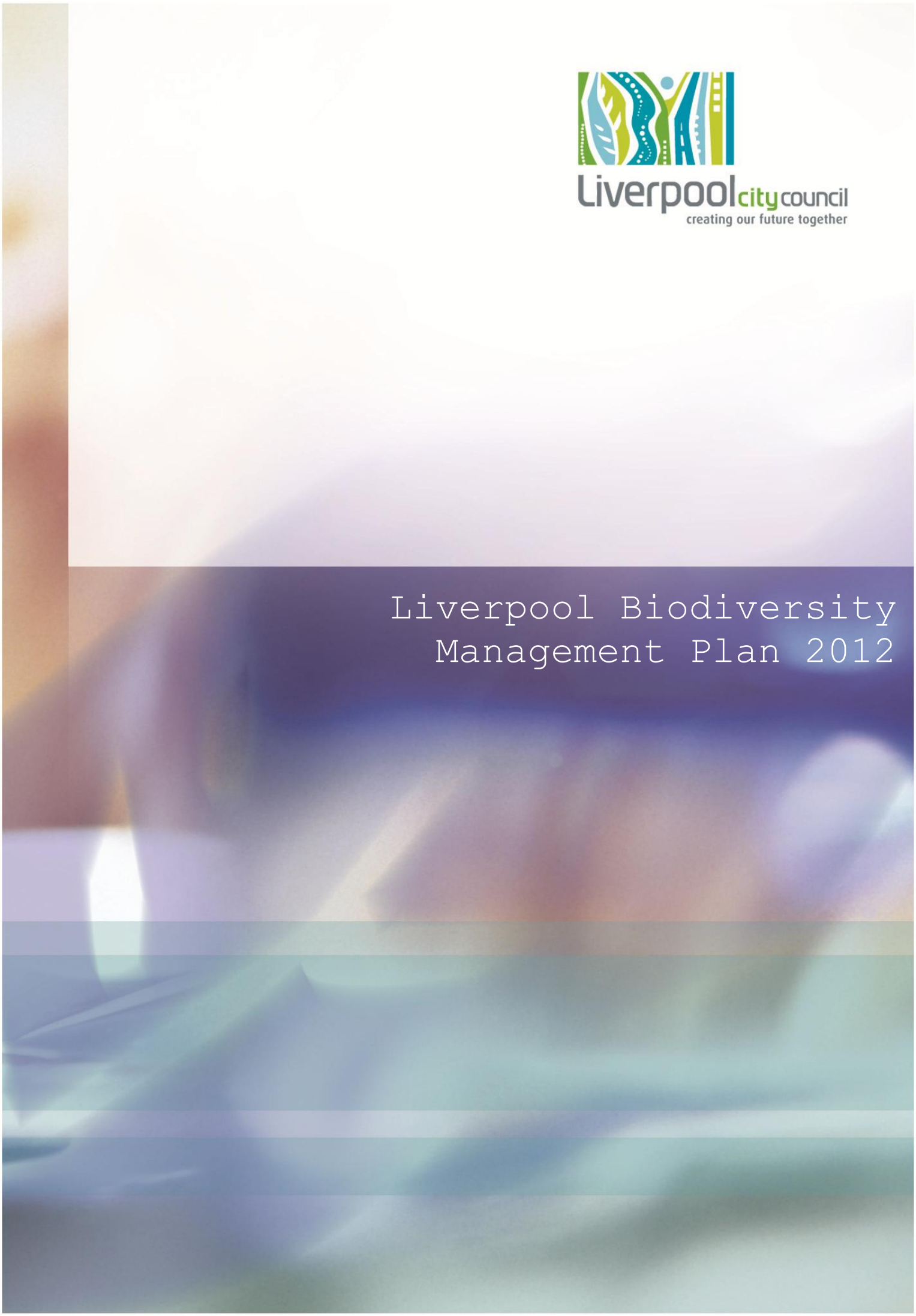

Liverpool city council
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Liverpool Biodiversity Management Plan 2012

ACKNOWLEDGEMENTS

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Abbreviations

ABBREVIATION	DESCRIPTION
BFEAC	NSW Rural Fire Service Bushfire Environmental Assessment Code
BMP	(Liverpool) Biodiversity Management Plan
CAP	Catchment Action Plan (of CMAs)
CEEC	Critically Endangered Ecological Community
CMA	Catchment Management Authority
CPRP	Cumberland Plain Recovery Plan
CSA	Conservation Significance Assessment
DCP	Development Control Plan
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities
DEC / DECC / DECCW	NSW Government Department of Environment and Conservation / Environment and Climate Change / Environment, Climate Change and Water. Replaced by NSW Office of Environment and Heritage and NSW Environment Protection Authority
DoP & I	NSW Department of Planning and Infrastructure
DPI	NSW Department of Primary Industries
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EPA Act	NSW Environmental Planning and Assessment Act (1979)
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999)
ESL	Environmentally Significant Lands layer of LEP
HNCMA	Hawkesbury Nepean Catchment Management Authority
KTP	Key Threatening Process
LALC	Local Aboriginal Land Council
LBMP	Liverpool Bushfire Management Plan
LCC	Liverpool City Council
LEP	Local Environment Plan
LG Act	NSW *Local Government Act (1993)*
LGA	Local Government Area
NPWS	NSW National Parks and Wildlife Service
OEH	NSW Office of Environment and Heritage
PAS	Priorities Action Statement
POM	Plan of Management

SMCMA	Sydney Metropolitan Catchment Management Authority
SOE	State of the Environment Report
TAP	Threat Abatement Plan
TEC	Threatened Ecological Community
TSC Act	NSW *Threatened Species Conservation Act* (1995)
VPA	Voluntary Planning Agreement
WSUD	Water Sensitive Urban Design

Executive Summary

The purpose of this Plan is to address significant conservation and environmental challenges faced by Liverpool City Council and to provide an implementation framework for the protection and management of biodiversity at the local, and where relevant, regional scale. This Plan is concerned with the conservation and management of native plants and animals, genetic variations, ecosystems and ecological processes which occur within, or are dependent upon, the Liverpool LGA.

Despite the Plan's local focus, it is recognised that there are broad-scale factors which influence local biodiversity, such as plant and animal diseases, bushfires, population growth and climate change. Conversely, the biodiversity of the local area influences the natural and human processes in other nearby regions. Accordingly, the plan includes actions for regional and state-wide co-operation. A collaborative approach to biodiversity management is emphasised by increased partnering with the Liverpool Community and adopting a Whole-of-Government approach to effectively implement initiatives relating to Federal, State and Local issues.

The Liverpool Biodiversity Management Plan is a medium term, ongoing, adaptive management program that is designed to provide a range of biodiversity conservation directions, on-ground actions and resourcing options that will work together toward improving the status of biodiversity resources within the LGA. The management plan provides direction and priorities for the current and subsequent Environment Restoration Plans as well as the delivery and operational plans to be developed by LCC for its directorates and business units.

This Plan illustrates Liverpool City Council's ongoing commitment to biodiversity conservation and management. By adopting this Plan and directing adequate resources towards achieving the identified objectives and actions, LCC aims to reconcile biodiversity conservation with the future urban growth identified for the LGA.

Structure of the Biodiversity Management Plan

Part 1

Chapter 1 - Biodiversity Basics

This section introduces the concepts and terminology around biodiversity, why biodiversity is important and who should be involved in managing biodiversity resources and values.

Chapter 2 – Strategic Directions in Biodiversity Management

This section explains the cascading nature of biodiversity management principles and gives a National, State, Regional and Local perspective on the strategic planning and conservation of biodiversity.

Chapter 3 – Liverpool Biodiversity Profile

This section provides a summary of the key biodiversity features of Liverpool LGA in order to put in context the suite of management actions presented in the following section. Greater detail of the biodiversity values of the LGA are provided in Section 5.

Chapter 4 - Biodiversity Management Actions

Part 4 identifies a range of actions designed to maintain and improve the level and sustainability of biodiversity resources within the Liverpool LGA. The actions are assigned timeframes and responsibilities for implementation, required resources are identified and key performance indicators are provided.

Part 2

Appendix 1 – Biodiversity Values within Liverpool LGA

This section describes the current biodiversity values within Liverpool LGA and how they have changed over recent times. The section details threatened species, populations and communities and native vegetation communities. This section builds on the preliminary level of biodiversity information presented in Chapter 3 and contains maps showing the various environmental features of the LGA which help to direct the management actions in Part 4.

Appendix 2 – Mapping Procedure Technical Information

This section explains the methodology and rationale behind the maps contained in Parts 5 & 6 and how data comparisons have been made between the 2008 and current Biodiversity Management Plan.

1 Biodiversity Basics

1.1 WHAT IS BIODIVERSITY?

Put simply, biodiversity is the variety of all life forms. Shortened from the original term of '*Biological Diversity*', it includes all living species, the genes they possess and the ecosystems and landscapes that make up our living world. Biodiversity as a collective resource is not static – it is constantly changing. It can be increased (positive change) by genetic changes or decreased (negative change) through species extinctions.

Biodiversity is both our store of natural capital and a major contributor to ecosystem services - it provides all of our food sources, the clean air we breathe and fresh water we drink, biological pest control, inputs to soil fertility and structure. Biodiversity provides opportunities for economic growth through farming, tourism, research and education and improves our quality of life through recreation, relaxation and spiritual reconnections.

The concept of biodiversity also emphasises the interconnectedness and interdependence of all life and is generally considered at 3 levels; genetic diversity, species diversity, and ecosystem diversity. These are briefly explained below.

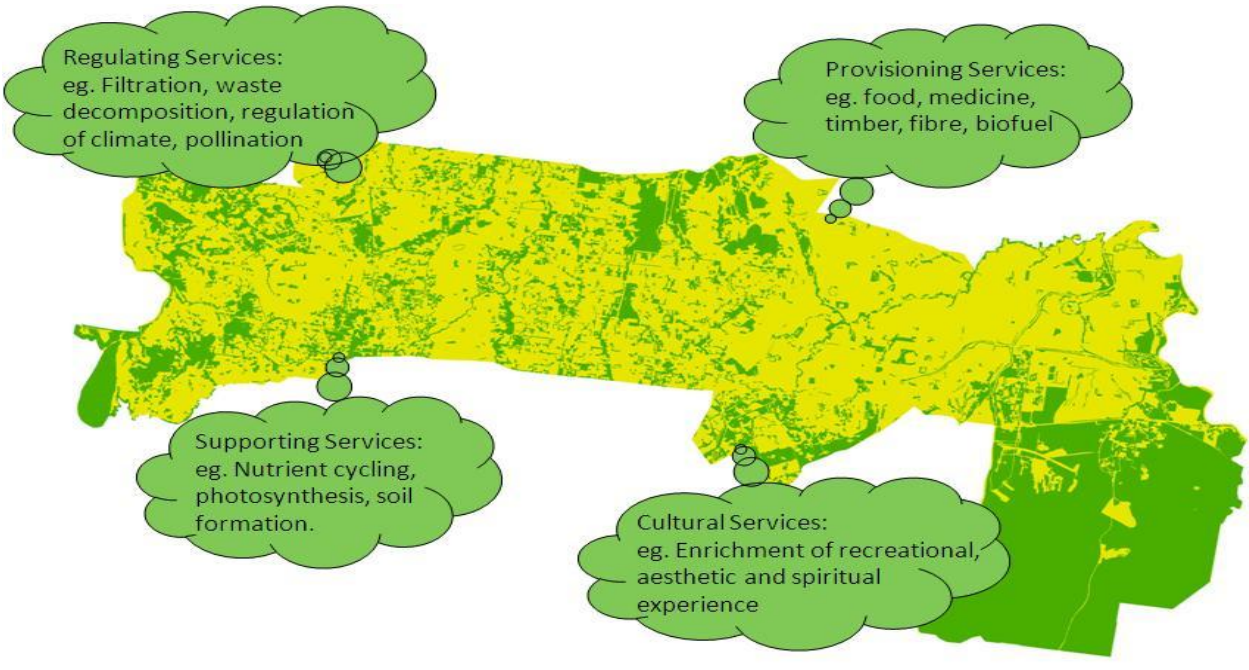
***Genetic diversity**:* The range of *genetic differences within one species* is referred to as genetic diversity.

***Species diversity**:* This relates to the *number of different species* in existence. It is the most common way that people think about biodiversity.

***Ecosystem diversity**:* The variety of *habitats, ecological communities and ecological processes*.

The 2010 Living Planet Report published by WWF (WWF, 2010) identifies 4 ways in which the human population benefits from the ecosystem services that biodiversity can provide (Figure 1).

Figure 1: Biodiversity provides value through ecosystem services.



1.2 WHY IS BIODIVERSITY IMPORTANT?

At the most fundamental level, biodiversity supports the ecosystems that sustain life on this planet.

The processes provided by biodiversity are often referred to as 'ecosystem services' and include plant pollination, soil formation, waste disposal, maintenance of clean air and water, food production, medicines and pest control, as well as providing cultural identity and recreational experiences. It has been recognised that areas with high levels of biodiversity are more easily able to withstand significant environmental changes and disturbances than areas of lower diversity. Conserving biodiversity is an essential part of safeguarding our biological life support systems.

All living creatures depend on these systems and their ecosystem services for our health, sustenance and wellbeing. If we continue to live unsustainably, we risk the degeneration of the vital ecological systems and processes that support our current existences, as well as reducing the environmental legacy we leave for future generations.

It is estimated that Australia is home to as many as 560 000 different species and the vast majority of these species are found nowhere else on Earth (Commonwealth of Australia, 2010). Like most countries around the world, Australia's biodiversity resources are under threat, despite an array of International, National, State and Local level biodiversity conservation policies, strategies, plans and actions. There are more than 1,700 species and ecological communities known to be at risk of extinction across Australia (DSEWPaC, 2010) and this is likely to be the tip of the iceberg.

Existing long term pressures on biodiversity continue to be the main causes of biodiversity loss. These include direct habitat loss for development of land; increased fragmentation of habitat areas; increasing pressure from pest species of plants, animals and other organisms; and incompatible land management practices. These impacts will be magnified by the growing reality and severity of broad-scale environmental change predicted to occur with global climate change.

