and the threats from ongoing development, the Scientific Committee is of the opinion that Shale Gravel Transition Forest in the Sydney Basin Bioregion is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate and that the community is eligible for listing as an endangered ecological community.

Dr Chris Dickman

Chairperson Scientific Committee

Proposed Gazettal date: 19/04/02



C: *Dillwynia tenuifolia* (a shrub) population - endangered population listing

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list the population of *Dillwynia tenuifolia* Sieber ex D.C. at Kemps Creek as an ENDANGERED POPULATION on Part 2 of Schedule 1 of the Act.

Listing of Endangered Populations is provided for by Section 11 of the Act. The Scientific Committee has found that:

1. The population proposed for listing is the population of *Dillwynia tenuifolia* Sieber ex D.C. which occurs in the area bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek within Liverpool City Local Government Area.
2. *Dillwynia tenuifolia*, a member of the Fabaceae, is an erect shrub between 0.6 and 1.0 metre high. *Dillwynia tenuifolia* is listed as vulnerable on Schedule 2 of the Act, and thus the population is eligible for listing as an Endangered Population.
3. *Dillwynia tenuifolia* occurs mainly on the Cumberland Plain, but with a few outlying populations.
4. The area occupied by the Kemps Creek population is within a disjunct occurrence of Castlereagh Ironbark Forest and Castlereagh Woodland, and within the site is widespread through both communities.
5. The site of the population is a small and disjunct remnant of what was formerly a much more extensive area of Castlereagh Woodlands on the central Cumberland Plain, which would have previously provided habitat for *Dillwynia tenuifolia*. The area surviving represents about 7.5% of the original area of Castlereagh Woodlands between Kemps Creek and South Creeks.
6. The population is threatened by proposed development which would involve clearing of vegetation, and by rubbish dumping and weed invasion.
7. The population is near the southern limit of the distribution of *Dillwynia tenuifolia*, and is of significance because of its size, the high density of individuals in parts of the site and the generally good condition of the remnants in which it occurs.
8. In the light of 1, 5, 6, and 7 above the Scientific Committee is of the opinion that the habitat of the population has been so drastically reduced that it is in immediate danger of extinction and is of significant conservation value, and meets the criteria for listing as an endangered population, and thus has made a final determination to list the population as endangered.

Dr Chris Dickman

Chairperson Scientific Committee

Gazetted: 28/11/97



APPENDIX 2: FLORA SPECIES RECORDED IN THE GEORGE STREET RESERVES

KEY

■ - Species of National or State conservation significance.

* - Introduced or non-indigenous native species.

Species Frequency of Occurrence within the Subject Land

V - Very common (species covers 51-100% of the site).

C - Common (species covers 26-50% of the site).

O - Occasional (species covers 5-25% of the site).

R - Rare (species covers <5% of the site; scattered distribution).

L - Localised distribution only (species covers <5% of the site; clumped distribution).

CLASS/SUBCLASS	FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	FREQUENCY
FILICOPSIDA	Adiantaceae	<i>Cheilanthes sieberi</i> <i>subsp. sieberi</i>			R
DICOTYLEDONS	Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet		R
DICOTYLEDONS	Aizoaceae	<i>Aptenia cordifolia</i>	Heartleaf Ice Plant	*	L
DICOTYLEDONS	Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed		R
DICOTYLEDONS	Amaranthaceae	<i>Alternanthera pungens</i>	Khaki Weed	*	R
DICOTYLEDONS	Amaranthaceae	<i>Amaranthus sp</i>	Amaranth	*	R
DICOTYLEDONS	Amaranthaceae	<i>Gomphrena celosioides</i>	Gomphrena Weed	*	R
DICOTYLEDONS	Apocynaceae	<i>Aranjia sericifera</i>	Moth Vine	*	R
DICOTYLEDONS	Asteraceae	<i>Ambrosia sp</i>	Ragweed	*	R
DICOTYLEDONS	Asteraceae	<i>Bidens pilosa</i>	Cobbler's Pegs	*	O
DICOTYLEDONS	Asteraceae	<i>Calotis cuneifolia</i>	Purple Burr-Daisy		O
DICOTYLEDONS	Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle	*	R
DICOTYLEDONS	Asteraceae	<i>Conyza sp</i>	Fleabane	*	R
DICOTYLEDONS	Asteraceae	<i>Gazania sp</i>		*	L
DICOTYLEDONS	Asteraceae	<i>Glossogyne tannensis</i>	Cobbler's Tack		L
DICOTYLEDONS	Asteraceae	<i>Hypochaeris radicata</i>	Catsear	*	R
DICOTYLEDONS	Asteraceae	<i>Osteospermum ecklonis</i>		*	L
DICOTYLEDONS	Asteraceae	<i>Ozothamnus diosmifolius</i>	White Dogwood		R
DICOTYLEDONS	Asteraceae	<i>Senecio madagascariensis</i>	Fireweed	*	R
DICOTYLEDONS	Asteraceae	<i>Soliva sessilis</i>	Bindyi	*	R
DICOTYLEDONS	Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle	*	R
DICOTYLEDONS	Asteraceae	<i>Verbesina encelioides</i> <i>subsp. encelioides</i>	Crownbeard	*	L
DICOTYLEDONS	Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed		R
DICOTYLEDONS	Basellaceae	<i>Anredera cordifolia</i>	Madeira Vine	*	R
DICOTYLEDONS	Berberidaceae	<i>Nandina domestica</i>	Japanese Sacred Bamboo	*	R
DICOTYLEDONS	Bignoniaceae	<i>Jacaranda mimosifolia</i>	Jacaranda	*	R
DICOTYLEDONS	Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Wonga Vine		R
DICOTYLEDONS	Brassicaceae	<i>Lepidium africanum</i>		*	R
DICOTYLEDONS	Cactaceae	<i>Opuntia sp</i>	Prickly Pear	*	R



CLASS/SUBCLASS	FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	FREQUENCY
DICOTYLEDONS	Casuarinaceae	<i>Allocasuarina littoralis</i>	Black Sheoak		R
DICOTYLEDONS	Casuarinaceae	<i>Allocasuarina sp</i>	Planted Casuarina	*	L
DICOTYLEDONS	Chenopodiaceae	<i>Atriplex semibaccata</i>	Creeping Saltbush		R
DICOTYLEDONS	Chenopodiaceae	<i>Chenopodium album</i>	Fat Hen	*	R
DICOTYLEDONS	Chenopodiaceae	<i>Chenopodium ?pumilio</i>			R
DICOTYLEDONS	Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush		R
DICOTYLEDONS	Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed		R
DICOTYLEDONS	Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed		O
DICOTYLEDONS	Crassulaceae	<i>Bryophyllum delagoense</i>	Mother of millions	*	O
DICOTYLEDONS	Crassulaceae	<i>Bryophyllum pinnatum</i>	Resurrection Plant	*	L
DICOTYLEDONS	Crassulaceae	<i>Crassula tetragona ssp robusta</i>		*	L
DICOTYLEDONS	Crassulaceae	<i>Sedum sp.</i>		*	L
DICOTYLEDONS	Ericaceae	<i>Astroloma humifusum</i>	Native Cranberry		R
DICOTYLEDONS	Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush		R
DICOTYLEDONS	Euphorbiaceae	<i>Triadica sebifera</i>	Chinese Tallow Tree	*	L
DICOTYLEDONS	Fabaceae (Caesalpinioideae)	<i>Senna pendula var. glabrata</i>		*	R
DICOTYLEDONS	Fabaceae (Faboideae)	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea		O
DICOTYLEDONS	Fabaceae (Faboideae)	<i>Dillwynia sieberi</i>			O
DICOTYLEDONS	Fabaceae (Faboideae)	<i>Dillwynia tenuifolia</i>		■	R
DICOTYLEDONS	Fabaceae (Faboideae)	<i>Glycine clandestina</i>			R
DICOTYLEDONS	Fabaceae (Faboideae)	<i>Hardenbergia violacea</i>	False Sarsaparilla		R
DICOTYLEDONS	Fabaceae (Faboideae)	<i>Indigofera australis</i>	Australian Indigo		R
DICOTYLEDONS	Fabaceae (Faboideae)	<i>Robinia pseudoacacia</i>	Black Locust	*	L
DICOTYLEDONS	Fabaceae (Mimosoideae)	<i>Acacia binervia</i>	Coast Myall		R
DICOTYLEDONS	Fabaceae (Mimosoideae)	<i>Acacia falcata</i>			R
DICOTYLEDONS	Fabaceae (Mimosoideae)	<i>Acacia fimbriata</i>	Fringed Wattle		R
DICOTYLEDONS	Fabaceae (Mimosoideae)	<i>Acacia linifolia</i>	Flax-leaved Wattle		R
DICOTYLEDONS	Fabaceae (Mimosoideae)	<i>Acacia parramattensis</i>	Parramatta Wattle		R
DICOTYLEDONS	Fabaceae (Mimosoideae)	<i>Acacia podalyriifolia</i>	Queensland Silver Wattle	*	R
DICOTYLEDONS	Fabaceae (Mimosoideae)	<i>Acacia ulicifolia</i>	Prickly Moses		R
DICOTYLEDONS	Geraniaceae	<i>Pelargonium sp</i>		*	L