1.3 WHY DO WE NEED A BIODIVERSITY MANAGEMENT PLAN?

Local government is increasingly being asked by the community and required by law to take a greater role in the management, protection and enhancement of the natural environment. Many of the environmental and planning issues faced by LCC are common to local governments throughout NSW; some however are unique to the Liverpool LGA and require individual and strategic responses. A local Biodiversity Management Plan aims to help ensure that local ecosystems, species and genes survive in their natural habitat, so that the local ecosystem services can continue to provide their environmental benefits.

Whilst there is a range of Federal and State legislation that needs to be considered, LCC has a particular charter as set out in the NSW *Local Government Act 1993* to address biodiversity conservation. Section 8 of the Act details this charter:

"To properly manage, develop, protect, restore, enhance and conserve the environment of the area for which it is responsible, in a manner that is consistent with and promotes the principles of ecologically sustainable development."

This Plan provides LCC with a strategic and practical approach to undertaking its roles and ensures responsibility for the protection, enhancement and conservation of the area's natural values, whilst ensuring compliance with the Federal and State legislation.

The Liverpool Biodiversity Strategy (2003) and this subsequent Biodiversity Management Plan (2012) illustrate LCC's ongoing commitment to biodiversity conservation and provides a concise working

document for staff in a range of departments to implement over the next 4 years. By adopting this Management Plan and directing adequate and timely resources towards achieving the identified objectives and actions, LCC aims to reconcile biodiversity conservation with rapid future urban growth and meet its legislative requirements under the NSW Local Government Act (1993). The Management Plan will require review at the end of its lifespan, suggested to be 4 years, to ensure that Council is on track to deliver the required outcomes and to ensure that the plan continues to address the priority issues in local biodiversity management using best available knowledge and techniques.

The plan is applicable only to Liverpool LGA, but has been developed within the context of wider frameworks including the neighbouring local government areas, broader catchment areas, NSW and Australia. Plans of Management, delivery programs, operational business plans and the like will continue to be developed and implemented by Council, within the framework of this plan. The plan also includes a number of biodiversity management actions, based on a desktop profile of biodiversity values in the LGA and a review of current policy, legislation, community expectations and best practice management.

1.4 WHO NEEDS TO MANAGE BIODIVERSITY?

The simple answer is everyone. If we want to continue to enjoy the benefits that biodiversity provides for us, then we all need to accept and fulfil our role in its management and protection. The majority of land within Liverpool LGA is privately owned, and therefore the role for Liverpool's community is both large and very significant. Government land owners and managers such as NSW National Parks and Wildlife Service, Department of Defence, Sydney Catchment Authority, Western Sydney Parklands Trust as well as LCC will take the lead role in managing the natural values on public land. But this will not be enough to halt the current decline in biodiversity and ensure sustainable ecosystems can be achieved. Significant contributions will be required on private land, by private land holders to link up key habitat areas and provide sympathetic buffer areas to the core conservation reserves. The value of partnerships between governments and communities, business, schools and others is growing ever more important in recognition that the issue of biodiversity decline is so significant an issue and that no one person or organisation has all the answers nor all the required resources.

2 Strategic Directions for Biodiversity Management

2.1 NATIONAL AND STATE DIRECTIONS IN BIODIVERSITY MANAGEMENT

Australia's Biodiversity Conservation Strategy (2010 – 2030) identifies three priorities for action to help stop, and then reverse, the current decline in Australia's biodiversity. These are tabulated below, along with the National targets for achievement.

Table 1: National Priority Actions and Targets

PRIORITY FOR ACTION	STRATEGIES	TARGET
Engaging all Australians in biodiversity conservation	Mainstreaming concepts of biodiversity	By 2015, achieve a 25% increase in the number of Australians and public and private organisations who participate in biodiversity conservation activities.
	Increasing Indigenous engagement	By 2015, achieve a 25% increase in employment and participation of Indigenous peoples in biodiversity conservation.
	Enhancing strategic investments and partnerships	By 2015, achieve a doubling of the value of complementary markets and an increase in private expenditure on biodiversity ecosystem services.
Building Ecosystem Resilience in a changing climate	Protecting diversity	By 2015, achieve a national increase of 600,000 km^2 of native habitat managed primarily for biodiversity conservation across terrestrial, aquatic and marine environments.
	Maintaining and re-establishing ecosystem functions	By 2015, 1,000 km^2 of fragmented landscapes and aquatic systems are being restored to improve ecological connectivity. By 2015, four collaborative continental-scale linkages are established and managed to improve ecological connectivity.
	Reducing threats to biodiversity	By 2015, reduce by at least 10% the impacts of invasive species on threatened species and ecological communities in terrestrial, aquatic and marine environments.
Getting measurable results	Improving and sharing knowledge	By 2015, nationally agreed science and knowledge priorities for biodiversity conservation are guiding research activities.
	Delivering conservation initiatives efficiently	By 2015, all jurisdictions will review relevant legislation, policies and programs to maximise alignment with Australia's Biodiversity Conservation Strategy.
	Implementing robust national monitoring, reporting and evaluation	By 2015, establish a national long-term biodiversity monitoring and reporting system.

This strategy is intended to form a policy umbrella over more specific plans which deal with native vegetation management, pest plant and animal species and the national reserve system. It is also intended to guide subsequent strategies and plans developed by State and Local Governments.

Similarly, the NSW (Draft) Biodiversity Strategy (2010 – 2015) identifies the following key themes and measurable targets that will contribute to building ecosystems that are healthy and resilient (see Table 2).

Table 2: Key Themes and Targets of the NSW (Draft) Biodiversity Strategy

KEY THEME	TARGET
Smarter Biodiversity Investment	By 2015, state-scale priorities are incorporated into biodiversity and related planning processes including Catchment Action Plan updates and plans of management for reserves and other public lands.
	By 2015, standard site-assessment tools have been taken up by public and private conservation organisations in New South Wales.
	By 2015, recovery and threat abatement efforts will reflect the priorities set out in the Priorities Action Statements under the TSC Act and FM Act.
Whole of Landscape Planning	By 2015, regional land-use planning processes are informed by landscape scale biodiversity assessment and contain provisions that contribute to the protection of biodiversity.
Improved Partnerships	By 2015, there is a 25% increase in employment and participation of Aboriginal people in natural resource management, including biodiversity conservation.
Effectively Managing Threats	Selected Statewide NRM targets will inform the evaluation of the effectiveness of actions for this theme (Appendix 5 of Draft Strategy)
Sustainable Production Environments	Selected Statewide NRM targets will inform the evaluation of the effectiveness of actions for this theme (Appendix 5 of the Draft Strategy)

The National and State documents identify the main threats to Australia's biodiversity as:

- Habitat loss, degradation and fragmentation,
- Invasive plant and animal species,
- Unsustainable use and management of natural resources,
- Changes to the aquatic environment and water flows,
- Changing fire regimes, and
- Climate change.

2.2 REGIONAL DIRECTIONS IN BIODIVERSITY MANAGEMENT

Australia's Biodiversity Conservation Strategy identifies that local government and natural resource management regional programs, such as Catchment Management Authorities, will be the critical scale for progress towards many outcomes and targets in the plan.

Liverpool LGA lies across the management areas of both the Hawkesbury Nepean Catchment Management Authority (HNCMA) and Sydney Metro Catchment Management Authority (SMCMA). Both CMAs have developed Catchment Action Plans (CAPs)to direct the funding and research priorities for land and water management within their geographic areas. The SMCMA CAP vision is "*An Urban Community that thrives within a valued natural landscape*" while the vision of the HNCMA CAP is "*to achieve a healthy and productive catchment valued now and in the future*".

Both CAPs contain targets and timeframes for the management of biodiversity, the land catchment areas and participating government agencies and wherever possible, LCCs biodiversity management actions should be consistent with these in order to maximise the potential to receive grant funding for planning and restoration works.

The state-wide targets for biodiversity developed by the Natural Resources Commission (NRC 2006) for Catchment Management Authorities have been interpreted regionally by the HNCMA and SMCMA in the following targets.

HNCMA	
Macro-Environmental Targets	**Specific Priority Targets**
By 2015 there is an increase in native vegetation extent and an improvement in native vegetation condition	By 2015 there is an increase in the recovery of threatened species, populations and ecological communities,
By 2015 there is an increase in the number of sustainable populations of a range of native fauna species	By 2015 there is a reduction in the impact of invasive species
By 2015 there is an improvement in the condition of riverine ecosystems	By 2015 there is an improvement in the condition of important wetlands and the extent of those wetlands is maintained
By 2015 there is an improvement in the ability of groundwater systems to support groundwater dependant ecosystems and designated beneficial uses	By 2015 there is an improvement in the condition of estuaries and coastal lake systems
By 2015 there is no decline in the condition in marine waters and ecosystems	
SMCMA	
Catchment Targets	**Management Targets**
By 2016 the extent and condition of terrestrial native vegetation in all landscapes is maintained or improved	By 2016 all local Councils and land managers are making planning and management decisions based on best available knowledge
By 2016 there is an increase in the connectivity of terrestrial native vegetation	By 2016 there is an increase in the conservation and management of non-reserved lands
By 2016 aquatic and terrestrial threatened species and EECs and endangered populations are better conserved by implementing actions identified in the PAS	By 2016 there is an increase in the extent, condition and connectivity of regional biodiversity corridors.
By 2016 the impact of terrestrial and aquatic invasive species on biodiversity is reduced by decreasing the number, distribution and impact of invasive weeds, pest animals and pathogens	By 2011 the Weed Management Strategy for the region has been implemented and reviewed by key land managers in a co-ordinated manner

	By 2011 Action Plans for priority pest animal species have been developed and implemented
	By 2011 education and research programs investigating the distribution and spread of priority invasive species have been implemented

2.3 BIODIVERSITY MANAGEMENT AT LIVERPOOL CITY COUNCIL

There are a number of key strategic documents that LCC has produced that contain statements relevant to the vision for biodiversity in the LGA.

In 2003, LCC adopted the Liverpool Biodiversity Strategy. The strategy set out the objectives and aims for biodiversity management within Liverpool Local Government Area (LGA). The Strategy's aims were to:

- Provide for the conservation of native plants, animals, habitat and ecological processes in the Liverpool LGA,
- Provide priorities and guidance for Council in making decisions relevant to managing these native plants and animals, and the natural environment of the area,
- Provide guidance for the use, conservation and enhancement of natural resources in the Liverpool LGA according to the principles of ecologically sustainable development
- Provide a greater level of certainty for the community via a pre-defined, transparent and accountable process.

In 2008, the objectives and actions of the Biodiversity Strategy were distilled and captured into Liverpool's first Biodiversity Management Plan. The first Management Plan has been progressively implemented by various sections and individuals within LCC, so that it is now necessary to update this original plan to account for completed actions, ensure consistency with current best practice biodiversity management and provide a logical 'plan of attack' for progressing biodiversity management actions over the next period.

LCC's Community Strategic Plan – ***Growing Liverpool 2021*** – has an overall vision for Liverpool to be "***a vibrant, historical regional city of growth, prosperity and diversity***". Growing Liverpool 2021 nominates several guiding principles for managing the LGA into the future and the principles which are relevant to managing biodiversity are:

(4) Recognise and build on the cultural, historic and natural characteristics of the city.
Social cohesion and social sustainability come from having a strong sense of place. The community's values and aspirations come from our history and culture. Cohesion does not mean uniformity but instead means embracing diversity. Liverpool is a city built on the floodplains of two large river systems, the Georges and Nepean Rivers, their creeks and other tributaries. The health of these river systems is socially important. Liverpool also has a long history of Aboriginal custodianship and of European settlement as well as the experience of recent waves of immigration represented by a range of ethnic groups. Collectively, these aspects of its history contributed to creating Liverpool's unique identity.

(5) Recognise the value of our natural ecosystems to our wellbeing and protect and restore them.

It is easy to take the natural environment for granted, yet our long term physical and emotional health relies on residing within healthy and fully functional natural ecosystems. Natural ecosystems are the basis for all life. All urban systems rely heavily on natural ecosystems that go well beyond their administrative borders. We must protect and restore those ecosystems directly within our influence if we are to protect our wellbeing.

(8) Measuring our performance

Clear and specific indicators are a key tool for making progress towards sustainability. This applies to the community and to the Council. Council's integrated environmental sustainability framework seeks to gather sustainability information and use it to help in guiding environmental decision making.

2.4 OBJECTIVES FOR BIODIVERSITY MANAGEMENT IN LIVERPOOL

The core objectives of this Biodiversity Management Plan are to:

- Maintain, protect, enhance and restore naturally occurring ecosystems, populations and species within Liverpool LGA, based on best practice biodiversity principles so that:
    - Targets developed for the protection of the vegetation communities present are met;
    - A high level of connectivity between vegetation patches is achieved through the establishment of an effective corridor network;
    - Threats to listed species, populations and communities and their habitat are reduced;
- Provide for the social, economic and cultural growth and wellbeing in ways that do not adversely impact on the health of the area's biodiversity;
- Partner with the community and all levels of government to maintain, enhance and restore native flora and fauna and their habitat;
- Develop a detailed understanding of the area's biodiversity resources, values and ecological processes and develop, maintain and prioritise appropriate resources for biodiversity conservation and management;
- Contribute and respond to the protection of biodiversity at a local, regional, State, National and International level;
- Consider the knowledge values and traditions of Indigenous communities; and
- Provide a planning document that has broad community support as a result of effective stakeholder input to its development.

2.5 BIODIVERSITY MANAGEMENT PLAN TARGETS

Biodiversity targets are needed to assess actual performance against desired outcomes. As seen in Sections 2.2 and 2.3, there are a multitude of biodiversity strategies, policies, principles, objectives and targets relating to biodiversity. Strategic biodiversity targets for Liverpool should be identified based on the relationship to broader Commonwealth, State and Regional targets, as identified in Figure 2.

Figure 2: Strategic Biodiversity targets for Liverpool based on the relationship to broader targets

The 2003 Liverpool Biodiversity Strategy listed targets for several specific vegetation types present within the LGA, however no broader biodiversity targets exist as yet for all aspects of biodiversity conservation management, nor for the land conservation categories resulting from the Conservation Significance Assessment completed. Targets were only developed for vegetation communities which were at that time listed as threatened ecological communities under the NSW TSC Act. Overall the targets, if reached, provided for a net increase in the area of good condition vegetation and an increase in the amount of good condition vegetation that is protected.

While these targets remain relevant for the vegetation communities which have targets set, they do not recognise the ecological value provided by areas of native vegetation that are not currently listed as threatened ecological communities. Additionally, without access to regular, up-to-date mapping data on vegetation extants and condition within the LGA, monitoring change against these targets will be difficult on the 4 year life span of the BMP.

This management plan recommends that a suite of biodiversity targets be developed in order to monitor progress towards, or away from, the desired outcomes.

The 2003 Liverpool Biodiversity Strategy targets and LCC's progress towards meeting those targets is presented in Table 3. These targets were derived from an analysis of the existing vegetation within the LGA, vegetation extant (i.e. how much vegetation remained based on 2002 mapping data), what condition existing vegetation was in (desktop based information only) and what proportion of the vegetation existed in land use zones considered to provide planning protection for that vegetation community. N /A has been used for vegetation communities which did not have a target set for them in 2003 (ie all communities that were not listed as threatened ecological communities at the time).

As the naming system for vegetation communities has changed between the 2003 Biodiversity Strategy and the 2012 BMP, and also differs from the names used to identify vegetation types listed as threatened ecological communities under the TSC Act, a comparison of the vegetation community names is provided below in Table 14: Vegetation Communities present within Liverpool LGA.

Table 3: Vegetation Community Targets from Liverpool Biodiversity Strategy[$]

Vegetation Community	Targets to be met by 2008			Results			
	Extent Good Condition Veg (2003)*	Extent Good condition* by 2008	Extent Good Condition* in planning protection by 2008^	Extent Good Condition (2007)	Extent Good Condition in planning protection (2007)	Extent Good Condition* Veg (2012)	Extent Good Condition* Veg in planning protection[#] (2012)
Threatened Ecological Communities							
1. **Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin** (River Flat Eucalypt Forest: Alluvial Woodland)	656 ha	720ha	50%	663 ha	234 ha (35%)	659 ha	203 ha (30%)
Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin (River Flat Eucalypt Forest: Riparian Forest)	106 ha	111 ha	50%	99 ha	40 ha (40%)	99 ha	30 ha (30%)
2. **Hard-leaved Scribbly Gum – Parramatta Red Gum Heathy woodland of the Cumberland Plain, Sydney Basin** (Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion)	228 ha	240 ha	50%	228 ha	49 ha (21%)	228 ha	44 ha (19%)
3. **Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin** (Castlereagh Swamp Woodland Community)	34 ha	34 ha	50%	25ha	0 ha (0%)	25 ha	0 ha (0%)
4. **Broad-leaved Ironbark - Grey Box - *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin** (Cooks River / Castlereagh Ironbark Forest in the Sydney Basin Bioregion)	177 ha	190 ha	50%	220 ha	99 ha (45%)	213 ha	63 ha (29%)
5. **Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin**	669 ha	710 ha	50%	611 ha	129 ha	611 ha	51 ha

(Cumberland Plain Woodland – Shale Hills Woodland) **Grey Box – Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin** (Cumberland Plain Woodland – Shale Plains Woodland)	1072 ha	1200 ha	50%	1003 ha	(21%) 389 ha (38%)	991ha	(8%) 214 ha (21%)
6. **Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin** (Moist Shale Woodland)	0 ha	7.35 ha	100%	0 ha	0 ha (0 %)	0 ha	0 ha (0%)
7. Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin (Shale Gravel Transition Forest)	682 ha	720 ha	50%	683 ha	122 ha (17%)	683 ha	117ha (17%)
9. Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (Shale / Sandstone Transition Forest in the Sydney Basin Bioregion - Low Sandstone Influence)	83 ha	100 ha	75%	105 ha	11 ha (10%)	102 ha	11ha (10%)
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (Shale / Sandstone Transition Forest in the Sydney Basin Bioregion - High Sandstone Influence)	9 ha	11 ha	60%	3 ha	0ha (0%)	3 ha	0ha (0%)
10. Coastal Freshwater Lagoons of the Sydney basin and South-East Corner (Freshwater Wetlands)	N / A	N / A	N / A	4 ha	1 ha (25%)	4ha	1 ha (25%)
11. Saltmarsh in estuaries of the Sydney Basin and South East Corner (Mangroves and Saltmarsh)	N / A	N / A	N / A	1 ha	0 ha (0%)	1 ha	0ha (0%)

Non-threatened Vegetation Communities							
12. Water Gum – Coachwood Riparian Scrub along sandstone streams in the Sydney Basin (Riparian Scrub)	N / A	N / A	N / A	71 ha	0 ha (0%)	71 ha	0ha (0%)
13. Red Bloodwood – Scribbly Gum heathy woodland on the sandstone plateaux of the Sydney Basin (Sandstone Ridgetop Woodland and Woodland Heath Complex)	N / A	N / A	N / A	1 551 ha	233 ha (15%)	1 548 ha	230 ha (15%)
14. Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of Western and Southern Sydney (Upper Georges River Sandstone Woodland)	N / A	N / A	N / A	1 601ha	20 ha (1%)	1 580 ha	17ha (10%)
15. Red Bloodwood – Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin (Western Sandstone Gully Forest)	N / A	N / A	N / A	1 449 ha	0 ha (0%)	1 449 ha	0 ha (0%)

*****_Condition A, B and C vegetation was defined by Hyder in 2007 as A = Canopy Cover > 10%, B = Canopy Cover < 10% with scattered trees and native understorey, and C = Canopy Cover < 10%, and scrub (as adapted from NSW NPWS 2002 mapping procedure)._

^The percentage targets quoted in this column come directly from the Liverpool Biodiversity Strategy (2003). The areas given in hectares are calculated as that percentage of the **desired** extant of vegetation to be present in 2008, not as a percentage of the actual amount present in 2003. Further, the targets related only to vegetation in good condition, and as both the 2007 and 2012 assessments are desktop based only, ground-truthing of the stands of vegetation is required in order to confirm these results.

For the 2007 and 2012 results of the % of vegetation communities in good condition with planning protection, this figure was calculated as the area of good condition vegetation with planning protection over the area of good condition vegetation present X 100%.

#For the 2012 results figures in Table 3, planning protection includes all vegetation on land zoned: E1 (National Parks and Nature Reserves), E2 (Environmental Conservation), E3 (Environmental Management, RE1 (Public Recreation) and WSP (Western Sydney Parklands).

$ Please see Table 14 for an explanation of previous vegetation community names, TSC Act community names and current Biometrics vegetation community nomenclature. The vegetation community name bolded in the table is the current Biometric community name and the vegetation community name not bolded is the name used in both the 2003 Biodiversity Strategy and the 2007 Draft Biodiversity Management Plan .

2.6 PROGRESS TO DATE ON BIODIVERSITY STRATEGY TARGETS

Table 3 above show the progress that LCC has made in conserving and protecting ecologically significant stands of all vegetation communities within the LGA.

The Biodiversity Strategy only set targets for vegetation communities that were threatened ecological communities at that time. Since 2003, Castlereagh Scribbly Gum Woodland (Vulnerable) and Freshwater Wetlands have been listed as Threatened Ecological Communities (TECs) and several EECs have been uplifted to the status of *Critically* Endangered Ecological Communities.

The analysis of 2012 extent of vegetation communities with planning protection has considered planning protection to include all vegetation on land zoned:

- E1 (National Parks and Nature Reserves),
- E2 (Environmental Conservation),
- E3 (Environmental Management), and
- RE1 (Public Recreation), and
- WSP (Western Sydney Parklands).

The targets that were nominated in the 2003 Biodiversity Strategy were both an area (extant) of 'good condition' vegetation that was 'desired' to be in existence by 2008 as well the proportion of those areas (extants) that were under planning protection.

The issue of reaching extant targets (ha) and percentage targets for just the vegetation communities which had targets set in the 2003 strategy are presented separately in Table 4. These figures represent only the vegetation present in good condition.

Overall, there continues to be decline in the amount of existing vegetation (extant) of the various vegetation community types as well as a decline in the proportion of these vegetation communities which have some form of planning or land use protection. This indicates a move away from the targets set in the 2003 Strategy.

The only vegetation community which has increased in the degree of land use protection afforded to it is the 'Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest in slopes of dry sandstone gullies of Western and Southern Sydney". However, while this community has a greater proportion with land use protection, its overall extant has actually decreased by 3 ha.

The 'Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain' vegetation community has actually reached and exceeded the extant (ha) target set in 2003 by 23 ha (approximately 12%), however the amount of this good condition vegetation with land use protection is still short of the target set by 20%. Similarly, the amount of 'Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (Low Sandstone Influence)' vegetation appears to be in excess of the extant (ha) target by 2ha, however only 10% of this vegetation had land use protection which remains 90% short of the target set in 2003.

Both the overall extent of good condition vegetation remaining and the extent in areas with planning protection are valuable targets and indicators of whether LCC is making progress to ensure better biodiversity outcomes. This plan recommends that a new set of conservation and reservation targets be set for all vegetation communities present within the LGA.

Table 4: Targets for Good Condition Vegetation Community Extants from 2003 Biodiversity Strategy and Results against targets

Vegetation Community	2003 Target For Extant Vegetation in 2008	2003 Target % under planning protection*	2012 Actual Extant Vegetation	2012 Actual % under planning protection*
Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	831 ha	50%	659 ha	30 %
Hard-leaved Scribbly Gum –Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin	240 ha	50%	228 ha	19%
Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin	34 ha	50%	25 ha	0 %
Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin	190 ha	50 %	213 ha	30%
Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin	710 ha	50%	611 ha	8%
Grey Box – Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Shale Plains Woodland	1200 ha	50 %	991 ha	21%
Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin	7.35 ha	100%	0 ha	0%
Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin	720ha	50%	683ha	17%
Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin				
- Low sandstone Influence	100ha	75%	102 ha	10%
- High Sandstone Influence	11 ha	60%	3 ha	0%

**Percentage calculations are based on the percent of good condition vegetation remaining (in 2012) that is in formal land use protection), compared to total amount of good condition vegetation present.*

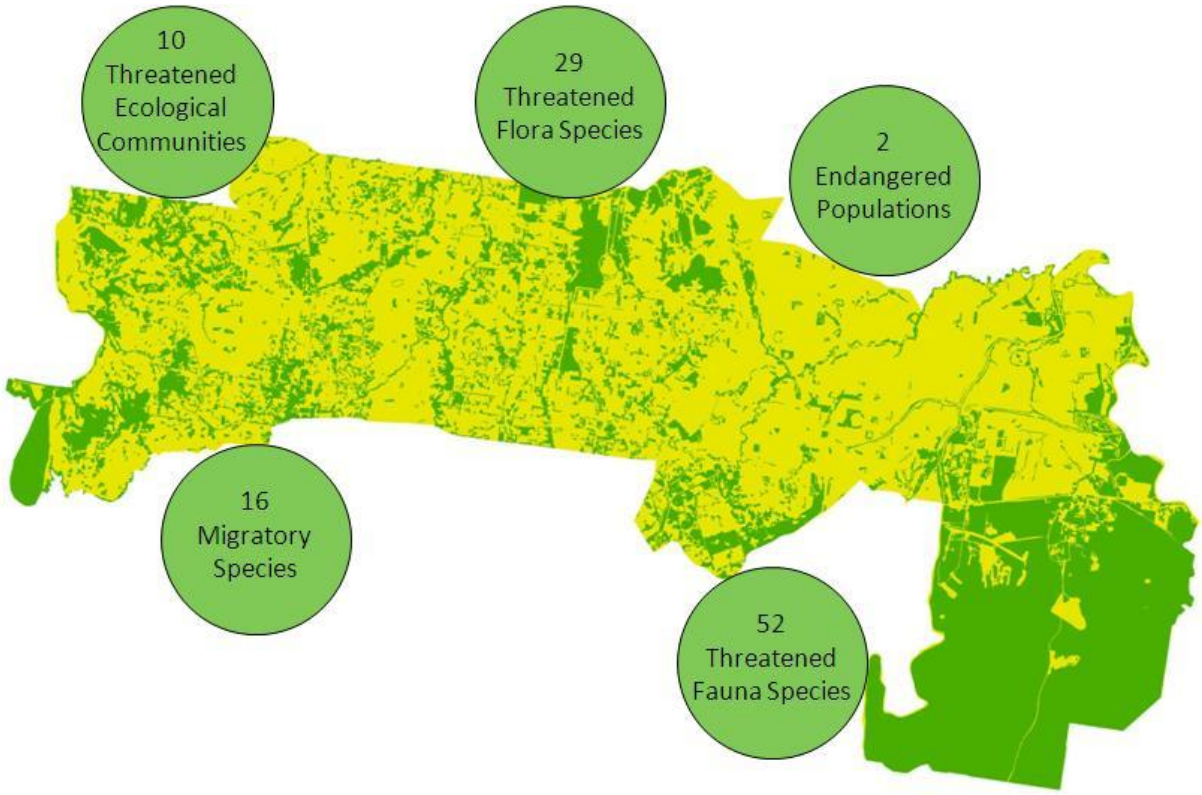
Planning Protection planning protection includes all vegetation on land zoned: E1 (National Parks and Nature Reserves), E2 (Environmental Conservation), E3 (Environmental Management, RE1 (Public Recreation) and WSP (Western Sydney Parklands).

Please see Table 14 for an explanation of previous vegetation community names, TSC Act community names and current Biometrics vegetation community nomenclature. The vegetation community name bolded in the table is the current Biometric community name and the vegetation community name not bolded is the name used in both the 2003 Biodiversity Strategy and the 2007 Draft Biodiversity Management Plan

3 Liverpool's Biodiversity Profile

This brief profile of biodiversity in Liverpool LGA was developed by collating relevant information from a range of sources at a local, regional, state and national scale. The following section provides a summary of biodiversity values in the LGA and includes flora, fauna, habitat, threatened species, populations and ecological communities. Relevant components of (adopted and draft) Federal and State Recovery Plans, Threat Abatement Plans, Priority Action Statements, HNCMA and SMCMA Catchment Action Plans and other relevant Plans of Management will be discussed as appropriate. The information in this section should be reviewed and updated regularly. (More detailed information on the significant flora, fauna, and vegetation communities in the LGA is provided in Part 2, Section 5.)

Figure 3: Biodiversity Snapshot of Liverpool LGA



3.1 VEGETATION COMMUNITIES

A vegetation or ecological community is a group of species that occur together in a particular area of the landscape. The species share and can tolerate similar environmental requirements. Ecological communities are commonly recognised by their assemblage of plant species and referred to by a collective name for that vegetation type or community. Vegetation communities serve many ecological roles including habitat provision, contributing to ecosystem processes, preventing erosion and facilitating links between habitat patches across the landscape.