CLASS/SUBCLASS	FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	FREQUENCY
DICOTYLEDONS	Goodeniaceae	<i>Goodenia hederacea</i> subsp. <i>hederacea</i>			O
DICOTYLEDONS	Lamiaceae	<i>Ajuga australis</i>	Austral Bugle		R
DICOTYLEDONS	Lauraceae	<i>Cassytha glabella</i>			R
DICOTYLEDONS	Linaceae	<i>Linum trigynum</i>	French Flax	*	R
DICOTYLEDONS	Lobeliaceae	<i>Pratia purpurascens</i>	Whiteroot		R
DICOTYLEDONS	Loranthaceae	<i>Amyema gaudichandii</i>			R
DICOTYLEDONS	Malaceae	<i>Malus pumila</i>	Apple	*	R
DICOTYLEDONS	Malvaceae	<i>Malva</i> sp.	Mallow	*	R
DICOTYLEDONS	Malvaceae	<i>Modiola caroliniana</i>	Red-flowered Mallow	*	R
DICOTYLEDONS	Malvaceae	<i>Pavonia hastata</i>		*	R
DICOTYLEDONS	Malvaceae	<i>Sida rhombifolia</i>	Paddy's Lucerne	*	O
DICOTYLEDONS	Meliaceae	<i>Melia azedarach</i>	White Cedar		R
DICOTYLEDONS	Myoporaceae	<i>Eremophila debilis</i>	Winter Apple		R
DICOTYLEDONS	Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple		R
DICOTYLEDONS	Myrtaceae	<i>Callistemon salignus</i>	Willow Bottlebrush		R
DICOTYLEDONS	Myrtaceae	<i>Callistemon</i> sp.	Planted Bottlebrush	*	R
DICOTYLEDONS	Myrtaceae	<i>Eucalyptus eugenoides</i>	Thin-leaved Stringybark		R
DICOTYLEDONS	Myrtaceae	<i>Eucalyptus fibrosa</i>	Red Ironbark		O
DICOTYLEDONS	Myrtaceae	<i>Eucalyptus microcorys</i>	Tallowwood	*	R
DICOTYLEDONS	Myrtaceae	<i>Eucalyptus moluccana</i>	Grey Box		C
DICOTYLEDONS	Myrtaceae	<i>Eucalyptus</i> sp.	Planted Eucalypt	*	R
DICOTYLEDONS	Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum		R
DICOTYLEDONS	Myrtaceae	<i>Leptospermum</i> sp.	Planted Teatree	*	R
DICOTYLEDONS	Myrtaceae	<i>Melaleuca decora</i>			O
DICOTYLEDONS	Myrtaceae	<i>Melaleuca nodosa</i>			R
DICOTYLEDONS	Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	*	L
DICOTYLEDONS	Myrtaceae	<i>Melaleuca</i> sp.	Planted Paperbark	*	R
DICOTYLEDONS	Oleaceae	<i>Ligustrum lucidum</i>	Large-leaved Privet	*	R
DICOTYLEDONS	Oleaceae	<i>Ligustrum sinense</i>	Small-leaved Privet	*	R
DICOTYLEDONS	Oxalidaceae	<i>Oxalis latifolia</i>		*	L
DICOTYLEDONS	Oxalidaceae	<i>Oxalis perennans</i>			R
DICOTYLEDONS	Oxalidaceae	<i>Oxalis</i> sp.	Oxalis	*	R
DICOTYLEDONS	Passifloraceae	<i>Passiflora subpeltata</i>	White Passionflower	*	L
DICOTYLEDONS	Pittosporaceae	<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Blackthorn		O
DICOTYLEDONS	Plantaginaceae	<i>Plantago lanceolata</i>	Lamb's Tongues	*	R
DICOTYLEDONS	Polygonaceae	<i>Persicaria decipiens</i>	Slender Knotweed		L



CLASS/SUBCLASS	FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	FREQUENCY
DICOTYLEDONS	Polygonaceae	<i>Polygonum arenastrum</i>	Wireweed	*	R
DICOTYLEDONS	Portulacaceae	<i>Portulaca oleracea</i>	Pigweed		R
DICOTYLEDONS	Proteaceae	<i>Grevillea robusta</i>	Silky Oak	*	R
DICOTYLEDONS	Proteaceae	<i>Grevillea sp</i>	Planted Grevillea	*	R
DICOTYLEDONS	Proteaceae	<i>Persoonia linearis</i>	Narrow-leaved Geebung		R
DICOTYLEDONS	Ranunculaceae	<i>Clematis aristata</i>	Old Man's Beard		R
DICOTYLEDONS	Rubiaceae	<i>Opercularia diphylla</i>			O
DICOTYLEDONS	Rubiaceae	<i>Pomax umbellata</i>			R
DICOTYLEDONS	Rubiaceae	<i>Richardia stellaris</i>		*	R
DICOTYLEDONS	Santalaceae	<i>Exocarpos cupressiformis</i>	Native Cherry		R
DICOTYLEDONS	Sapindaceae	<i>Dodonaea viscosa subsp. cuneata</i>			R
DICOTYLEDONS	Scrophulariaceae	<i>Veronica plebeia</i>	Trailing Speedwell		R
DICOTYLEDONS	Solanaceae	<i>Datura sp</i>	Thornapple	*	R
DICOTYLEDONS	Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn	*	R
DICOTYLEDONS	Solanaceae	<i>Solanum nigrum</i>	Black-berry Nightshade	*	R
DICOTYLEDONS	Solanaceae	<i>Solanum seaforthianum</i>	Brazilian Nightshade	*	L
DICOTYLEDONS	Stackhousiaceae	<i>Stackhousia viminea</i>	Slender Stackhousia		R
DICOTYLEDONS	Sterculiaceae	<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	*	R
DICOTYLEDONS	Ulmaceae	<i>Ulmus parvifolia</i>		*	L
DICOTYLEDONS	Verbenaceae	<i>Verbena bonariensis</i>	Purpletop	*	R
DICOTYLEDONS	Verbenaceae	<i>Verbena rigida var. rigida</i>	Veined Verbena	*	R
MONOCOTYLEDONS	Alliaceae	<i>Nothoscordum borbonicum</i>	Onion Weed	*	R
MONOCOTYLEDONS	Aloeaceae	<i>Aloe sp</i>		*	L
MONOCOTYLEDONS	Anthericaceae	<i>Arthropodium milleflorum</i>	Vanilla Lily		R
MONOCOTYLEDONS	Anthericaceae	<i>Chlorophytum comosum</i>	Spider Plant	*	L
MONOCOTYLEDONS	Asparagaceae	<i>Asparagus aethiopicus</i>	Asparagus Fern	*	R
MONOCOTYLEDONS	Asparagaceae	<i>Asparagus asparagoides</i>	Florist's Smilax	*	R
MONOCOTYLEDONS	Commelinaceae	<i>Commelina cyanea</i>	Native Wandering Jew		R
MONOCOTYLEDONS	Commelinaceae	<i>Murdannia graminea</i>			R
MONOCOTYLEDONS	Commelinaceae	<i>Tradescantia fluminensis</i>	Wandering Jew	*	L
MONOCOTYLEDONS	Cyperaceae	<i>Carex inversa</i>	Knob Sedge		R
MONOCOTYLEDONS	Cyperaceae	<i>Cyperus aggregatus</i>		*	R
MONOCOTYLEDONS	Cyperaceae	<i>Cyperus eragrostis</i>	Umbrella Sedge	*	R
MONOCOTYLEDONS	Cyperaceae	<i>Cyperus gracilis</i>			R