Of the 30, 600ha of land within Liverpool LGA, approximately 10, 672ha of the LGA is covered by known native vegetation communities. (An additional 166 ha of the LGA is covered by vegetation, the composition of which is unknown at present). Of the 10, 672 ha of known vegetation communities, 5,994 ha (56 %) is listed as one of 10 different Threatened Ecological Communities present in the LGA.

The spread of these vegetation communities across the LGA is shown in Figure 4 and Figure 5 shows vegetation condition (based on NPWS 2002 data), while Figure 6 shows the area of vegetation known to be cleared since the mapping was updated in 2007. Since the mapping undertaken in 2003 and 2007, there has been a significant change to the scientific nomenclature system used to describe and classify native vegetation communities. Accordingly, the current system of naming known as Biometrics, has been used to refer to vegetation communities present within Liverpool LGA. To enable comparisons from results of previous mapping analyses, the equivalent vegetation community names are provided in

Table 5 below.

Vegetation communities which are listed as Threatened Ecological Communities under either the NSW TSC Act or Commonwealth EPBC act are highlighted with (TEC) after the community name in Figure 4. The extent of vegetation which is a TEC is mapped in Figure 7.

The terminology used in the vegetation condition map (Figure 5) relates to the condition descriptions developed by NSW NPWS during the mapping of Native vegetation of the Cumberland Plain, Western Sydney. The Liverpool Biodiversity Strategy (2003) defined 'Good Condition" vegetation as all vegetation in condition classes A, B and C, "Poor Condition" vegetation was defined as all vegetation in condition classes Tx, TXu, Txr and X. The classification of vegetation into these condition classes ***does not*** correlate to the condition classes used in the biometric vegetation assessment protocol associated with the NSW biobanking process.

Table 5 : Vegetation Community Names

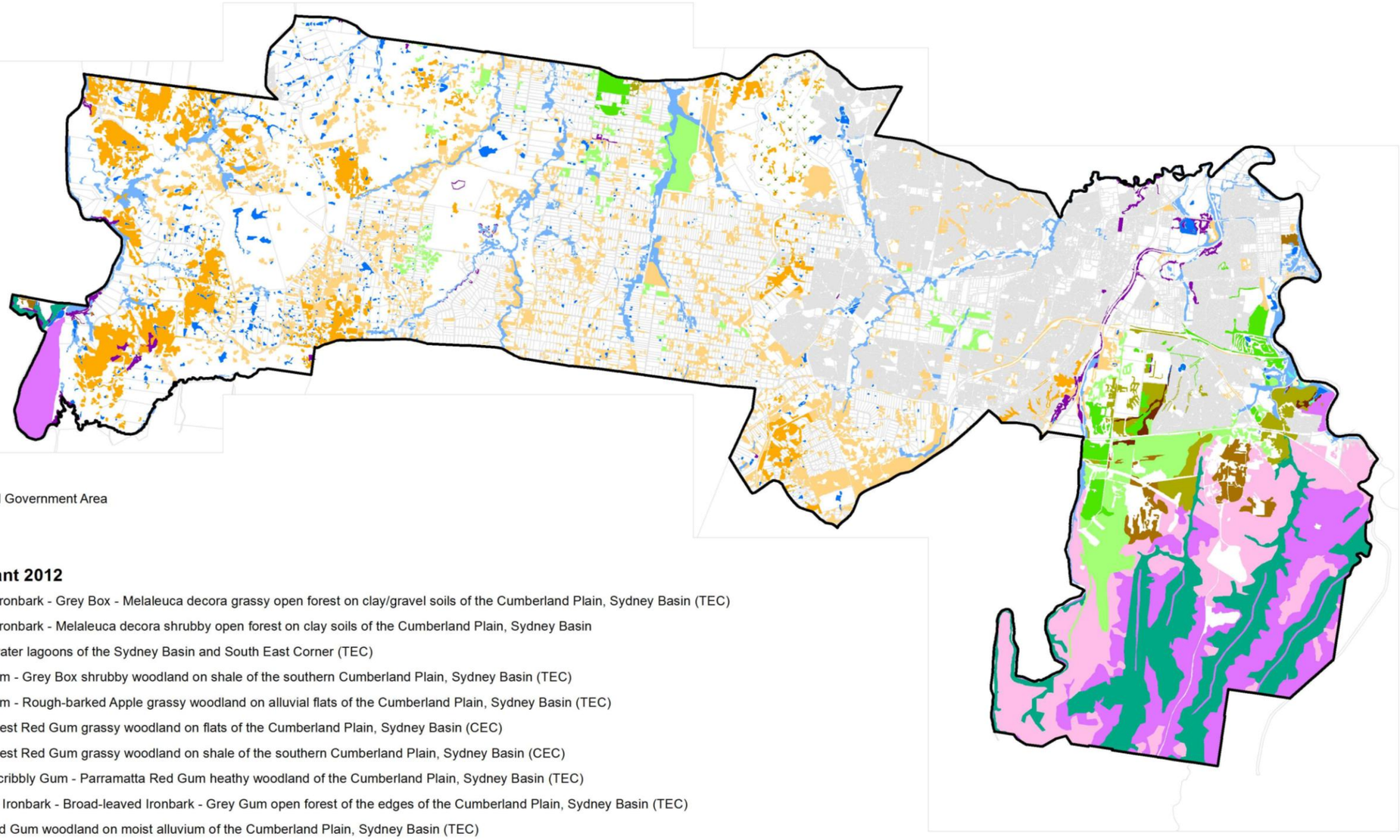
BIOMETRIC VEGETATION TYPE[1]	PREVIOUSLY USED VEGETATION COMMUNITY NAME[2]	TEC Name
Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	Alluvial Woodland Riparian Forest	River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (incorporating the previously listed Sydney Coastal River-flat Forest)
Hard-leaved Scribbly Gum –Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin	Castlereagh Scribbly Gum Woodland	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion
Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin	Castlereagh Swamp Woodland	Castlereagh Swamp Woodland Community
Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin	Cooks River / Castlereagh Ironbark Forest	Cooks River / Castlereagh Ironbark Forest in the Sydney Basin Bioregion
Shale Hills Woodlands = Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin **Shale Plains Woodland** = Grey Box – Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin	Cumberland Plain Woodland (including Shale Hills Woodland and Shale Plains Woodland)	Cumberland Plain Woodland
Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin	Moist Shale Woodland	Moist Shale Woodland in the Sydney Basin Bioregion
Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin	Shale Gravel Transition Forest	Shale Gravel Transition Forest in the Sydney Basin Bioregion
Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	Shale Sandstone Transition Forest (including high and low sandstone influence)	Shale/Sandstone Transition Forest
Coastal freshwater lagoons of the Sydney Basin and South East Corner	Freshwater Wetlands	Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and Southeast Corner Bioregions

[1] Nomenclature used in the Biometric vegetation community descriptions.

[2] Nomenclature used in NPWS 2002 Western Sydney Mapping, Liverpool Biodiversity Strategy (2003) and (Draft) Liverpool Biodiversity Management Plan (2008)

BIOMETRIC VEGETATION TYPE[1]	PREVIOUSLY USED VEGETATION COMMUNITY NAME[2]	TEC Name
Saltmarsh in estuaries of the Sydney Basin and South East Corner/ Mangrove forest in estuaries of the Sydney Basin and South East Corner	Mangrove/ Saltmarsh	Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregion
Water Gum - Coachwood riparian scrub along sandstone streams, Sydney Basin	Riparian Scrub	N / A
Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin	Sandstone Ridgetop Woodland & Woodland Heath Comnplex	N / A
Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin	Upper Georges River Sandstone Woodland	N / A
Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin	Western Sandstone Gully Forest	N / A

Liverpool Biodiversity Management Plan- Biometric Vegetation Types



Legend

- Liverpool Local Government Area
- Cadastre
- Water

Vegetation- extant 2012

- Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin (TEC)
- Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin
- Coastal freshwater lagoons of the Sydney Basin and South East Corner (TEC)
- Forest Red Gum - Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin (TEC)
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin (TEC)
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin (CEC)
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin (CEC)
- Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin (TEC)
- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (TEC)
- Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin (TEC)
- Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin
- Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin
- Saltmarsh in estuaries of the Sydney Basin and South East Corner (TEC)
- Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney *
- Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner
- Water Gum - Coachwood riparian scrub along sandstone streams, Sydney Basin
- Plantings
- Unclassified

0 1.25 2.5 5 km

Projection: GDA 1994 MGA Zone 56

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Figure 4: Vegetation Communities across Liverpool LGA