CLASS/SUBCLASS	FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	FREQUENCY
MONOCOTYLEDONS	Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge		R
MONOCOTYLEDONS	Cyperaceae	<i>Lepidosperma laterale</i>			L
MONOCOTYLEDONS	Juncaceae	<i>Juncus usitatus</i>			L
MONOCOTYLEDONS	Lomandraceae	<i>Lomandra confertifolia</i> subsp. <i>rubiginosa</i>			R
MONOCOTYLEDONS	Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		R
MONOCOTYLEDONS	Lomandraceae	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush		R
MONOCOTYLEDONS	Phormiaceae	<i>Dianella caerulea</i>	Blue Flax-lily		R
MONOCOTYLEDONS	Phormiaceae	<i>Dianella longifolia</i> var. <i>longifolia</i>			R
MONOCOTYLEDONS	Poaceae	<i>Aristida vagans</i>	Threeawn Speargrass		O
MONOCOTYLEDONS	Poaceae	<i>Austrodanthonia tenuior</i>			R
MONOCOTYLEDONS	Poaceae	<i>Bothriochloa macra</i>	Red Grass		L
MONOCOTYLEDONS	Poaceae	<i>Bromus catharticus</i>	Prairie Grass	*	R
MONOCOTYLEDONS	Poaceae	<i>Chloris gayana</i>	Rhodes Grass	*	R
MONOCOTYLEDONS	Poaceae	<i>Chloris ventricosa</i>	Tall Chloris		R
MONOCOTYLEDONS	Poaceae	<i>Chloris virgata</i>	Feathertop Rhodes Grass	*	L
MONOCOTYLEDONS	Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass		O
MONOCOTYLEDONS	Poaceae	<i>Cynodon dactylon</i>	Common Couch	*	O
MONOCOTYLEDONS	Poaceae	<i>Echinochloa crusgalli</i>	Barnyard Grass	*	R
MONOCOTYLEDONS	Poaceae	<i>Ehrharta erecta</i>	Panic Veldtgrass	*	L
MONOCOTYLEDONS	Poaceae	<i>Eleusine tristachya</i>	Goose Grass	*	R
MONOCOTYLEDONS	Poaceae	<i>Enteropogon acicularis</i>			R
MONOCOTYLEDONS	Poaceae	<i>Entolasia stricta</i>	Wiry Panic		R
MONOCOTYLEDONS	Poaceae	<i>Eragrostis curvula</i>	African Lovegrass	*	C
MONOCOTYLEDONS	Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass		R
MONOCOTYLEDONS	Poaceae	<i>Eriochloa pseudoacrotricha</i>	Early Spring Grass		R
MONOCOTYLEDONS	Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>			R
MONOCOTYLEDONS	Poaceae	<i>Panicum effusum</i>	Hairy Panic		R
MONOCOTYLEDONS	Poaceae	<i>Panicum maximum</i>	Guinea Grass	*	L
MONOCOTYLEDONS	Poaceae	<i>Panicum miliaceum</i>	French Millet	*	L
MONOCOTYLEDONS	Poaceae	<i>Paspalidium distans</i>			O
MONOCOTYLEDONS	Poaceae	<i>Paspalum dilatatum</i>	Paspalum	*	R
MONOCOTYLEDONS	Poaceae	<i>Paspalum urvillei</i>	Vasey Grass	*	R
MONOCOTYLEDONS	Poaceae	<i>Pennisetum clandestinum</i>	Kikuyu Grass	*	R
MONOCOTYLEDONS	Poaceae	<i>Setaria gracilis</i>	Slender Pigeon Grass	*	R
MONOCOTYLEDONS	Poaceae	<i>Sorghum halepense</i>	Johnson Grass	*	L



CLASS/SUBCLASS	FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	FREQUENCY
MONOCOTYLEDONS	Poaceae	<i>Sporobolus creber</i>	Slender Rat's Tail Grass		R
MONOCOTYLEDONS	Poaceae	<i>Stenotaphrum secundatum</i>	Buffalo Grass	*	L
MONOCOTYLEDONS	Poaceae	<i>Themeda australis</i>	Kangaroo Grass		O
MONOCOTYLEDONS	Typhaceae	<i>Typha sp</i>	Cumbungi		L

**APPENDIX 3: LISTED NOXIOUS WEEDS WITHIN HAWKESBURY RIVER COUNTY COUNCIL**

(Hawkesbury River County Council includes Baulkham Hills, Blacktown, Hawkesbury and Penrith Local Government Areas)

Those species in **bold** were recorded in the George Street Reserves (#116 & #256) during the current survey (March/April 07). The actions required for each category of weed are described below.

COMMON NAME	BOTANICAL NAME	CLASS
African boxthorn	<i>Lycium ferocissimum</i>	4
African feathergrass	<i>Pennisetum macrourum</i>	5
African turnipweed	<i>Sisymbrium runcinatum</i>	5
African turnipweed	<i>Sisymbrium thellungii</i>	5
Alligator weed	<i>Alternanthera philoxeroides</i>	3
Anchored water hyacinth	<i>Eichhornia azurea</i>	1
Annual ragweed	<i>Ambrosia artemisiifolia</i>	5
Arrowhead	<i>Sagittaria montevidensis</i>	5
Artichoke thistle	<i>Cynara cardunculus</i>	5
Athel tree	<i>Tamarix aphylla</i>	5
Bathurst/Noogoora/Californian/cockle burrs	<i>Xanthium</i> species	4
Black knapweed	<i>Centaurea nigra</i>	1
Blackberry	<i>Rubus fruticosus</i> aggregate species	4
Bridal creeper	<i>Asparagus asparagoides</i>	5
Broomrapes	<i>Orobanche</i> species. Includes all <i>Orobanche</i> species except the native <i>O. cernua</i> variety <i>australiana</i> and <i>O. minor</i>	1
Burr ragweed	<i>Ambrosia confertiflora</i>	5
Cabomba	<i>Cabomba caroliniana</i>	5
Cayenne snakeweed	<i>Stachytarpheta cayennensis</i>	5
Chilean needle grass *	<i>Nassella neesiana</i>	4
Chinese violet	<i>Asystasia gangetica</i> subspecies <i>micrantha</i>	1
Clockweed	<i>Gaura lindheimeri</i>	5
Clockweed	<i>Gaura parviflora</i>	5
Columbus grass	<i>Sorghum × alnum</i>	4
Corn sowthistle	<i>Sonchus arvensis</i>	5
Crofton weed	<i>Ageratina adenophora</i>	4
Dodder	<i>Cuscuta</i> species. Includes All <i>Cuscuta</i> species except the native species <i>C. australis</i> , <i>C. tasmanica</i> and <i>C. victoriana</i>	5
East Indian hygrophila	<i>Hygrophila polysperma</i>	1
Espartillo	<i>Achnatherum brachychaetum</i>	5
Eurasian water milfoil	<i>Myriophyllum spicatum</i>	1
Fine-bristled burr grass	<i>Cenchrus brownii</i>	5
Fountain grass	<i>Pennisetum setaceum</i>	5
Gallon's curse	<i>Cenchrus biflorus</i>	5



COMMON NAME	BOTANICAL NAME	CLASS
Giant Parramatta grass *	<i>Sporobolus fertilis</i>	3
Glaucous starthistle	<i>Carthamus glaucus</i>	5
Golden thistle	<i>Scolymus hispanicus</i>	5
Green cestrum	<i>Cestrum parqui</i>	3
Harrisia cactus	<i>Harrisia</i> species	4
Hawkweed	<i>Hieracium</i> species	1
Horsetail	<i>Equisetum</i> species	1
Hygrophila	<i>Hygrophila costata</i>	2
Hymenachne	<i>Hymenachne amplexicaulis</i>	1
Johnson grass	<i>Sorghum halepense</i>	4
Karoo thorn	<i>Acacia karroo</i>	1
Kochia	<i>Bassia scoparia</i>	1
Lagarosiphon	<i>Lagarosiphon major</i>	1
Lantana	<i>Lantana</i> species	5
Long-leaf willow primrose	<i>Ludwigia longifolia</i>	4, 5
Ludwigia	<i>Ludwigia peruviana</i>	3
Mexican feather grass	<i>Nassella tenuissima</i>	1
Mexican poppy	<i>Argemone mexicana</i>	5
Miconia	<i>Miconia</i> species	1
Mimosa	<i>Mimosa pigra</i>	1
Mossman River grass	<i>Cenchrus echinatus</i>	5
Mother-of-millions	<i>Bryophyllum</i> species and hybrids	3
Onion grass	<i>Romulea</i> species. Includes all <i>Romulea</i> species and varieties except <i>R. rosea</i> var. <i>australis</i>	5
Oxalis	<i>Oxalis</i> species and varieties. Includes all <i>Oxalis</i> species and varieties except the native species <i>O. chnoodes</i>, <i>O. exilis</i>, <i>O. perennans</i>, <i>O. radicata</i>, <i>O. rubens</i>, and <i>O. thompsoniae</i>	5
Pampas grass	<i>Cortaderia</i> species	4
Parthenium weed	<i>Parthenium hysterophorus</i>	1
Paterson's curse, Vipers bugloss, Italian bugloss	<i>Echium</i> species	4
Pellitory	<i>Parietaria judaica</i>	4
Pond apple	<i>Annona glabra</i>	1
Prickly acacia	<i>Acacia nilotica</i>	1
Prickly pear	<i>Cylindropuntia</i> species	4
Prickly pear	<i>Opuntia</i> species except <i>O. ficus-indica</i>	4
Privet (Broad leaf)	<i>Ligustrum lucidum</i>	4
Privet (Narrow-leaf/Chinese)	<i>Ligustrum sinense</i>	4
Red rice	<i>Oryza rufipogon</i>	5
Rhus tree	<i>Toxicodendron succedanea</i>	4
Rubbervine	<i>Cryptostegia grandiflora</i>	1



COMMON NAME	BOTANICAL NAME	CLASS
Sagittaria	<i>Sagittaria platyphylla</i>	5
Salvinia	<i>Salvinia molesta</i>	3
Sand oat	<i>Avena strigosa</i>	5
Senegal tea plant	<i>Gymnocoronis spilanthoides</i>	1
Serrated tussock	<i>Nassella trichotoma</i>	4
Siam weed	<i>Chromolaena odorata</i>	1
Smooth-stemmed turnip	<i>Brassica barrelieri</i> subspecies <i>oxyrrhina</i>	5
Soldier thistle	<i>Picnemon acarna</i>	5
Spiny burrgrass	<i>Cenchrus incertus</i>	4
Spiny burrgrass	<i>Cenchrus longispinus</i>	4
Spotted knapweed	<i>Centaurea maculosa</i>	1
St. John's wort	<i>Hypericum perforatum</i>	4
Texas blueweed	<i>Helianthus ciliaris</i>	5
Water caltrop	<i>Trapa</i> species	1
Water hyacinth	<i>Eichhornia crassipes</i>	3
Water lettuce	<i>Pistia stratiotes</i>	1
Water soldier	<i>Stratiotes aloides</i>	1
Willows	<i>Salix</i> species. Includes all <i>Salix</i> species except <i>S. babylonica</i> , <i>S. × reichardtii</i> , <i>S. × calodendron</i>	5
Witchweed	<i>Striga</i> species. Includes all <i>Striga</i> species except native species and <i>Striga parviflora</i>	1
Yellow burrhead	<i>Limncharis flava</i>	1
Yellow nutgrass	<i>Cyperus esculentus</i>	5

Actions Required For Noxious Weed Classes

- 1 The plant must be eradicated from the land and the land must be kept free of the plant
- 2 The plant must be eradicated from the land and the land must be kept free of the plant
- 3 The plant must be fully and continuously suppressed and destroyed
- 4 The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
- 5 The requirements in the Noxious Weeds Act 1993 (as amended 2005) for a notifiable weed must be complied with



APPENDIX 4: TARGET WEEDS RECORDED & RECOMMENDED CONTROL METHODS

Species	Common Name	Status / Comments	Method of Control							
			Hand Weeding			Herbicide Application				Other
			Hand removal	Rake & pile	Dig out	Cut stump & poison	Drill & poison	Scrape & poison	Spot spray	
Woody Weeds										
<i>Acacia podylifolia</i>	Mount Morgan Wattle	Environmental weed			✓ (seedlings or saplings only < 1 m)	✓	✓			Remove seedlings if adult plants are to be retained
<i>Genista monspessulana</i>	Montpellier Broom	Environmental weed, but noxious elsewhere			✓ (seedlings or saplings only)					Monitor for seed germination after fire
<i>Grevillea robusta</i>	Silky Oak	Non-indigenous native			✓ (seedlings or saplings only)					
<i>Ligustrum lucidum</i> <i>L. sinense</i>	Privets	Noxious weed			✓ (seedlings or saplings only)	✓	✓		✓ (seedlings)	
<i>Lycium ferocissimum</i>	African Boxthorn	Noxious weed					✓	✓		
<i>Jacaranda mimosifolia</i>	Jacaranda	Garden escape			✓ (seedlings or saplings only)	✓	✓			
<i>Robiunia psuedoacacia</i>	Honey Loquat	Environmental weed			✓ (seedlings only)	✓				One occurrence: under property fence
<i>Sida rhombifolia</i>	Paddy’s Lucerne	Agricultural weed			✓	✓			✓	Long taproot:: remove all material and dispose off-site.
Herbaceous Weeds										
<i>Agapanthus praecox</i>	Agapanthus	Environmental weed			✓			✓		Use surfactant if foliar spraying
<i>Ambrosia s.</i>	Ragweed	Environmental weed							✓	Highly allergenic: eradicate (one occurrence)
<i>Asparagus aethiopicus</i>	Ground/Fern Asparagus	Environmental weed, but noxious elsewhere			✓			✓	✓	Hand removal – remove corms in toto Foliar spray -use Brushoff in early spring (preferably)
<i>Bidens pilosa</i>	Cobblers Pegs	Agricultural/Ruderal weed	✓		✓				✓	Wil eventually be shaded out as regeneration proceedds
<i>Bryophyllum delagonese</i> , <i>B. pinnatum</i>	Mother of Millions Resurrection Plant	Noxious weed Environmental weed	✓		✓				✓	Remove ALL material from bushland, including underlying soil: use surfactant with glyphosate or Brushoff (as label directions)
<i>Chenopodium album</i>	Fat Hen	Agricultural weed							✓	
<i>Chloris gayana</i> , <i>C. virgata</i>	Rhodes Grasses	Pasture grasses			✓				✓	Rhizomatous growth: long seeding season
<i>Cirsium vulgare</i>	Spear Thistle	Agricultural weed	✓		✓				✓	Sharp spines: wear gloves
<i>Conyza</i> spp.	Fleabanes	Ruderal weed	✓							As for Bidens, above
<i>Cynodon dactylon</i>	Common Couch Grass	Turf grass							✓	Retain to stabilise soils where necessary: keep away from new native seedlings
<i>Ehrharta erecta</i>	Perennial Veldt Grass	Environmental weed	✓						✓	Over plant or mulch thickly. Persistent weed.
<i>Cyperus eragrostis</i>	Umbrella Sedge	Environmental weed			✓					In drainge lines: can’t use herbicide with a permit
<i>Eragrostis curvula</i>	African Love Grass	Pasture Grass Environmental Weed			✓				✓	Slash before seeding if possible (repeat monthly in summer) Use Fusilade as a foliar spray (grass selective herbicide)
<i>Nandina domestica</i>	Japanese Sacred Bamboo	Garden escape			✓				✓	Repeat treatment: use surfacant



Species	Common Name	Status / Comments	Method of Control							
			Hand Weeding			Herbicide Application				Other
			Hand removal	Rake & pile	Dig out	Cut stump & poison	Drill & poison	Scrape & poison	Spot spray	
<i>Nothoscordum borbonicum</i>	Onion Weed	Garden escape								
<i>Opuntia</i> sp	Prickly Pear	Noxious weed			✓					Dispose of material at landfill site.
<i>Osteospermum ? ecklonis</i>	South African Daisy	Environmental weed			✓				✓	Use a surfactant if foliar spraying
<i>Paspalum dilatatum</i> <i>P. urvellei</i>	Paspalum Vasey Grass	Pasture Grasses			✓				✓	Avoid herbicide spray near water: dig out in drains
<i>Pelagonium</i> sp	Geranium	Garden escape			✓				✓	
<i>Pennisetum clandestinum</i>	Kikuyu Grass	Turf grass – environmental weed			✓				✓	Scalp soil after foliar herbicide or burn individual tussocks if possible.
<i>Plantago lanceolata</i>	Plantain	Agricultural/Ruderal weed			✓					
<i>Senecio madagascariensis</i>	Fireweed	Environmental weed, but noxious elsewhere	✓		✓				✓	Will regenerate again after any disturbance to soil.
<i>Solanum nigrum</i> <i>S. seaforthianum</i>	Deadly Nightshade Brazilian Nighshade	Environmental weed	✓		✓				✓	
<i>Sonchus oleraceus</i>	Sow Thistle	Agricultural weed	✓		✓				✓	
<i>Sporobolus virginicus</i>	Parramatta Grass	Agricultural weed			✓					
<i>Sorghum halepense</i>	Johnson Grass	Noxious weed			✓				✓	Limited occurrence
<i>Succulents (Sedums, Crassula)</i>	succulents	Garden escapes			✓					
<i>Verbena bonariensis</i>	Purpletop	Agricultural/ Ruderal weed								
Vines / Scramblers										
<i>Anredera cordifolia</i>	Madeira Vine	Environmental weed			✓			✓		Remove all aerial & underground tubers. One location only.
<i>Araujia sericifera</i>	White Moth Plant	Environmental weed			✓					
<i>Asparagus asparagoides</i>	Bridal Creeper	Noxious weed			✓				✓	Hand removal – remove corms in toto Foliar spray - use Brushoff in early spring (preferably)
<i>Passiflora subpeltata</i>	White Passionfruit	Garden escape			✓			✓	✓	One occurrence: possible to eradicate (garden escape)
<i>Tradescantia fluminensis</i>	Wandering Jew	Environmental weed, but noxious elsewhere	✓	✓					✓	Foliar spray – use glyphosate early spring when leaf growth is new and soft.. Alternatively, use Starane any season.

Note: not all weeds recorded in the subject site are listed above. Some secondary and/or insignificant weeds have not been targeted for control. However, significant secondary weeds are listed for targeted control actions.

Note also that it is entirely possible that other weeds will regenerate after clearing provides additional growing sites.



APPENDIX 5: A GENERIC GUIDE TO MONITORING PROGRESS OF WORKS IN BUSHLAND REHABILITATION PROGRAMS

The set up of a simple monitoring program at the outset of the restoration project is of high importance. Monitoring will provide an objective measurement of progress and record the slow and often subtle changes. A monitoring program will enable the project manager and bush regeneration contractor to assess the Performance Indicators listed in Section 7.10 this report.

As many changes are not readily visible in the short-term, it is recommended that monitoring events be carried out every six (6) months. However data should be collected over a number of years so that trends can be determined. A simple generic guide to monitoring the progress of bushland rehabilitation projects has been included below.

Note that a project-specific monitoring program should be designed for each bush regeneration and rehabilitation site prior to commencement of work.

ESTABLISHING PERMANENT TRANSECTS AND QUADRATS

This method is the traditional way to measure changes in plant community structure and diversity. The simplest way to record changes is to count the numbers and types of seedlings regenerating in a measured plot over a period of time.

Establishing permanent transects and quadrats will be used to monitor Performance Indicators 1, 2, 3, 5, 6, and 7.

In the absence of more specific guidelines in Recovery Plans, for all Management Units, at least one permanent quadrat will be established (as per Threatened Species Survey & Assessment Guidelines NPWS). Sampling is to occur on at least once a year (but monthly for the first six (6) months after treatment).

In addition to the NPWS guidelines, information recorded will include indigenous plant species including the number of naturally regenerating seedlings and cover (using the Braun-Blanquette method).

Baseline data will be collected in each quadrat before the commencement of any ecological restoration works. Sampling will allow for comparison between areas with different soil seedbank treatments, including areas that have not been treated.