Liverpool Biodiversity Management Plan- Vegetation Condition

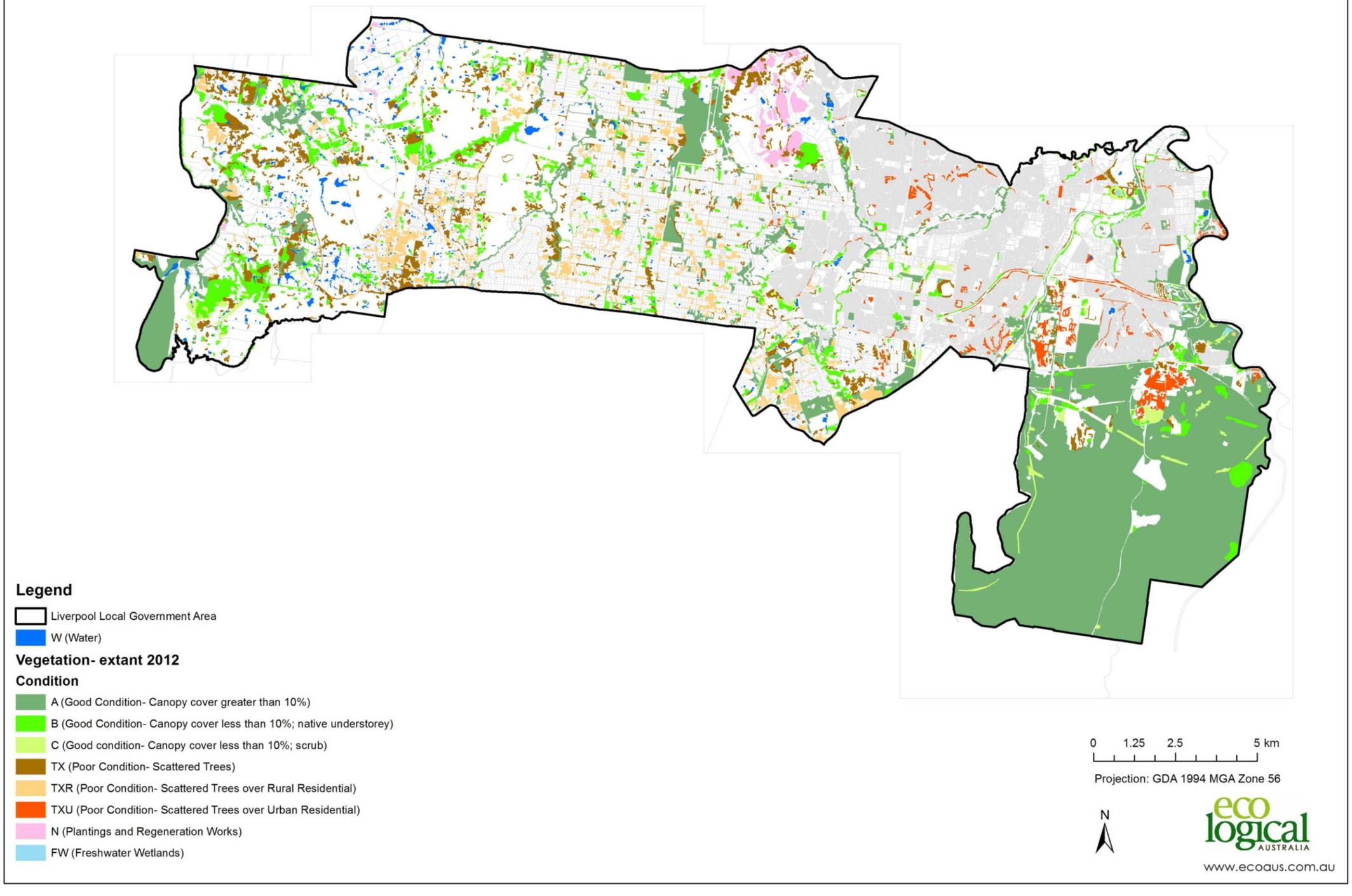


Figure 5: Vegetation Condition

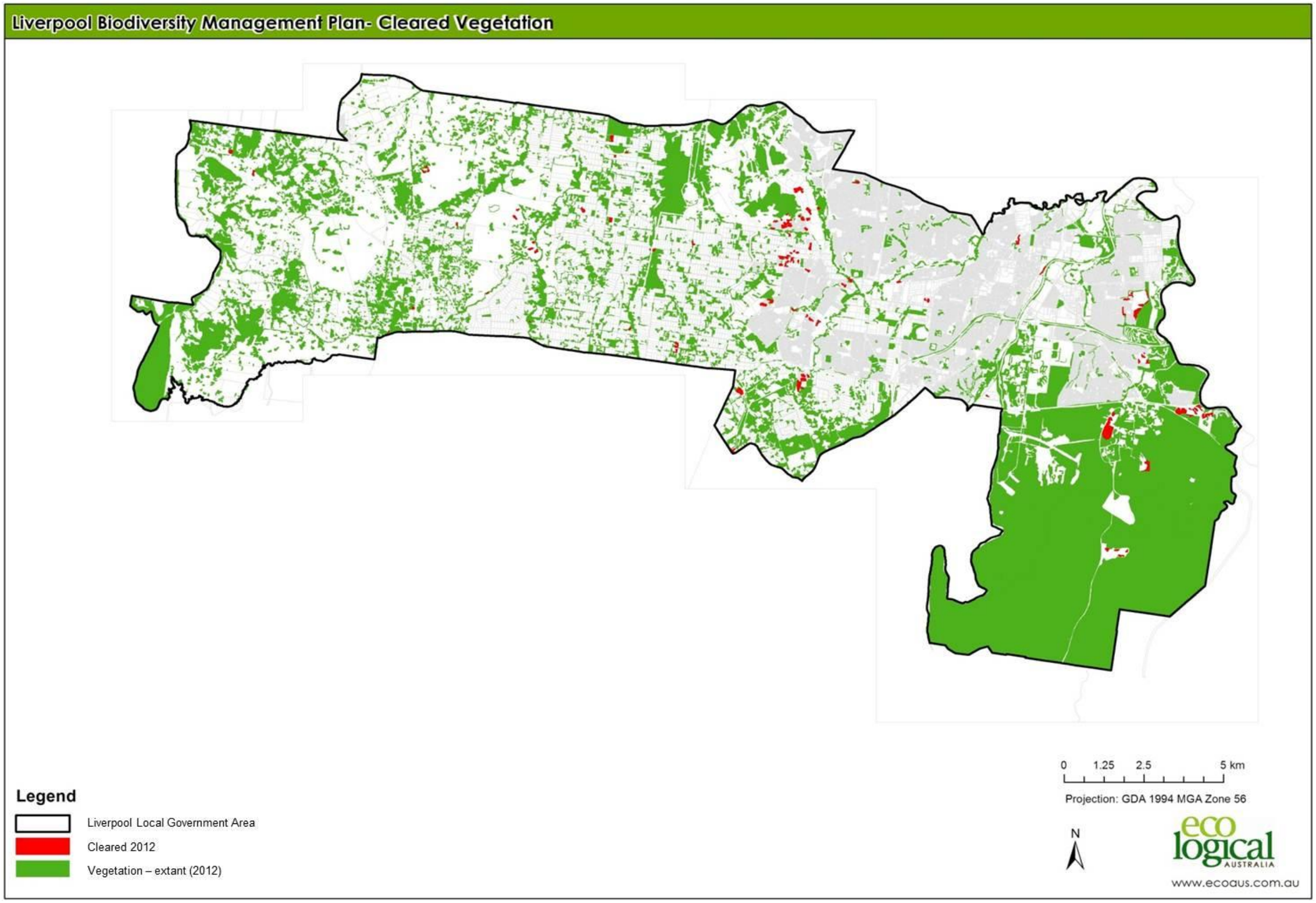
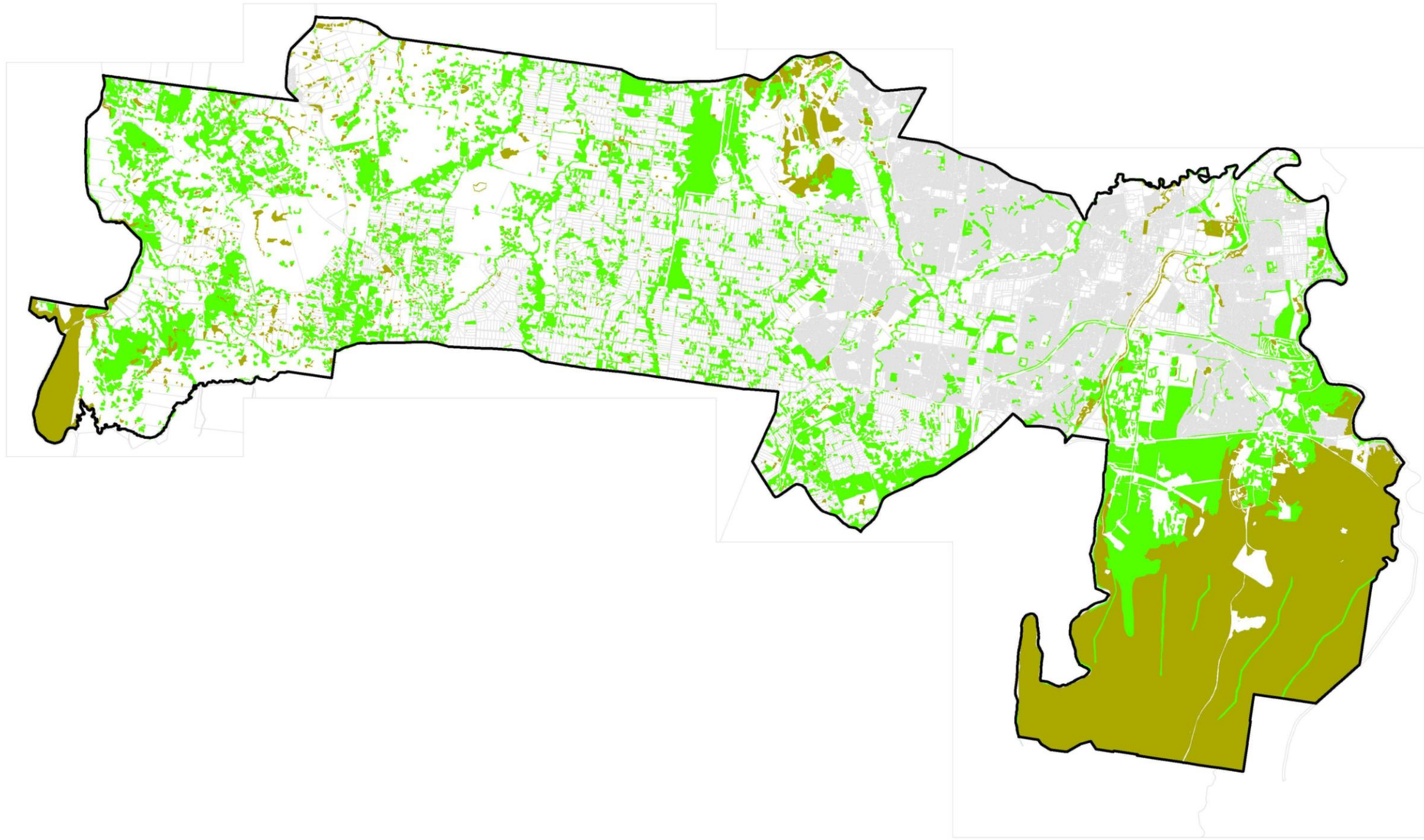


Figure 6: Areas of vegetation cleared since 2007 mapping

Liverpool Biodiversity Management Plan- Threatened Ecological Communities



Legend

- Liverpool Local Government Area
- Threatened Ecological Communities
- Other Vegetation

0 1.25 2.5 5 km

Projection: GDA 1994 MGA Zone 56

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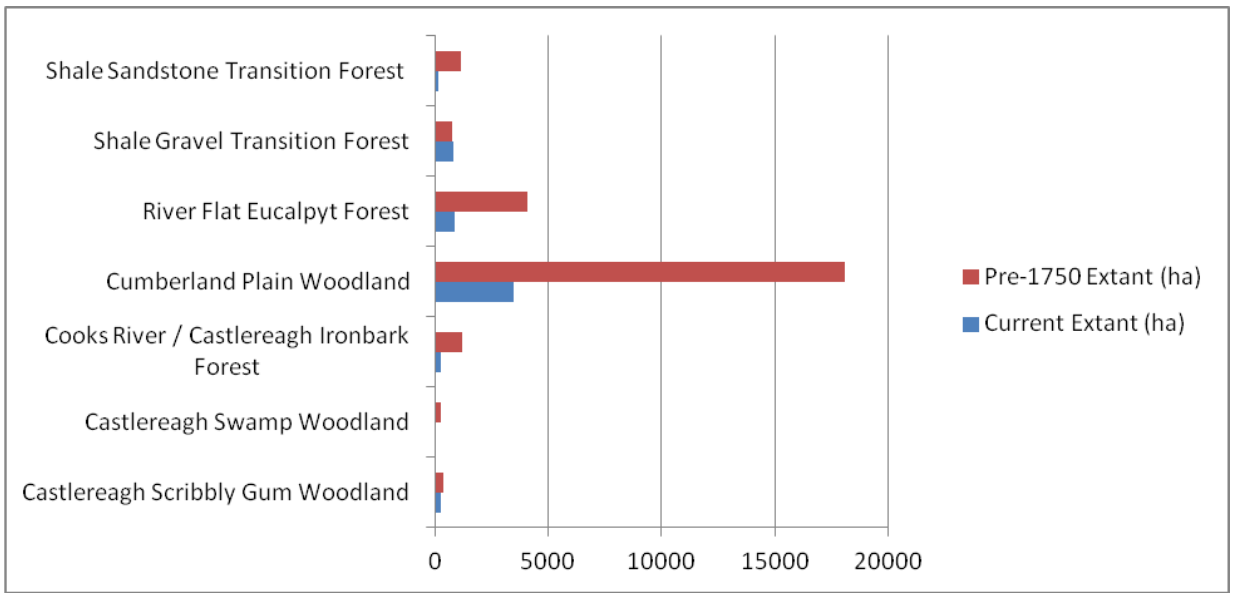
Figure 7: Extent of Threatened Ecological Communities and other vegetation

Of the dominant vegetation communities present within Liverpool LGA prior to European settlement, the graph in Figure 8 illustrates the substantial clearance of vegetation that has occurred between the estimated vegetation cover from 1750 and now. The most dramatically impacted vegetation community is the Cumberland Plain Woodland. (Refer to Table 13 for a comparison of TEC vegetation community names and the equivalent Biometric vegetation community name.)

Figure 8: Current and Pre-1750 Extant of dominant vegetation types in Liverpool LGA



3.2 FAUNA HABITAT

A study completed in 2008 by the (former) NSW Department of Environment and Conservation to assist the Sydney Metropolitan Catchment Management Authority (SMCMA) address the conservation of native fauna (including threatened species) in their Catchment Action Plan identified fauna habitat areas of various significance levels throughout the Sydney Metropolitan catchment. The Holsworthy Military area was nominated in the group with the "Highest Significance" for fauna habitat given its very high fauna diversity, good ecosystem heath, very large continuous extent, restricted public access and high level of representation of Cumberland Plain and other species.

In the "High Significance" category locations at Chipping Norton, Pleasure Point and Long Point were listed. This was due to their moderate levels of fauna diversity, variety of vegetation communities including wetland and heath as well as Cumberland Plain Species and the location of a Grey-headed Flying-fox camp at Chipping Norton. Locations in Hoxton Park and Ingleburn are nominated in the "Moderate Significance" category due to their low to moderate fauna diversity, limited public access, presence of cave dwelling bat species and range of vegetation communities present.

3.3 THREATENED SPECIES, POPULATIONS AND COMMUNITIES

Following is a brief discussion of the endangered populations, threatened flora and fauna, threatened ecological communities and migratory species that have been recorded in the Liverpool City Council area. These records have been obtained from searches of the NSW NPWS Bionet, and Commonwealth Protected Matters Search tool (DSEWPaC).

Table 6 provides a summary of the species, populations and communities listed under either the NSW TSC Act or the Commonwealth EPBC Act.

Table 6: Summary of listed species, populations and communities within Liverpool LGA

Threatened Flora Species	Threatened Fauna Species	Endangered Populations	Threatened Ecological Communities	Listed Migratory Species
29	52	2	10	16

3.3.1 Endangered Populations

Endangered populations are listed under Schedule 1 of the NSW *TSC Act 1995*. A population is eligible to be listed as endangered if, in the opinion of the NSW Scientific Committee:

- Numbers have been reduced to a critical level.
- Habitat has been so drastically reduced that it is in immediate danger of extinction.
- It is not a population of a species already listed in Schedule 1 or 1A of the Act.
- It is disjunct or near the limit of its geographic range.
- It is likely to be genetically, morphologically or ecologically distinct, or it is otherwise of significant conservation value (NSW *TSC Act 1995* and NSW *Threatened Species Conservation Regulation 2002*).

The NSW *TSC Act 1995* currently lists the following 2 endangered flora populations within the Liverpool LGA:

- *Dillwynia tenuifolia* at Kemps Creek, in the northwest of the Liverpool LGA.
- *Marsdenia viridiflora* R. Br. Subsp*. Viridiflora* in Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs.

There are no endangered fauna populations listed for the Liverpool LGA.

3.3.2 Threatened Flora

Section 5 lists the 29 Threatened flora species recorded in Liverpool LGA. Recommendations have been made in this plan to prioritise the management and recovery of threatened species in reserves and to incorporate appropriate management actions from draft and approved Recovery Plans in any subsequent Reserve Plans for Management.

3.3.3 Threatened Fauna

Section 5 lists the 52 threatened fauna species previously recorded within Liverpool LGA. Recommendations have been made in this plan to give specific priority to the management and recovery of threatened species in reserves and to incorporate appropriate management actions from draft and approved Recovery Plans into subsequent Reserve Plans of Management.

3.3.4 Threatened Ecological Communities

Of the 16 known vegetation communities present within the LGA, 10 of these are listed as either vulnerable, endangered or critically endangered ecological communities under either or both the NSW TSC Act (1995) or Commonwealth EPBC Act (1999).

These 11 threatened ecological communities represent 56% of the remaining native vegetation present within the Liverpool LGA, an area of approximately 5, 994 ha. Section 5 describes in detail the TECs and other vegetation communities present.

3.3.5 Migratory Species

The Commonwealth EPBC Act lists species protected under a range of international conventions and agreements, primarily migratory bird species. There are 16 migratory bird species listed as being recorded within Liverpool and these are listed in Section 5.

3.4 LANDSCAPE BIODIVERSITY CONNECTIVITY

Connectivity plays a key role in the objectives and targets of the major policy initiatives that link to this plan, from the NSW State Plan to the State-wide NSW Biodiversity strategy and the SMCMA and HNCMA Catchment Action Plans. This Biodiversity Management Plan aims to define the levels of existing connectivity (vegetation links and fauna corridors) within and regionally adjoining the LGA, and identify priorities for protection and enhancement of connected habitat across the LGA and the region.

3.4.1 Designing for Corridor Effectiveness

The *Western Sydney Urban Bushland Biodiversity Survey* (NSW NPWS, 1997) identified the following corridors as targets for conservation within the Liverpool LGA:

- Kemps Creek riparian corridor which links the Penrith LGA to areas within Liverpool LGA such as Rossmore and Denham Court, and Varroville in Campbelltown.
- Other riparian corridors such as South Creek, Cabramatta Creek, Hinchinbrook Creek and, if enhanced, Georges River.
- The Holsworthy Training Area which connects areas Heathcote National Park and Crown Lands in Menai with the drinking water catchment areas (managed by Sydney Catchment Authority).