Recording of all ecological restoration works will use standard NPWS recording sheets, and will include hours of weed control performed per bushland management zone or sub-zones.

CHOOSING THE PLOT SIZE

This is often the hardest decision to make: the area has to be large enough to take in the major life forms and small enough to be manageable. In grassland a plot of one (1) m² is adequate to gain a representative sample; for shrubs – three (3) m² is adequate, but in a treed area, plots of 10 m² or larger may be necessary.

ASSEMBLING FLORA LISTS

The assembly of flora lists is basic to all bushland projects. The purpose of the bush regeneration project is not to accumulate an ever-increasing list of new species, but rather to record the diversity and abundance of the existing plant community and to monitor any changes that take place as the project proceeds.



Flora lists should be updated regularly and the location(s) of any unusual, rare or threatened species should be marked on the base map and the relevant authorities should be informed (eg. National Herbarium, NPWS).

In addition to the information recorded in permanent quadrats, comprehensive lists of plant species will be maintained and updated for each management zone. This will be performed as per Threatened Species Survey & Assessment Guidelines NPWS.

ASSEMBLING FAUNA LISTS

The recording of fauna follows the same guidelines as for flora and is of equal importance. In the first instance a simple list of fauna sighted (or evidence of) can be used.

Ultimately, comprehensive (both exotic and native) fauna lists will be compiled and maintained. Data will be collected as per NPWS Wildlife Atlas Format.

Data collected will be used to monitor Performance Indicators 8 and 9.

ASSEMBLING A LIST OF FLOWERING & FRUITING TIMES

For the native species, a long-term project will be useful since this project calls for local seed collection and propagation.

Adapting weed-clearing activities to coincide with natural seeding times and germination patterns of desirable natives is advised, as clearing weed growth increases germination sites and increases seedling survival chances.

For each indigenous plant species, the flowering and fruiting period will be recorded each year as a week of year figure (i.e. 1 to 52). This is to monitor for pollination and seed set.

Keeping a record of flowering and fruiting times for local weed species can make weed control easier. For example, if it is known that Pampas Grass flowers and as the seed ripens locally between March and May, plan to treat Pampas Grass well before that time. If berry-fruited weeds like Cotoneaster, Lantana or Privet are present, remove the plants before the berries are ripe and attractive to birds.

It is recommended that quantitative measurement be used within each management zone in order to provide information relating to:

- Type and % cover of weed species before and after bush regeneration work;
- Type and % cover of native plant species before and after weed removal; and
- Type and % cover of native plants species regenerating after regeneration.

MONITORING SOIL SEEDBANK TRIALS

These trials will allow the testing of a range of strategies designed to stimulate native plant regeneration.

Quadrats will be monitored every three (3) months for 12 months. Results will be quantified by measuring % cover using Braun-Blanquet (see Moore & Chapman 1986), visual analysis and photographs taken from a series of fixed photo-points.

THREATENING PROCESSES

All threatening processes operating within the bushland, including key threatening processes listed under *TSC Act* must be noted, and relevant data collected.



Monitoring of any Threatening Processes that occur will be consistent with the relevant Threat Abatement Plans.

Monitoring a decrease in each of the key threatening processes identified for the site is a requirement of Performance Indicator 11.

PHOTOGRAPHS

Taking photographs is an easy way to record changes in vegetation structure. A photograph captures the subtle changes that are often missed when working closely on a site over time. Photographs are useful in recording sequence shots at various stages in the project to illustrate the techniques used and the results obtained, and are also valuable teaching tools.

Photography in the bushland environment is not particularly easy for amateurs, as plants cast shadows and without the correct lens filters, everything looks 'green'. Obtain professional advice about ASA ratings and take photographs early in the morning or when conditions are overcast.

A number of permanent photo-points will be selected and marked with a short wooden stake. The location of these photo-points will be recorded on a base map. Photographs will be taken from the same spot every six (6) months.

OTHER MONITORING VARIABLES

Other useful variables recommended include:

Temperatures - These can be recorded using a wet-dry bulb thermometer. Data may be graphed to show that as the canopy re-forms (regardless of height above the ground) fluctuations of temperature become less extreme. Changes in temperature can be related to the type and numbers of native plants regenerating. Recording sites (marked and recorded on a base map) can be selected and regular soil temperature readings taken with the bulb just under the soil surface (e.g. 2-4 mm) and air temperature readings taken about two (2) metres above the ground.

Light readings - These may be taken using a light meter, first at ground level, and again at a height of two (2) m. Relate the light intensity to the type and number of native plants regenerating and/or to those already growing on the site. The lowering of the light levels in a rainforest/closed forest (by reforming the canopy) promotes the regeneration of rainforest canopy species, but reducing light levels in dry sclerophyll woodland or heath decreases the diversity and numbers of indigenous species and promotes the growth of wet gully species and frequently of exotic moisture-loving weeds. Light readings can be taken in correlation with the soil temperature readings set out above. Readings should be taken both in clearings or light gaps and under the tree canopy.

The health of the litter layer - This can be recorded by observing the cyclical build-up and breakdown of the fallen leaves, the appearance of the soil (whether compacted or friable), the presence of small animals in the litter layer and the production of soil fungi, as indicated by fruiting bodies on the surface and thread-like mycelia in the soil. Simple measurements such as the depth of litter or percentage of groundcover are important. This information will provide clues to other processes occurring on the site over time.

Rainfall readings - These can be obtained from the local meteorological station or taken on site. Determine the local rainfall pattern. Avoid weeding in hot weather when the soil is hard or in the wet season when the ground is so boggy that mud is churned up. Very dry periods are reflected in the survival rate of seedlings, so if tubestock planting is planned, defer planting until regular rains are expected.



APPENDIX 6: LIST OF INDIGENOUS SPECIES RECOMMENDED FOR ENRICHMENT PLANTING

Species	Common Name	Height (m)	Suitable for CPW	Suitable for SGTS	Comments
Canopy (> 20m)					Sparse plantings: edges and gaps only
<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark	15-25	✓	✓	
<i>Eucalyptus fibrosa</i>	Thin-leaved Ironbark	35	✓	✓	Very good drainage needed
<i>Eucalyptus moluccana</i>	Grey Box	25	✓	✓	
<i>Eucalyptus tereticornis</i>	Forest Red Gum	40	✓	✓	
Sub-canopy (8-20m)					
<i>Acacia fimbriata</i>	Fringed Wattle	To 3	✓		
<i>Acacia parramattensis</i>	Parramatta Green Wattle	10	✓	✓	Short-lived pioneer ~ 10-12 years average
<i>Allocasuarina littoralis</i>	Black She-oak	3-6	✓		Plant in small groves 5-7 units
Shrubs (< 8m)					
<i>Acacia falcata</i>	Sickle-leaf Wattle	5	✓	✓	Pioneer species, full or filtered sun
<i>Acacia implexa</i>	Hickory	8	✓		
<i>Acacia linifolia</i>	Flax-leaf Wattle	2	✓		Disturbance tolerant
<i>Acacia ulicifolia</i>	Prickly Wattle	1.5	✓		
<i>Breynia oblongifolia</i>	Dwarf's Apples	2-3	✓		Damp soils
<i>Bosiaea prostrata</i>	A pea plant	Prostrate	✓	✓	Fabaceae – prostrate shrub, branches to 20 cm
<i>Callistemon salignus</i>	Willow Bottlebrush	3-4	✓		Moist soils: swales
<i>Daviesia ulicifolia</i>	Gorse Bitter Pea	1.5	✓	✓	Fabaceae
<i>Dillwynia sieberi</i>	Prickly Parrot Pea	1-5 - 2	✓	✓	Fabaceae
<i>Dodonaea viscosa</i> ssp <i>cuneata</i>	Hop Bush	1-3	✓	✓	Fast growing pioneer species: forms thickets
<i>Indigofera australis</i>	Indigo	1.5	✓	✓	Open lax habitat: Fabaceae



Species	Common Name	Height (m)	Suitable for CPW	Suitable for SGTS	Comments
<i>Melaleuca decora</i>	White Feather Honeymyrtle	6-20	✓	✓	Marshy ground: swales
Groundcover					
<i>Aristida vagans</i>	Three-awned Spear Grass	0.5	✓	✓	Spread seed in rip lines: full or filtered sun
<i>Austrodanthonia tenuior</i>	Wallaby Grass	0.7	✓	✓	Drier sites: full or filtered sun
<i>Brunoniella australis</i>	Blue Trumpet	0.15-0.3	✓	✓	
<i>Bothriochloa macra</i>	Red-leg Grass	0.75 - 1	✓	✓	Full or filtered sun
<i>Chloris ventricosa</i>	Windmill Grass	0.5	✓		Short-lived perennial grass
<i>Cymbopogon refractus</i>	Barbed-wire Grass		✓	✓	Full or filtered sun
<i>Dianella longifolia</i> var <i>longifolia</i>	Blue Flax Lily	1	✓	✓	Strap-like foliage, blue flowers: hardy: edge site plantings
<i>Dianella revoluta</i>	Blue Flax Lily		✓	✓	Strap-like foliage, blue flowers: hardy: edge site plantings
<i>Dichelachne micrantha</i>	Short-hair Plume Grass	0.5-0.9	✓	✓	Full or filtered sun
<i>Echinopogon caespitosus</i> , <i>E. ovatus</i>	Hedgehog Grasses	0.5	✓	✓	Full or filtered sun
<i>Einadia</i> spp	Saloop / Saltbushes	0.5	✓	✓	Useful ground cover, can be transplanted or fragmented
<i>Entolasia stricta</i> , <i>E. marginata</i>	Wiry Panic	0.5 – 0.75	✓	✓	Scatter seed in rip lines (or scarify soil): full or filtered sun
<i>Eragrostis brownii</i>	Brown's Lovegrass	0.3	✓	✓	Scatter seed in rip lines (or scarify soil): full or filtered sun
<i>Geranium solanderi</i>	Native Geranium	0.5	✓	✓	Sprawling herb on clay soils
<i>Goodenia bederacea</i> subsp <i>bederacea</i>	Violet-leaved Goodenia	0.4	✓	✓	Prostrate herb: sheltered sites only