In 1998, LCC engaged OCULUS to conduct a study of bushland corridors in new release areas (OCULUS, 1998). This study identified and investigated options for bushland corridors and concluded that there is potential to create the following 3 major biodiversity corridors, linking areas of core habitat across the release areas of Liverpool LGA:

- Maxwells Creek/Prestons corridor.
- Cabramatta Creek corridor.
- Hinchinbrook Creek corridor.

The study also highlighted that there were threats to core habitat from clearing, construction of flood detention basins, residential and industrial development.

More recent work by Eco Logical Australia Pty Ltd (2003) and Hyder Consulting (2007) mapped corridors along riparian areas and linked core stands of vegetation that exceeded a minimum size threshold. This mapping has been updated and is provided in Section 5.

The National Parks Association nominated a land parcel of over 200 hectares for conservation purposes within the Liverpool LGA. The land (the proposed Voyager and Pleasure Point Nature Reserve) is located south of the Georges River, and adjacent to the Holsworthy Military Area (proposed Holsworthy Nature Reserve). The parcel includes various tenures including Commonwealth Defence Housing Authority, Commonwealth Department of Defence, public lands (LCC) and private freehold. The land is of high conservation significance and contains a large diversity of species. It provides a major bushland corridor linking the Holsworthy Military Area, Georges River National Park and vegetated Crown Lands at Menai. Some land in this area has now been zoned one of the (E) Environment land use zones in Liverpool LEP 2008.

This biodiversity management plan provides an outline of local and regional corridor networks. Corridors can be created through the protection, restoration and rehabilitation of interconnected parcels of native bushland. In order to develop an effective corridor network the following principles will need to apply:

- Corridors are to be managed to promote structural and floristic diversity as seen in a natural state. Where possible, widening existing narrow corridors along creeks and roadways should be a priority. Priority should also be given to bushland considered threatened or rare on a regional scale, or bushland that could be secured as habitat for threatened or rare plants and animals
- Where wide corridors are not feasible, a primary corridor (which may be narrower than optimum width) can be supported by a secondary corridor.
- Proposed corridors should utilise riparian vegetation associated with waterways and areas of core / support for core remnant bushland.
- Land use and activities within corridors need to be guided by environmental planning instruments, e.g. development control plan.
- The rehabilitation of corridors will need to consider the suitability of the location, restrictions on corridor width, and the density and type of planting permitted in the particular location. An overview of these considerations will assist in planning a consolidated connectivity network.

3.4.2 Regional, Local and Riparian Biodiversity Corridors

This plan presents regional biodiversity connectivity identified by the 2012 Conservation Significance Assessment (CSA). Small and isolated remnant vegetation patches present a number of management challenges, however the effective size of remnants can be increased by linking and enhancing adjacent remnants through linear features such as riparian corridors and road verges or through a series of stepping stones provided by smaller, pocket parks and public lands with areas of native vegetation (such as school yards). Connectivity and riparian mapping that is part of this management plan can play a role in restoring catchment values whilst at the same time identifying opportunities for promoting the social, recreational, cultural and educational values of waterways through strategic investment in key areas.

3.5 BUSHFIRE MANAGEMENT

Detailed bushfire planning for asset protection and sustainable ecosystems should be achieved through development of Plans of Management for reserves within the LGA. The *Bush Fire Environmental Assessment Code for NSW* (NSW Rural Fire Service 2006b) specifies fire thresholds for specific vegetation communities, and this document should be consulted for all fire management related works on Council owned reserves. The prescribed fire intervals for vegetation types within Liverpool LGA are presented in Table 7.

Table 7: BFEAC NSW Recommendations for fire intervals

Vegetation Community	BFEAC NSW Recommendations	
	Minimum fire interval for Strategic Fire Advantage Zones (years)	**Minimum fire interval for Land Management Zones (years)**
Castlereagh Scribbly Gum Woodland	5	8
Castlereagh Swamp Woodland	7	7
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	7	10
Cumberland Plain Woodland	5	8
Moist Shale Woodland	5	8
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	7	10
Shale Gravel Transition Forest in the Sydney Basin Bioregion	5	8
Shale / Sandstone Transition Forest	5	8
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	7	10
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	No burning permitted - a bush fire hazard reduction certificate cannot be issued in coastal freshwater wetlands and lagoons, except where works involve only the manual removal of noxious or environmental weeds (as defined within clause 4.9 of BFEAC)	
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	No burning permitted - a bush fire hazard reduction certificate cannot be issued in saline wetlands, except where works involve only the manual removal of noxious or environmental weeds (as defined within clause 4.9 of BFEAC) Land to which State Environmental Planning Policy No 14—Coastal Wetlands applies are “excluded lands” and a bush fire hazard reduction certificate cannot be	

Vegetation Community	BFEAC NSW Recommendations	
	Minimum fire interval for Strategic Fire Advantage Zones (years)	Minimum fire interval for Land Management Zones (years)
	issued.	
Riparian Scrub	7	10
Sandstone Ridgetop Woodland	7	10
Upper Georges River Sandstone Woodland	7	10
Western Sandstone Gully Forest	7	10
Woodland Heath Complex	7	10

3.6 GENERAL VEGETATION MANAGEMENT PRINCIPLES

Native vegetation is usually managed within the broader environmental / natural resource management context that takes account of multiple environmental values and issues. However, sustainable native vegetation management does not only serve environmental objectives. Outcomes from sustainable native vegetation management also contribute substantially to important economic and social objectives. The National Framework for the Management and Monitoring of Australia's Native Vegetation (2001) seeks to achieve the following outcomes:

- a reversal in the long-term decline in the extent and quality of Australia's native vegetation cover by:
  - conserving native vegetation, and substantially reducing land clearing;
  - conserving Australia's biodiversity; and
  - restoring, by means of substantially increased revegetation, the environmental values and productive capacity of Australia's degraded land and water;
- conservation and, where appropriate, restoration of native vegetation to maintain and enhance biodiversity, protect water quality and conserve soil resources, including on private land managed for agriculture, forestry and urban development;
- retention and enhancement of biodiversity and native vegetation at both regional and national levels; and
- an improvement in the condition of existing native vegetation.

3.7 LANDUSE PLANNING, DEVELOPMENT ASSESSMENT AND BIODIVERSITY MANAGEMENT

Liverpool LEP (2008) and Liverpool DCP (2008) provide a range of environmental protection provisions through the aims of the LEP, land use zonings (particularly the E, W and RE zones), prohibitions of development types, inclusion of development setbacks from sensitive areas, site environmental assessment and management requirements, tree preservation requirements, etc. These are strengthened through LCC's development and adoption of a set of standard development consent conditions.

This management plan recommends that during the next review of the LEP and DCP, the above components should be reviewed in light of the updated vegetation community and CSA mapping to ensure that incompatible land use objectives are removed and ensure that areas of TECs (and particularly CEECs) and Core and Support for Core CSA areas are given appropriate protection provisions.

Table 8 summarises LCC's legislative responsibility in regards to the key National and State legislation which govern biodiversity management.

Table 8: Legislative responsibility for biodiversity management

Act	Summary	Implications for Liverpool
The *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth EPBC Act)	Provides a national scheme for environmental protection and biodiversity conservation. Incorporates referral mechanisms and environmental impact assessment processes for projects of national significance. Triggers for referral to the Commonwealth include impacting on nationally listed: • Threatened species, populations, communities and migratory species • Heritage items • Wetlands of international significance • The Great Barrier Reef Marine Park and Commonwealth Marine Areas	Lists EECs and CEECs, threatened and migratory species Test for significance triggers Referrals for approval of works
Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act).	Principal planning legislation for the State providing a framework for the overall environmental planning and assessment of development proposals.	Drives the planning and development processes in Liverpool. The Act provides for the preparation of a number of environmental planning instruments (including SEPPs and LEPs)
Threatened Species Conservation Act 1995 (NSW TSC Act):	This requires that Councils consider the impact on threatened species in fulfilling their statutory responsibilities under the EP&A Act. Also provides for the preparation of Species Recovery Plans that may bind Council to certain actions or activities on Council owned land. Allows for the development of and implementation of biobanking agreements to secure conservation outcomes as well as biocertification of LEPs.	Management of threatened species and communities on Council owned lands Responsibilities for threatened species management during strategic land use planning and development assessments Fulfil the actions required under priority action statements and recovery plans Potential to enter biobank agreements for reserved lands with (external) funds for ongoing management.
Local Government Act 1993 (NSW LG Act)	Now incorporates ESD considerations (including biodiversity conservation) as a key aspect of Council operations. Requires preparation of Plans of Management for all Council-owned land, and for the classification of land into natural areas and various sub-categories. Additionally, this Act has a range of other provisions that allow for appropriate management of operational land and	Plans of management need to be developed for the Liverpool reserves consistent with National and State Recovery Plans / PAS

Act	Summary	Implications for Liverpool
	infrastructure, provide educational services, set rates and charges, issue orders and have a range of enforcement powers.	

The Conservation Significance Assessment (CSA) carried out to inform this management plan shows that 775.6 ha of Core vegetation and 9.6 ha of land classified as Support for Core are already protected through appropriate land use zonings (i.e. E1, E2, E3 and RE1) and the designation of riparian corridors in the Liverpool DCP (2008). It is the remaining 5813.6 ha of Core and16.25 ha of Support for Core which represent the most significant conservation challenge for LCC and this plan.

This Management Plan recommends consideration of the use of LEP Zone E2 for those lands with RE 1 Recreation Zonings that are located in areas classified by the CSA as Core and Support for Core. Similarly, this plan recommends LEP Zone W1 (Natural Waterways) for those lands with current RE 1 zonings that are located in areas classified by the CSA as Riparian Corridor and LEP Zone E3 for areas currently zoned as RE 1 that are located in areas classified by the CSA as Regional Connectivity. A summary of these changes is presented in Table 9.

Strategic land –use planning through the use of 'environmental' zones in an LEP does not necessarily secure an in-perpetuity conservation outcome in the way that Biobanking agreements do. However, the requirement for approval of amendments to an LEP to be approved and signed off by the NSW Department of Planning and Infrastructure (in addition to the requirement set by the NSW D P & I to consult with other relevant state agencies such as NSW OEH) ensures that lands of conservation value are unlikely to be zoned inappropriately.

Table 9: Current and Potential Land Use Zones to achieve biodiversity management outcomes

CSA Category	Current LEP 2008 Zoning	Potential Future LEP Zoning
Core & Support for Core	RE 1	E2
Riparian Corridor	RE 1	W1
Regional Connectivity	RE1	E3 / W1

Lands categorised by the CSA as Other Remnant Vegetation should also be retained and rezoned wherever possible, particularly to promote the enhancement and re-connection of fragmented habitat patches with the aim to support the total habitat availability and improve terrestrial and aquatic regional connectivity.

3.7.1 Objectives For Lands Of Conservation Significance

Part of the data analysis for this Biodiversity Management Plan includes the completion of a Conservation Significance Assessment. This assessment generates land areas that are classified into a range of conservation classes, for which specific protection and management objectives are presented below in Table 10.

Table 10: Objectives for lands of Conservation Significance

Conservation Significance Class	Objectives
Core = Regional Core, Local Core and Core – Urban Remnant	To protect remaining high conservation value vegetation To protect and restore buffer areas to high conservation value vegetation To protect the contribution of high conservation value vegetation has to regional and local connectivity areas
Support For Core	To ensure that these land continue to provide a buffer and protection for Core vegetation To provide target areas for restoration projects To protect the contribution these lands have to regional and local connectivity areas
Riparian Corridors	To protect and manage existing good condition vegetation remnants in "Riparian Corridors" To restore degraded vegetation in "Riparian Corridors" To regenerate vegetation in cleared areas along "Riparian Corridors" To protect and restore buffer areas to vegetation in the "Riparian Corridors" To identify, protect and manage the aquatic ecological values, To protect the linkages provided by "Riparian Corridors"
Regional Connectivity Areas	To protect and manage existing good condition vegetation remnants in "Regional Connectivity Areas" To protect the linkages provided by "Regional Connectivity Areas" To restore degraded vegetation To regenerate vegetation in cleared areas
Other Native Vegetation:	To protect any viable remnants of native vegetation To protect the contribution that native vegetation makes to regional and local connectivity

3.8 BIOBANKING AND BIOCERTIFICATION: CONSIDERATIONS FOR LIVERPOOL CITY COUNCIL AND LIVERPOOL LOCAL GOVERNMENT AREA

The NSW Government introduced the Biodiversity Banking and Offsets Scheme (or 'BioBanking') in 2008 to help address the loss of biodiversity values, including threatened species. BioBanking is a voluntary market-based scheme administered by NSW OEH that provides a streamlined biodiversity assessment process for development, a rigorous and credible biodiversity offsetting scheme, as well as an opportunity for landowners to generate income by managing land for conservation. The framework for the scheme was established under Part 7A of the Threatened Species Conservation Act 1995 (NSW), and is supported by the Threatened Species Conservation (Biodiversity Banking) Regulation 2008 (NSW), BioBanking Assessment Methodology and Compliance Assurance Strategy.

Biodiversity certification is implemented via Part 7AA of the NSW *Threatened Species Conservation Act 1995*. It consists of an assessment at a landscape scale of the effects (both positive and negative) on ecological values. Such an assessment involves identifying and calculating the impact of development, as well as the calculation of the number of credits to be generated by conservation lands within the biodiversity assessment area. If granted, the effect is that for lands where development is proposed become 'biodiversity certified' and assessments of significance of impact (i.e. 7 part tests) are no longer required for individual developments as Part 5A of the EP & A Act no longer applies. To become biodiversity certified, the "improve & maintain" test must be passed.

3.8.1 Council's Obligations and Opportunities

The BioBanking Handbook for Local Government (DECC 2008) and the NSW Planning Circular PS 10-010 (March 2010) describe Council's obligations and opportunities regarding BioBanking. Key points are summarised below:

- Local councils play a vital role in BioBanking as development consent authorities. Where a developer chooses to use BioBanking, local councils are legally required to incorporate the conditions of a BioBanking statement (issued by OEH) into the relevant development consent.
- Liverpool Council may be able to establish BioBank sites on Council owned land and generate biodiversity credits to help manage land for biodiversity. This can assist with the ongoing costs for conservation management of the land.
- Council will only receive biodiversity credits for performing management actions over and above existing legal obligations. This is to account for the principles of 'additionality' for offsets. That is, offset activities must be additional to actions or works required by existing legal requirements or carried out using public funds. This includes legislative requirements for certain categories of publicly owned land being managed for conservation.
- Council owned or managed lands where a BioBank site could be established include:
    - Areas classified as community land (for example, 'natural areas') under the Local Government Act 1993 (NSW);
    - Land under certain environmental protection zonings;
    - Crown land managed by local councils on behalf of reserve trusts under the Crown Lands Act 1989 (NSW);
    - Land obtained or dedicated to council through development contributions where the land has not been used as an offset;

In rapidly developing areas such as Liverpool where there is constant pressure on biodiversity in the face of the need for development and growth, the biobanking offsets approach provides a means of targeting investment in key areas of biodiversity value, building connectivity across the landscape, working closely with the community to protect high value areas and as a means of sourcing funding for the ongoing costs of land management in the LGA. It is important to note that Biobanking extinguishes availability of the land for other uses – however when used on reserves where the primary purpose is for environmental protection this may be less of an issue for Council. Both ecosystem credits and species credits can be recognised on the one area of land if both an endangered ecological community and threatened species are present on the site. This strategy contains actions to guide consideration of the first steps towards leveraging these arrangements.

4 Biodiversity Management Actions

4.1 BIODIVERSITY MANAGEMENT PLAN AIMS

From Liverpool's Draft Biodiversity Management Plan (2008), the overall Strategic Goal of biodiversity management in the LGA is:

To protect and manage the native biodiversity of the Liverpool Local Government Area and maintain ecological processes and systems.

Specifically the aims of the Liverpool Biodiversity Management Plan (LBMP) are to:

- Provide for the conservation of native plants, animals, habitat and ecological processes within the Liverpool LGA,
- Prioritise actions and guide LCC in making decisions relevant to managing the biodiversity in the LGA,
- Provide guidance for the use, conservation and enhancement of natural resources in the Liverpool LGA according to the principles of Ecologically Sustainable Development,
- Build on existing, and develop new, community partnerships to manage biodiversity on private and public lands,
- Ensure Council planning and operational activities integrate with other agencies to achieve the most effective biodiversity outcomes, and
- Develop an effective monitoring and reporting framework to measure progress of the plan and the status of biodiversity resources within the LGA.

4.2 PRIORITISATION OF AREAS FOR PROTECTION, RETENTION AND PRO-ACTIVE MANAGEMENT

Prioritisation of areas for protection, retention and pro-active management in this management plan is based on the conservation priorities identified in the Conservation Significance Assessment undertaken for the development of this management plan.

A conservation significance assessment uses vegetation community mapping and supporting ecological criteria to evaluate a number of biodiversity variables as being present or absent for each mapped polygon (area) of vegetation. The assessment produces an indication of *relative* ranking of areas of native vegetation in terms of their ecological importance and contribution to overall biodiversity resources. Essentially, areas categorises as ***CORE*** are considered the most ecologically significant, with other categories being ***SUPPORT FOR CORE***, ***RIPARIAN CORRIDOR***, ***REGIONAL CONNECTIVITY*** or ***OTHER REMNANT VEGETATION***. (The categorisation of land into these categories is fully detailed in Section 6, as is the area of land falling into each category accompanied by maps).

4.3 IMPLEMENTATION OF ACTIONS

The LBMP will direct how LCC implements strategies and actions aimed at protecting, managing and improving the biodiversity resources within the LGA. It provides a delivery mechanism for the objectives

of the original 2003 Liverpool Biodiversity Strategy as well as other biodiversity-related environmental goals and targets of LCC.

The action plan is divided into the broad issues identified in the LCC Biodiversity Strategy, and incorporates monitoring and required resources into each of these specific issues:

1. Statutory Planning and Policy,
2. Land and Water Management, and
3. Partnerships and Community Engagement.

A brief introduction to each issue is provided, and followed by an action table that identifies action timeframes, responsibilities, implementation priority and links to other actions and issues. Reporting on the completion of activities and their impact on managing biodiversity should happen through the annual State of the Environment Reports. The timeframe provided for completion of the action is an indication of the Action's priority for implementation, but these may change if influences change.

4.3.1 Biodiversity Management Actions

The action tables below collate the actions recommended from earlier in this plan, as well as the incomplete actions from the 2008 (Draft) Biodiversity Management Plan which are still considered pertinent, which originated from the earlier 2003 Biodiversity Strategy. Where possible and relevant, the actions reference to actions from Recovery and Threat Abatement Plans, Catchment Actions Plans of the SMCMA and HNCMA and other relevant environmental management documents.

4.4 TIMEFRAMES FOR IMPLEMENTATION

Timeframes have been nominated for each of the actions listed below. Where statutory timeframes exist for that action, these have been used. Where statutory timeframes don't currently exist, the actions have been nominated as"

- Short Term = 1 – 2 years
- Medium Term = 2 – 5 years
- Long Term = 5 years +
- Ongoing = the action should begin as soon as possible / practicable and essentially become standard practice.

1. Statutory Planning and Policy

Statutory planning processes provide a mechanism for building biodiversity protection and conservation into Local Government's most common decision making frameworks – that of developing strategic plans (such as LEPs and DCPs) and of changes to land use activities. Early and adequate consideration of biodiversity issues delivers not only benefits to the physical environment and biodiversity resources within Liverpool LGA, but also results in greater certainty and clarity for the community, planners, land developers and Council.

Planning policies and controls are an effective mechanism for delivering biodiversity management outcomes. Planning controls are currently primarily provided in the form of Liverpool Local Environment Plan (2008) and Liverpool Development Control Plan (2008). These plans detail the general restrictions on development of land within the LGA. Specifically in regards to biodiversity conservation and management, the use of both land use zones (to identify environmentally sensitive land) and general prescriptions and restrictions (on environmentally damaging activities) are combined to protect environmental values and areas of environmental significance. Existing and future land use planning controls must accurately reflect the true environmental values and ecological significance of areas.

ACTION SP 1: INCORPORATE BIODIVERSITY MANAGEMENT PRINCIPLES INTO ALL FUTURE STATUTORY PLANNING DOCUMENTS		
Timeframe	**Lead & Supporting Roles**	**Key Performance Indicator(s)**
Ongoing	**Strategic Planning (LEAD)** Sustainable Environment Statutory Planning	Permissibility tables, land use zonings, definitions and planning controls in LEPs and DCPs adequately reflect the biodiversity values of the area. Vision of Biodiversity Management Plan included in the Aims of subsequent LEPs and DCPs and Objectives of Biodiversity Management Plan are incorporated into all future planning documents Natural Resources Biodiversity and Natural Resources Water (or ESL) map in LEP accurately reflects most recent CSA outcomes and data from DA processes (eg flora and fauna reports in adjacent areas). Rezoning of land identified by CSA as Core and Support for Core currently zoned RE1 rezoned to E2. Rezoning of land identified by CSA as Riparian Corridor currently zoned RE1 rezoned to W1. Rezoning of land identified by CSA as Regional Connectivity currently zoned RE1 rezoned to E3 or W1. Natural Resources Biodiversity / Natural Resources Water / ESL / CSA categories listed on Section 149 certificates Management objectives, priorities and principles from HNCMA and SMCMA Catchment Action Plans are incorporated into future planning documents LCC's Tree Preservation Order requires an assessment of the conservation significance of the vegetation. Landscaping provisions in future DCPs are informed by results of most recent CSA.

ACTION SP 2: IMPLEMENT AN ASSESSMENT PROCESS (FLOWCHART / CHECKLIST / STAFF GUIDE) TO ENSURE THAT BIODIVERSITY ISSUES ARE ADDRESSED DURING ALL FORMAL DEVELOPMENT / ACTIVITY ASSESSMENTS		
Timeframe	**Lead & Supporting Role**	**Key Performance Indicator(s)**

Ongoing	**Statutory Planning (LEAD)** Sustainable Environment Strategic Planning	LCC's model development consent conditions include conditions that adequately address the conservation, management and enhancement of biodiversity values on high priority conservation lands. LCC's model development consent conditions apply to development that is adjacent to high priority conservation lands Random audit of completed assessments shows 90% compliance with process adopted. Random audit shows checklist used appropriate by LCC staff in 100% of time Post development audits shows that conditions of consent were met and that the development delivered good / desired biodiversity outcomes.
ACTION SP 3: ACCURATE AND CURRENT VEGETATION MAPPING INFORMATION IS AVAILABLE IN PLANNING DECISIONS		
Timeframe	**Lead & Supporting Role**	**Key Performance Indicator(s)**
Every 4 years	**Sustainable Environment & Strategic Planning (LEAD)** All other LCC Departments	Natural Resources Biodiversity and Natural Resources Water (or ESL) Map in LEP accurately reflects most recent CSA outcomes All Strategic and Statutory Planning staff and relevant Civil Maintenance staff are trained in the use and interpretation of the Biodiversity Mapping supporting this management plan. Staff training is updated as the management plan / data is updated. Mapping and data from Biodiversity Management Plan accessible to all LCC staff through GIS where possible, or hard copy maps. Mapping and data from Biodiversity Management Plan is made publicly available through LCC's website.
ACTION SP 4: DEVELOP PLANNING POLICIES AND PROCEDURES WHICH REFLECT CURRENT NATIONAL, STATE AND REGIONAL FRAMEWORKS		
Timeframe	**Lead & Supporting Role**	**Key Performance Indicator(s)**

Ongoing	**Sustainable Environment (LEAD)** Strategic Planning	Biodiversity Management Plan, Environment Restoration Plan incorporate best practice management principles and targets for biodiversity management. Progress on delivering outcomes monitored and reported annually through State of the Environment report.
ACTION SP 5: DEVELOP A GENERIC PLAN OF MANAGEMENT FOR ALL NATURAL AREAS WITHIN LIVERPOOL LGA IN ACCORDANCE WITH DIV 2 OF NSW LOCAL GOVERNMENT ACT 1993.		
Timeframe	**Lead & Supporting Role**	**Key Performance Indicator(s)**
Short	**Community Services (LEAD)** Recreation & CBD Services Sustainable Environment Strategic Planning City Assets	Generic POM developed and adopted Generic POM sets up framework to be followed for all site specific POMs Site specific POMs developed in accordance with priority conservation lands and conservation significance assessment analyses
ACTION SP 6: SITE-SPECIFIC PLANS OF MANAGEMENT DEVELOPED AND ADOPTED FOR ALL NATURAL AREAS UNDER LCC CARE, CONTROL AND MANAGEMENT.		
Timeframe	**Lead & Supporting Role**	**Key Performance Indicator**

Medium	**Community Services (LEAD)** Strategic Planning Sustainable Environment Recreation & CBD Services City Assets	Delivery of site specific POMs prioritised by biodiversity values, conservation significance level and level of conflicting pressures / threats All Natural Areas to have a site specific POMs All Natural Areas POMs to include biodiversity related controls from other policies. All Natural Areas POMs to incorporate provisions from Draft and Adopted Recovery Plans and Priority Action Statements
Action SP 7: PRIORITY CONSERVATION LAND IDENTIFIED IN CUMBERLAND PLAIN RECOVERY PLAN ARE TO BE INCLUDED IN ENVIRONMENT PROTECTION AND REGIONAL OPEN SPACE ZONES (ACTION 1.4 CPRP)		
Timeframe	**Lead and** Supporting **Role**	**Key Performance Indicator(s)**
Ongoing	**Strategic Planning & Community Services (LEAD)** Sustainable Environment	Priority Conservation Lands are zoned for protection at next review of Liverpool LEP. Management Actions from CPRP included in subsequent POMs developed for these lands Management Actions from CPRP included as land use controls provisions in subsequent Liverpool LEPs, DCPs, Policies etc.
ACTION SP 8: INVESTIGATE VARIETY OF FUNDING OPTIONS TO MAXIMISE VOLUME OF FUNDING THAT IS DIRECTED TOWARDS BIODIVERSITY ENHANCEMENT WORKS (FOR EG ENVIRONMENT / STORMWATER LEVIES, S94 FUNDS, VOLUNTARY PLANNING AGREEMENTS ETC).		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**

Medium	**Strategic Planning, City Assets and Sustainable Environment (LEADS)** Strategic Planning Recreation & CBD Services Financial Management	Accurate costings of all biodiversity management tasks (ie fencing, herbicide application, direct seeding, primary and secondary weeding) Legal and financial details of all possible funding mechanisms – VPAs, S94, Levies, Incentives, Biobanking Details of all available grant funding programs Trials of innovative ways of funding restoration works completed and success of initiative reported on annually in SOE

ACTION SP 9: REVIEW BIODIVERSITY MANAGEMENT PLAN EVERY 4 YEARS

Timeframe	**Lead & Supporting Role**	**Key Performance Indicators**
Medium	**Sustainable Environment (LEAD)** Information Management	Review completed every 4 years Number of actions from management plan successfully implemented Change in biodiversity resources of Liverpool LGA (ie increase or decrease in native vegetation cover).

ACTION SP 10: WORK CO-OPERATIVELY WITH STATE AND ADJOINING LOCAL GOVERNMENTS TO DEVELOP AND IMPLEMENT INITIATIVES TO ENSURE CONSISTENT BIODIVERSITY PLANNING PROCESSES ARE UTILISED, AND DECISIONS ARE BASED ON CURRENT DATA

Timeframe	**Lead & Supporting Role**	**Key Performance Indicator(s)**

Ongoing	**Sustainable Environment (LEAD)** Strategic Planning NSW OEH	Participation in HNCMA and SMCMA initiatives Participation in Regional Weeds Committee, Regional Biodiversity Forum, Georges River Combined Councils Committee Participation in Macarthur Bushfire Management Committee
Action SP 11: UNDERTAKE A DESKTOP BIOBANKING ASSESSMENT TO ASSESS VEGETATION IN COUNCIL RESERVES, DETERMINE THE LEVEL OF CREDIT DISCOUNTING THAT WOULD APPLY, AND EVALUATE THE NEED FOR THOSE VEGETATION COMMUNITIES IN THE BIOBANKING MARKET PLACE TO DETERMINE A MARKET PRICE AND THE BENEFITS TO LCC OF ENTERING INTO FORMAL BIOBANKING AGREEMENTS		
Timeframe	**Lead & Supporting Role**	**Key performance Indicator(s)**
Medium	Sustainable Environment Recreation & CBD Services Property Services	Completion of Biobanking Assessment and implementation of cost effective initiatives
ACTION SP 12: INVESTIGATE BENEFITS FROM CARBON SEQUESTRATION OF RESTORATION WORKS AND PROTECTION OF SIGNIFICANT VEGETATED AREAS.		
Timeframe	**Lead and** Supporting **Role**	**Key Performance Indicator(s)**
Medium	**Sustainable Environment (LEAD)** Financial Management Recreation & CBD Services	Cost / Benefit options analysed for Carbon Sequestration. Cost-neutral / positive actions implemented on ongoing basis.