Species	Common Name	Height (m)	Suitable for CPW	Suitable for SGTS	Comments
<i>Hardenbergia violacea</i>	False Sarsaparilla	To 1	✓	✓	Hardy: mass plant in high light situations. Potential ground cover for fill soil bund and other fill sites. Pond edges
<i>Hibbertia diffusa</i>	Guinea Flower	0.5	✓		Sprawling mat-forming herb: dry soils
<i>Hypericum gramineum</i>	Small St John's Wort	0.3	✓		
<i>Lomandra longifolia</i>	Spiny Mat-rush	0.4	✓	✓	Versatile: plant in clusters for habitat
<i>Lomandra multiflora subsp. multiflora</i>	Many flowered Mat-rush	0.5	✓	✓	Plant in groups for good habitat
<i>Juncus usitatus</i>	Common Rush	1	✓	✓	Wet sites/swale: can dominate if site gets too boggy
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Meadow Grass	0.5	✓	✓	Delicate grass: damp shady sites only.
<i>Persicaria decipiens</i>	Slender Knot-weed		✓	✓	Drainage lines: Plant in clumps
<i>Plectranthus parviflorus</i>	Cockspur Flower	1	✓	✓	
<i>Pomax umbellata</i>	Pomax	0.2-0.3		✓	
<i>Sporobolus creber</i>	Slender Rat's Tail Grass	0.5?	✓	✓	
<i>Themeda australis</i>	Kangaroo Grass	1	✓	✓	Full sun required: good habitat if left unslashed
<i>Veronica cinerea</i>	Speedwell	0.4	✓	✓	Moist soils/sheltered sites only

Note: commonly occurring shrubs such as *Bursaria spinosa* and some common native grasses and common ground covers have not been recommended for planting as they will regenerate naturally or volunteer into the site from nearby bushland.



APPENDIX 7: BUSHLAND REHABILITATION - EXPERIMENTAL TRIALS

SOIL SEED BANK GERMINATION TESTS (EX-SITU)

The methodology outlined below aims to test the diversity and size of the existing soil seed bank within the study area.

1. Select at least 10 random sampling points throughout the site.
2. At each sampling point, scrape away or manually remove all covering vegetation from an area of approximately 30cm x 30cm.
3. Collect sufficient soil from each sampling point to fill two germination trays (approximately 10cm depth).
4. Label trays with sampling point name/number.
5. Place all 20 filled germination trays in a sheltered environment.
6. Water trays so that soil surface remains moist (but not wet) and maintain the trays so as to promote maximum germination (eg avoid large temperature fluctuations).
7. Inspect trays weekly for a period of at least 10 weeks. Monitor the growth of any seedlings, tabulating the species and the number of each species germinating.
8. Weeds germinating in the trays should be noted and removed.
9. Photographs of the trays should be taken in fortnightly intervals.
10. At the end of the ten week monitoring program results should be reviewed to determine whether the monitoring period should be extended.

QUADRAT TREATMENT TRIALS (*IN SITU*)

Fire has the potential to stimulate the germination of some plants. It can break seed dormancy and provide resources that are critical to the early life stages of many species.

It is considered that fire within the study area may promote the regeneration of species represented in the active soil seed bank. Due to the hazards involved with prescribed fires, such as potential damage to adjacent premises and reduced local air quality, the experiment would involve *in situ* treatments that simulate the effects of fire, but minimise the hazards.

The proposed methodology is outlined below.

QUADRAT SELECTION

1. Select 50, (one) 1 m² randomly arranged quadrats throughout the site.
2. Mark out and name/number quadrats to allow them to be monitored.
3. Take an initial photograph of each quadrat (i.e. before prescribing a treatment to the quadrat).
4. Submit an equal number of quadrats to each of the five (5) treatments presented below. Allocate treatments to a random distribution of quadrats.

QUADRAT TREATMENTS

i) Do Nothing

Used as “control” plots. They will provide data that is representative of the site, highlighting any fluctuations that are not a result of the prescribed treatments. Do not interfere with these quadrats beyond marking their location.



ii) Pile Burns

Due to the minimal fuel load present at the site, it is considered that a pile burn would be required to obtain a fire with the desired intensity and duration. They would be small scale burns, minimising potential impacts and hazards as addressed above. The proposed methodology is presented below.

1. Collect a sufficient amount of vegetation debris from within the study area to form piles on the 10 pile burn quadrats to approximately 1 metre in height.
2. Form piles on each of the 10 (or more) chosen quadrats, extending the pile boundaries to just beyond the quadrat boundaries (approximately 30 centimetres). Ensure that each quadrat receives a similar type of debris (e.g. size, flammability).
3. Remove any flammable materials from near the quadrat that may cause the fire to spread beyond the quadrat.
4. Ignite each pile (ensuring there are no hazards that would increase the risk of the fire to spread, such as high wind speeds).
5. Do not leave the fire unattended until it is completely out, i.e. no longer smouldering.

iii) Smoke Water

The application of smoke water is a method that introduces chemicals present in smoke, without the need for fire. The methodology proposed is set out below.

1. Manually remove groundcover vegetation growing within the ten chosen quadrats.
2. Prepare the smoke water as specified by the producer (ensuring the product is suitable for direct application to the soil e.g. Regen 2000® Direct).
3. Apply the smoke water to the entire area of each quadrat, following the application process recommended by the smoke water producer (including the season of application).

iv) Scarification

By disturbing the ground surface and removing existing vegetation, scarification temporarily reduces the level of competition within the affected area. This allows maximum resources for germinating plants, potentially increasing their growth success rate. The proposed methodology is outlined below.

1. Manually remove groundcover vegetation growing within the ten chosen quadrats.
2. Rake soil surface over entire area of each quadrat, disturbing the soil to a depth of approximately five (5) to 10 centimetres.

v) Canopy Removal

It is considered that dense canopy growth may be restricting seedling growth due to shading. It is proposed that any limbs from canopy species that directly overhang the chosen 10 quadrats are removed.

MONITORING RESULTS

Inspect quadrats every three (3) months a period of 12 months. Tabulate the species present within each quadrat and the approximate percentage cover for each species. Photographs of each quadrat should be taken during each monitoring visit.



APPENDIX 8: GLOSSARY

Aeolian	Wind blown or transported by wind, as in aeolian sand dunes
Aquifer	Porous soil or geological formation capable of being permeated by water, which holds and yields ground water.
Assisted Natural Regeneration	Bush regeneration approach combining traditional weeding methods with supplementary (or enrichment) planting
Biodiversity (biological diversity)	The variety of all life forms, comprising genetic diversity (within species), species diversity and ecosystem diversity. The variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems) and the ecological complexes of which they are part.
Biological control	The control of weeds and pests through the use of other organisms (predators, herbivores, parasites and disease-producing organisms).
Biomass	Total living matter in a specific area.
Blow-out sites	A depression caused by wind erosion. May result in the exposure of the lower soil horizons.
Buffer	An area of land between two conflicting land-uses, for example a nature reserve and an intensive development.
Bushland	<p>Land on which there is vegetation that is either a remainder of the natural vegetation of the land or if altered, is still representative of the structure and floristics of the natural vegetation (As defined in <i>SEPP-19</i>).</p> <p>For the purposes of the VMP – any area which is dominated by locally indigenous, naturally occurring species.</p>
Bush regeneration	<u>The</u> practice of restoring bushland by focusing on reinstating and reinforcing the system's on-going natural regeneration processes.
Catchment	The land area drained by a river and its tributaries.
Community land	<p>Land that is classified as community land under Division 1 of Part 2 of Chapter 6 of the <i>LG Act 1993</i>.</p> <p>There are two classifications of public land (land under the control of the council) under the <i>LG Act 1993</i> – community and operational. Areas classified as community land are kept available for use by the general public and cannot be sold (except in limited defined circumstances). They cannot be leased or licensed for more than 21 years.</p>
Condition	The state of health of the native vegetation community: degree to which it has been degraded, simplified or otherwise altered.
Conservation	The processes and actions of looking after a place so as to retain its natural significance and always includes protection, maintenance and monitoring. In the VMP monitoring is used to measure the progress of work and evaluate the rehabilitation program.
Contaminant	An undesirable or harmful impurity.
Contaminated site	Land which has harmful contaminants caused by previous land use.
Corridor (wildlife)	Areas of native vegetation that link larger areas of remaining native vegetation.
Critical habitat	Habitat declared to be critical under Part 3 of the <i>TSC Act 1995</i> . For the purposes of the <i>TSC Act 1995</i> and other Acts as amended by the <i>TSC Act 1995</i> , critical habitat is the whole or any part or parts of an area or areas of land comprising the habitat of an endangered species, an endangered population or an endangered ecological community that is essential for the survival of the species, population or ecological community.
Cut-stump	Method of weed eradication used for woody weeds whereby the stem is cut close to ground level and undiluted glyphosate applied within 30 seconds.
Desire lines	Routes people instinctively take through an open space.
Diversity	Consists of 2 components: species richness and relative abundance



Ecologically sustainable development	Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased. Also referred to as 'Environmentally Sustainable Development'.
Ecosystem	Communities of organisms and their physical environment interacting as a unit.
Ecosystem processes	The numerous interactions between different components (both living and non-living) of an ecosystem that support the biological elements of the system. These processes include the storage and recycling of nutrients and minerals, disturbance, competition, weathering and succession, and are generally necessary for maintaining the balance between interconnected elements of the ecosystem; for instance, green plants capture and process solar energy, which is then distributed throughout the ecosystem along food webs by animals.
Ecosystem resilience	The degree, manner and pace of restoration of the structure and function of the original ecosystem after disturbance, or more simply, the ability of an ecosystem to recover from disturbance.
Edge effects	Habitat conditions (such as degree of humidity and exposure to light or wind) created at or near the interface of bushland and open areas
Eight-part test	An eight-part test under Section 5A of the <i>EP&A Act 1979</i> is designed to determine 'whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats' listed on the Schedules of the <i>TSC Act 1995</i> , and consequently whether a Species Impact Statement is required.
Endangered species	Those likely to become extinct unless action is taken to remove the factors that threaten their survival.
Environmental weed	Species which have been introduced into the habitat, which naturalise from their point of introduction, displace native species and/or otherwise modify the natural environment.
Exotic species	An introduced species, especially one that is not of Australian origin.
Fabrication	A form of bushland regeneration used when the sites biophysical attributes have changed to the point where the original plant community cannot be reconstructed or recreated.
Feral animal	Wild exotic animal, usually a domesticated animal which has become wild.
Fire regime	The history of fire events in an area including the frequency, intensity and season of burning (season in this context refers to the time of the year in which the fire occurred).
Foliar spraying	Diluted glyphosate applied to the leaves by wand or spot spraying. Useful for the control of unwanted grasses and herbaceous weeds.
Fragmentation (habitat/ecosystem)	The division of natural areas by vegetation clearance, isolating the remnants and the species within them and limiting genetic flow.
Generalist species	Species that can survive and tolerate a broad range of environmental conditions.
Genetic Diversity	The variety of genetic information contained in the total genes of individual plants, animals and microorganisms of a place.
Geodiversity	The natural range (diversity) of geological, geomorphological and soil features, assemblages, systems and processes.
Gross pollutant trap	Device designed to trap debris and sediments in watercourses.
Habitat	The living space of a species or community, providing a particular set of environmental conditions.
Heath	A plant community dominated by small closely spaced shrubs, most of which have stiff and often small leaves.
Herbicide	Chemical substance used for killing plants.
Hydrology	The chemistry and physics of water and water movement.
Indigenous species	A species naturally distributed within a specific region, native to a particular locality. A species that occurs at a place within its historically known natural range and that



	forms part of the natural biodiversity of a place.
Key threatening process	Schedule 3 of the <i>TSC Act 1995</i> provides for the listing of key threatening processes. Key threatening processes are processes that adversely affect 2 or more threatened species or which could cause a species to become threatened.
Keystone weeds	Major or dominant weeds in a community which pose serious and immediate threats because of their ability to change the structure and floristic composition of a plant community over time. Also referred to as 'primary target weeds' or 'ecosystem modifiers'.
Life cycle	The series of forms that an organism takes as it lives and reproduces.
Life cycle requirements	The elements required by an organism to complete its life cycle. Eg sites for feeding, roosting and breeding and corridors for dispersal and foraging.
Maintenance weeding	Denotes low-key and infrequent weeding sessions. An area is said to be 'on maintenance' only after a diverse/healthy native plant community has been established.
Mesic	A plant with soft leaves and little fibrous tissue.
Monotypic	Having only one representative, eg a genus or family with a single species.
Mosaic burning	A pattern of burning that provides a mosaic of fire intervals that mitigates wildfire spread and provides a diversity of fire age classes
Native species	Normally used to refer to a species indigenous to NSW, but is also sometimes used to refer to a locally indigenous species.
Native vegetation	Vegetation that is indigenous to NSW, that is, of species that existed in NSW before European settlement.
Naturalised	An exotic plant that is established and reproducing as though native.
Natural Integrity	The degree to which a place or ecosystem retains its natural biodiversity and geodiversity and other natural processes and characteristics.
Natural Regeneration	Response of site to weed removal and other measures designed to stimulate soil in the soil seed bank (i.e. without planting)
Noxious weed	Weeds declared under the <i>Noxious Weeds Act 1993</i> . A plant that causes serious economic loss, or one that has a detrimental effect on man, animals or the environment.
Nurse crop	Planted species that grow fast and densely, with the aim of stabilising the soil, providing organic matter, nutrients and shelter for native seedlings. They are often sterile and/or annual species that die-out after a short period, creating space for natives to naturally seed and grow.
Obligate seeders	Species which have seeds that are dependent on fire for germination.
Operational land	Land that is classified as operational land under Division 1 of Part 2 of Chapter 6 of the <i>LG Act 1993</i> (see <i>community land</i>). Areas classified as operational land have no restrictions on the sale or long-term lease of the land.
Opportunistic species	A species that can take advantage of adverse conditions and thrive in locations where more sensitive species will not survive.
Passive recreation	Recreation activities that require limited physical exertion on behalf of the participant. Examples of passive recreation activities include bird watching, walking or photography.
Pesticide	Any substance used to kill pest organisms.
pH	A measure of the degree of acidity or alkalinity; expressed on a logarithmic scale of 1 to 14: 1 is most acid, 7 neutral and 14 most alkaline.
Pile burns	Used for the disposal of weed waste by burning material in piles. The heat and smoke produced by the fire may also stimulate native regeneration.
Pioneer (early successional) species	Plant species that are the first to colonise a disturbed environment. They are characterised by their ability to disperse and germinate, rapid growth, high photosynthetic capacity and short life span.



Plant community	A unit of vegetation with a relatively uniform species composition and physical structure. Plant communities also tend to have characteristic environmental features such as bedrock geology, soil type, topographic position, climate, and energy, nutrient, and water cycles.
Primary weeding	Denotes weeding through an area for the first time only, may involve target weeding of selected species only or a thorough weeding of all invasive species.
Propagules	Any part of a plant that is able to produce a new plant when dispersed eg. Spore, seed, cutting, root or stem fragments.
Protection	The taking care of a place by managing impacts to ensure that natural significance (biodiversity/geodiversity) is retained.
Recovery plan	A plan prepared under Part 4 of the <i>TSC Act 1995</i> or Part 7A of the <i>Fisheries Management Act 1994</i> providing for the recovery of threatened species, populations or ecological communities.
Regeneration	The <i>natural</i> recovery of natural integrity from disturbance of a community of organisms or an ecosystem: from soil seed bank (<i>in situ</i>), vegetative reproduction or via recruitment from external sources.
Rehabilitation	To re-establish the original or repair damage.
Reinstatement	To introduce to a place one or more species or elements of habitat or geodiversity that are known to have existed there naturally at a previous time, but that can no longer be found in that place.
Relative abundance	Amount of each species present at a site
Remnant	Usually a small patch of vegetation containing at least part of the original plant community floristics and structure.
Restoration	<p>Returning existing habitats to a known or past state or to approximate the original natural condition by repairing degradation, removing exotic species, reinstatement or allowing recovery.</p> <p>For the purposes of the F&FMP – planting, using local native species to restore diversity and community structure.</p>
Restoration ecology	The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.
Revegetation	The process of returning plant life to an area eg. planting tubestock, direct seeding, hydro-mulching, brush matting.
Rhizome	An underground stem, usually horizontal, producing leafy shoots and new stems eg Couch grass, Iris, Pampas grass (adj. Rhizomatous)
Run-off	The portion of precipitation (rain, hail, snow) which flows across the ground surface as water; major agent of water erosion.
Scalping	Mechanical removal of weeds and ground debris that exposes favourable mineral soil for planting.
Scarification	A method of seedbed preparation which consists of loosening the soil surface by a physical disturbance.
Sclerophyll	Plants with hard, stiff and tough leaves (typical in low rainfall areas).
Secondary weeding	Denotes weeding through an area the second time around, usually carried out 3-6 months after primary weeding.
Secondary weeds	Weeds not constituting a significant threat to the communities they invade: generally herbaceous and/or pioneer species.
Seed bank	The seed naturally available at a site; most of the seed bank is generally stored in the soil, but some may be stored in fruits, such as Banksia cones.
Selective herbicide	Herbicide is more toxic to some species than others, at specified concentrations.
Senescence	The growth phase in a plant or plant part (eg a leaf) from full maturity to death.
Scrub	A general definition of a plant community dominated by shrubs, including thickets: colonising open ground: 2-8 metres: often a single species.



Shrub	A multi branched woody plant less than 8 metres high and usually with many stems.
Soil coherence	The degree to which soil material is held together at different moisture levels.
Soil profile	The vertical sequence of layers (horizons) in the soil.
Species diversity	A measure of the number of individuals and their relative abundance in a site: comprising both species richness and relative abundance. The <i>variety</i> of species in a place.
Species richness	The number of species present at a site
Spot fires	Isolated fires started ahead of the main fire front by sparks, embers or other ignited material, sometimes to a distance of several kilometres.
Stakeholder	A person with an interest in an issue.
Stormwater	Water which runs off urban and agricultural catchments, which may carry rubbish, animal droppings, sewage overflows, grass clippings and heavy metals. This untreated water is carried in stormwater channels and discharged directly into creeks, rivers, harbours and oceans.
Target weeding	Weeding process that concentrates on eradication of certain species.
Threatened species	“A species listed in Part 1 or 4 of Schedule 1 or in Schedule 2 of the <i>TSC Act 1995</i> . More generally, threatened species is a plant or animal generally considered as vulnerable or endangered under various threatened species conservation laws. It is used to indicate that there is some level of threat as to the species viability in the wild. (Nature Conservation Council)
Tree injection	Method of weed eradication whereby holes are drilled into the stem (below the bark but NOT into the heartwood) and herbicide injected into each hole.
Tubestock	The growing of plant material in tubes or small pots.
Urban bushland	Bushland is defined in <i>SEPP-19</i> as meaning "land on which there is vegetation which is either a remainder of the natural vegetation of the land or, if altered, is still representative of the structure and floristics of the natural vegetation".
Urbanisation	The process of altering land uses to create and further develop urban centres.
Visual amenity	The views and visual aesthetics offered by a particular site.
Vulnerable species	A species specified in <u>Schedule 2</u> of <i>TSC Act 1995</i> . More generally, vulnerable species that may soon become endangered if causal factors (habitat destruction, over-exploitation, other environmental disturbances) continue (EPA)
Woodland	A plant community dominated by trees with crowns relatively close to the ground (usually eucalyptus species) that are separated from each other and with grasses and other herbs forming a more or less continuous ground cover between them.

References

Australian Natural Heritage Charter (IUCN / Environment Australia 2002)

[www://ahc.gov.au/infores/publications/anhc/pubs/charterfinal/pdf](http://ahc.gov.au/infores/publications/anhc/pubs/charterfinal/pdf)

Bushfire and Environmental Services, 2002, SCA Land at Prospect Reservoir-Fire Management Plan, Sydney Catchment Authority, Penrith, NSW).

Centre for Plant Biodiversity Research, 2002. A Short Botanical Glossary - <http://www.anbg.gov.au/glossary/croft.html> last updated 16/7/02.

Department of Agriculture, NSW, 2000. Glossary – Soil Management Terminology <http://www.agric.nsw.gov.au/reader/6831>.

Environmental Protection Authority NSW, 2001. Glossary. <http://www.epa.nsw.gov.au/soe/95/28.htm> Last updated 3/7/01.

Harden, G.J., (ed.) 1993. Flora of New South Wales Vols 1-4, New South Wales University Press, Kensington.



APPENDIX 9: DEFINITION OF TERMS UNDER LOCAL GOVERNMENT ACT 1993

Bushland:	<p>The category bushland is assigned to land that contains primary native vegetation and that vegetation is</p> <ul style="list-style-type: none">▪ The natural vegetation or a remainder of the natural vegetation of the land, or▪ Although not the natural vegetation of the land, is still representative of the structure of floristics, or structure and floristics, of the natural vegetation in the locality. <p>Such land includes:</p> <ul style="list-style-type: none">▪ Bushland that is mostly undisturbed with a good mix of tree ages, and natural regeneration, where the understorey is comprised of native grasses and herbs or native shrubs, and which contains a range of habitats for native fauna (such as logs, shrubs, tree hollows and leaf litter), or▪ Moderately disturbed bushland with some regeneration of trees and shrubs, where there may be a regrowth area with trees of even age, where native shrubs and grasses are present in the understorey even though there may be some weed invasion, or▪ Highly disturbed bushland where native understorey has been removed, where there may be significant weed invasion and where there is no natural regeneration of trees or shrubs, but where the land is still capable of being rehabilitated.
Community land:	<p>is land intended for public access and use. To prevent alienation of this land, it cannot be sold, leased, licensed or any other estate granted over land for more than 21 years.</p>
Cultural Significance:	<p>is a category of land that requires resolution by Council. Such land may be declared an area of cultural significance because of the presence on the land of any item that the council considers to be of Aboriginal, historical or cultural significance.</p>
Escarpment:	<p>The category escarpment is assigned to land that includes such features as a long cliff-like ridge or rock, and the land includes significant or unusual geological, geomorphological or scenic qualities.</p>
Foreshore:	<p>The category of foreshore is assigned to land that is situated on the water's edge and forms a transition zone between the aquatic and terrestrial environment.</p>
General Community Use:	<p>is a category of land that should be applied where the land may be available for use for any purpose for which community land may be used, whether by the public at large or by specific sections of the public. It includes land that does not fall into the categories of natural area, sportsground, park or area of cultural significance.</p>
Lease:	<p>confers and exclusive right to possession on the tenant/ lessee. It is usually a written document and often registered on the title.</p>



License:	does not confer an exclusive right to possession and confers on the licensee the right to use the land, or part of it, for a limited purpose, often for a limited time.
Natural Area:	As defined by the Local Government (General) Regulation is land that, whether or not in an undisturbed state, possesses a significant geological feature, geomorphological feature, landform, representative system or there natural feature or attribute that would be sufficient to further categorise the land as bushland, wetland, escarpment, watercourse or foreshore.
Objectives:	are broad statements that identify the end result or a desired outcome.
Other Estate:	is defined as: interest, charge, right, title, claim, demand, lien and encumbrance whether at law or in equity. An example is the grant of easements.
Park:	as defined by Local Government (General) Regulation is land that is or is proposed to be, improved by landscaping, gardens or the provision of non-sporting equipment and facilities, for use mainly for passive or active recreational, social, educational and cultural pursuits that do not unduly intrude on the peaceful enjoyment of the land by others.
Performance Target:	Is an objective or goal to be performed.
<u>Park Improvement</u>	
Program – (PIP):	Is the capital works for the Parks and Recreation Branch.
Playground:	an outdoor structure/ area for children to play on.
Section 94 (s94):	This section of the Environmental Planning and Assessment Act permits councils to collect monetary contributions from persons developing land to meet the increased demand for public services and amenities generated by their development.
Skate Park/Ramp:	a constructed facility used for skating.
Sportsground:	as defined by the Local Government (General) Regulation is land used or proposed to be used primarily for active recreation involving organized sports or the playing of outdoor games.
Watercourse:	<p>The category of Watercourse has been assigned to land that includes:</p> <ul style="list-style-type: none">▪ Any stream of water, whether perennial or intermittent, flowing in a natural channel, or in a natural channel that has been artificially improved, or in an artificial channel that has changed the course of the stream of water, and any other stream of water into or from which the stream of water flows, and▪ Associated riparian land or vegetation, including land that is protected land for the purposes of the Rivers and Foreshores Improvement Act 1949 or State protected land identified in



an order under section 7 of the Native Vegetation Conservation Act 1997.

Wetland:

The category of wetland has been assigned to land that includes marshes, mangroves, backwaters, billabongs, swamps, sedgelands, wet meadows or wet heathlands that form a waterbody that is inundated cyclically, intermittently or permanently with fresh, brackish or salt water, whether slow moving or stationary.



APPENDIX 10: PLATES

Issue: Access, Tracking & Damage to Vegetation



Vehicle Tracks in Reserve #256



Pedestrian track in Reserve #116



Issue: Drainage Problems, Reserve #116



Pipe erosion, subsidence and other major drainage problems in Reserve #116 – north-western corner near Rugby Leagues Club Ovals. Note collapsing fence and fallen trees on embankment.



George Street Embankment (north end) with fallen trees due to undermining by water flow and inappropriate drainage design, Reserve #116..



Issue: Drainage Problems, Reserve #116



View to League Ovals to North, showing severe erosion, Reserve #116.



Sheet erosion on compacted soils, Reserve #116



Weedy stormwater drain blocked with silt and other rubbish located behind houses on Wetherill Crescent, Reserve #256

Issue: Weed Invasion



Core Bushland in Reserve #116, with regeneration of Eucalypts and Wattles. Note African Love Grass dominant in the understorey.



Weed thicket, including Privet behind house on Sirius Road, Reserve #116. Note dense growth of Kikuyu Grass and other garden escapes.



Mother of Millions growing amongst native ground covers at the base of mature Eucalypt trees.
Potential habitat for Cumberland Land Snail



Issue Park Management, Wetherill Crescent Reserve #256



Earthen bund edging around Park off Wetherill Crescent, Reserve #256. Used as a pedestrian walking track and BMX track.



Mown grassland with garden clippings placed around trees.



Issue: Dumping & Other Inappropriate Uses



Dumping and weeds at the residential interface, Reserve #256



BMX bicycle jumps at rear of Park, Reserve #256



Graffiti on property boundary fences, Reserve #116

Issue: Bushfire Hazard



Mown firebreak behind houses on Sirius Road, Reserve #116