2. Land and Water Management

The protection, conservation and management of biodiversity relies upon the fundamental principles of retaining, maintaining and restoring ecosystem processes and functions and managing issues which threaten biodiversity. From an ecological and economic perspective, it is preferable to prevent biodiversity decline rather than ameliorate or reverse adverse impacts after they have occurred.

Strategic land management decisions and property acquisitions will be required to ensure effective conservation outcomes by improving local and regional connectivity, providing buffer zones to core conservation areas, increasing the patch size of remnant habitat and improving the resilience of ecosystems to both natural and human induced disturbance. These decisions must be guided by current and accurate biodiversity data contained in Section 5 of this management plan.

Similarly, management of bushfire within the urban environment will require a good understanding of the role that wildfire has played in shaping the current biodiversity resources within the LGA and how fire can be responsibly used to maintain this biodiversity. Isolated pockets and patches of habitat, as small as individual paddock trees with hollows and roosting sites, all contribute to the total habitat resources within the LGA which require protection and management to ensure viable levels of biodiversity are retained into the future.

ACTION LWM 1: ACQUIRE AND / OR MANAGE LAND TO PRO-ACTIVELY PROTECT AND RESTORE NATIVE VEGETATION COMMUNITIES AND KEY HABITAT		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**
Ongoing	**City Assets & Strategic Planning (LEAD)** Recreation & CBD Services Sustainable Environment	Land acquisitions guided by LCC biodiversity priorities, Conservation Significance level, regional connectivity level of site and the Priority Conservation Lands identified in the Cumberland Plain recovery Plan. Hectares of land purchased / obtained annually. Proportion of land purchased / obtained annually which meets biodiversity priorities. S94 Plans / VPAs etc linked to latest CSA outcomes for delivery of priority conservation land and outcomes Funds acquired to secure purchase and ongoing management of key lands
ACTION LWM 2: MANAGE BUSHFIRE FOR THE PROTECTION OF LIFE, PROPERTY AND THE ENVIRONMENT		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**

Ongoing	**Sustainable Environment & NSW RFS & NSWFR (LEAD)** Recreation & CBD Services	All Asset Protection Zone establishment and maintenance works conducted by LCC are assessed and approved under the NSW RFS Environmental Assessment Code All Asset Protection Zone establishment and maintenance works conducted on private lands are assessed and approved under the NSW RFS Environmental Assessment Code Biodiversity issues are adequately incorporated into the Macarthur Bushfire Management Plan Fire history of LCC managed lands is mapped regularly and integrated into planning policies and bushfire management plans, particularly inter-fire intervals

ACTION LWM 3: DEVELOP BUSHFIRE MANAGEMENT PLANS FOR ALL COUNCIL LAND SHOWN AS BUSHFIRE HAZARD ON LCC'S BUSHFIRE PRONE LAND MAPS.

Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**
Medium	**Sustainable Environment & NSW RFS & NSWFR (LEAD)** Recreation & CBD Services	Bushfire Management Plans for all bushfire hazard LCC land developed identifying required APZs, SFAZs, LMZs and appropriate fire regimes for vegetation types in reserve Research findings of the relevant bushfire research facilities and NSW OEH / NPWS are incorporated into all Bushfire Management Plans. All core lands are managed within their preferred ecological fire regimes

ACTION LWM 4: UNDERTAKE REGULAR FUEL MAINTENANCE ACTIVITIES IN ALL RESERVES WITH BUSHFIRE MANAGEMENT PLANS

Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator**
Short	**Sustainable Environment (LEAD)** Recreation & CBD Services	All LCC owned lands in High Bushfire Danger Areas / Mapped as Bushfire Prone Land have Bush Fire Management Plans. All Reserves managed as per relevant Bushfire Management Plan

ACTION LWM 5: SUPPORT AND PROMOTE THE ADOPTION OF BEST PRACTICE STANDARDS FOR BUSHLAND MANAGEMENT AND RESTORATION ON PUBLIC AND PRIVATE LANDS WITHIN THE CUMBERLAND PLAIN (as specified in Appendix 2 of the CPRP).		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator**
Short	**Sustainable Environment (LEAD)** Strategic Planning Statutory Planning Recreation & CBD Services GR CCC, HNCMA, SMCMA	NSW OEH Best Practice Guide for Recovering Bushland on the Cumberland used by LCC sections responsible for planning / delivery and maintenance of community land. NSW OEH and Commonwealth SEWPaC Recovery Plans guide restoration works undertaken by LCC Links to appropriate guides provided on LCC Website for use by all private citizens Liverpool DCP and standard conditions to include the NSW OEH Best Practice Guide to recovering bushland on the Cumberland Plain. Liverpool DCP and standard conditions of consent to require monitoring overtime to report on effectiveness of reaching targets / conditions of consent

ACTION LWM 6: DEVELOP AND IMPLEMENT A MONITORING AND REPORTING PROGRAM FOR ALL LCC ENVIRONMENTAL RESTORATION PROGRAMS AND ACTIVITIES		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator**
Short	**Sustainable Environment (LEAD)**	Restoration activities reported annually in State of the Environment Report Restoration activities increase in area annually Participation in restoration activities increases annually Integration with GIS databases on flora / fauna / vegetation community extants / conditions

ACTION LWM 7: ANY FUTURE SIGNIFICANT TREE REGISTER DEVELOPED IS TO CAPTURE AND PROTECT TREES WITH SIGNIFICANT HABITAT AND / OR HERITAGE VALUE.		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**

Medium	**Recreation & CBD Services (LEAD)** Sustainable Environment Statutory Planning Strategic Planning	Register development completed. Criteria for nomination and acceptance of tree as heritage item includes consideration of other factors (ecological, socio-cultural, economic, etc) All significant tree data captured Assessment protocol developed to capture data on habitat resources present and habitat lost with tree pruning / removal, including trees listed as Heritage Items in LEP. 'Palm Pilot' or other equipment acquired for data capture in the field

ACTION LWM 8 : UPDATE AND CONTINUE IMPLEMENTATION OF LIVERPOOL WEED MANAGEMENT STRATEGY

Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**
Short	**Sustainable Environment (LEAD)** Recreation & CBD Services NSW Department Primary Industries and South-West Sydney Regional Weed Committee, HNCMA and SMCMA	Plan incorporates objectives, targets and actions from South-West Sydney Regional Weed Management Strategy Terrestrial and aquatic weed management programs and actions are co-ordinated with bush regeneration and bushfire fuel management activities on private and public lands. Sites targeted for weed management inspections and activities prioritised according to Conservation Significance level. Follow up inspections undertaken within 6 months of notice issue to confirm outcomes of weed management activities Adequate funds acquired to implement weed management activities Partnerships developed with NSW DPI, South-West Sydney Regional Weeds Committee Community engagement activities developed and implemented to increase awareness of environmentally damaging activities and best practice weed management techniques

ACTION LWM 9 : DEVELOP AND UTILISE SITE ASSESSMENT PROCEDURE TO ENSURE IMPLEMENTATION OF WEED MANAGEMENT NOTICES / DIRECTIONS DO NOT ADVERSELY IMPACT NATIVE BIODIVERSITY VALUES

Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**
Short	**Sustainable Environment (LEAD)** Building and Health Recreation & CBD Services Statutory Planning	Assessment procedure developed that is in accordance with South-West Sydney Regional Weed Management Strategy Assessment procedure utilised and documented on every inspection Advice to protect biodiversity on site included in formal notices issued to landholders Mechanisms developed to link weed management requirements in conditions of consent to follow up inspections / audits of development sites and / or noxious weed inspection sites.

ACTION LWM 10 : INCREASE AVAILABILITY AND USE OF INFORMATION REGARDING NOXIOUS AND ENVIRONMENTAL WEED MANAGEMENT		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**
Short	**Sustainable Environment (LEAD)** Communications Recreation & CBD Services	LCC website contains current and accurate information on weed species, locations of weed problems, best management practices and links to DPI and HNCMA and SMCMA weed information Other resources developed and utilised by LCC staff, bushcare groups and general community Proactively work with landholders in areas with weed problems to advise of land management responsibilities, best practice techniques, grant funding programs and potential enforcement action Relevant LCC Staff trained in weed identification and best practice control techniques for works on Council owned and managed lands Funds acquired for delivery of engagement resources (brochures / guides, posters, etc)

ACTION LWM 11 : INVESTIGATE OPTIONS TO EFFECTIVELY CONTROL PEST ANIMAL SPECIES		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator**
Medium	**Enforcement & Parking Services (LEAD)** Sustainable Environment Recreation & CBD Services	Options developed incorporate objectives, targets and actions from relevant NSW OEH / DPI Threat Abatement Plans, Recovery Plans and Priority Action Statements Terrestrial and aquatic pest animal management programs and actions are co-ordinated with terrestrial and aquatic weed management activities. Sites targeted for pest animal management activities prioritised according to Conservation Significance level and Priority Conservation lands identified in the CPRP. Funds acquired to implement pest animal management activities. LCC funds leveraged to obtain funding from external sources. Partnerships developed with other land and pest animal managers List of preferred pest animal contractors developed and utilised by LCC when undertaking pest animal management activities in Council owned and managed lands Ongoing membership and contribution to Urban Feral Animal Group

ACTION LWM 12 : IMPLEMENT COMPANION ANIMALS MANAGEMENT PLAN TO RAISE AWARENESS AND DECREASE IMPACT OF COMPANION ANIMALS ON NATIVE BIODIVERSITY

Timeframe	Lead & Supporting Role	Key Performance Indicators
Medium	**Enforcement & Parking Services (LEAD)** Sustainable Environment	Responsible pet ownership encouraged and enforced through delivery of Policy Increased proportion of impounded animals are registered and returned to owners Decreased number of animal impoundments Increased awareness of and compliance with pet ownership responsibilities

ACTION LWM 13 : DEVELOP WATERWAYS ASSET MANAGEMENT PLAN TO MANAGE AQUATIC BIODIVERSITY AND RIPARIAN CORRIDOR ISSUES

Timeframe	Lead & Supporting Role	Key Performance Indicator
Short	**City Assets (LEAD)** Sustainable Environment Recreation & CBD Services	Plan developed Actions within Plan are prioritise, funded and implemented according to timetable Plan reviewed and updated regularly Adequate funds acquired to implement actions in Plan

ACTION LWM 14 : UTILISE THE PROVISIONS OF THE WATER MANAGEMENT ACT (2000), LIVERPOOL LEP 2008 AND LIVERPOOL DCP 2008 AND THE RIPARIAN CORRIDORS MAP TO REQUIRE THE CREATION, PROTECTION, RESTORATION AND ONGOING MANAGEMENT OF RIPARIAN CORRIDORS AND ADJACENT BUFFER ZONES

Timeframe	Lead & Supporting Role	Key Performance Indicator
Ongoing	**City Assets (LEAD)** **Statutory Planning (LEAD)** Sustainable Environment Strategic Planning	All watercourses subject to adjacent development activity are restored and managed as per an approved Vegetation Management Plan All aquatic / riparian habitat assessments and approvals undertaken in accordance with NSW Office of Water guidelines and categorisation of watercourses. Water quality sampling program developed and implemented. Sampling program shows improving water quality results of biological, physical and chemical indicators. Protection, restoration and maintenance of instream and riparian habitats completed in accordance with Best Practice Guidelines for restoration of riparian and instream habitats

ACTION LWM 15 : WATER SENSITIVE URBAN DESIGN (WSUD) POLICY DESIGNED, ADOPTED AND IMPLEMENTED BY LCC

Timeframe	Lead & Supporting Role	Key Performance Indicators
Medium	**City Assets (LEAD)** Strategic Planning Sustainable Environment	Promote, encourage and require the use of WSUD in new developments through implementation of Policy. Policy consistent with Western Sydney WSUD Guidelines and Growth Centres WSUD Guidelines Reduced potable water demand in new developments and infrastructure achieved through water efficiency and greater recycling.

ACTION LWM 16: WORK WITH RELEVANT AGENCIES TO IMPROVE FISH PASSAGE AND RESTORE NATURAL CONDITIONS ALONG WATERWAYS WITHIN THE LGA

Timeframe	Lead & Supporting Role	Key Performance Indicator
Ongoing	**City Assets (LEAD)** Sustainable Environment Recreation & CBD Services NSW Fisheries / Department of Primary Industries NSW OEH HNCMA and SMCMA	Lengths of creek bank restored and maintained Number / area of fish passage barriers removed or assisted fish passage installations completed Adequate funds acquired to implement actions Partnerships developed with NSW DPI, HNCMA and SMCMA

ACTION LWM 17 : DEVELOP INDICATORS OF TERRESTRIAL AND AQUATIC BIODIVERSITY HEALTH. MONITOR AND REPORT ON THESE ANNUALLY THROUGH STATE OF ENVIRONMENT REPORTS

Timeframe	Lead & Supporting Role	Key Performance Indicators
Short	**Sustainable Environment (LEAD)** Corporate Services All sections of LCC required to collect data	Practical and valuable indicators developed. LCC Indicators are monitored and reported on annually in State of the Environment Report from 2013. Indicators show improving trends in biodiversity values and resources Indicator data also available on LCC website

ACTION LWM 18 : DEVELOP A GIS–BASED DATA TRACKING SYSTEM TO MONITOR PLANNED AND ACTUAL BIODIVERSITY OUTCOMES.

Timeframe	Lead & Supporting Role	Key Performance Indicators
Medium	**Information Management (LEAD)** Sustainable Environment Statutory Planning	Relevant LCC Sections and Staff utilise tracking system and data reported regularly Tracking System utilised by all environmental restoration contractors Electronic GIS data from contractors engaged in environmental restoration works on public land added to LCC GIS Database. LCC generated records of threatened species are added regularly to NSW Bionet
ACTION LWM 19 : IMPLEMENT THE INTENT OF THE CUMBERLAND PLAIN RECOVERY PLAN TO ENHANCE THE COMPLIANCE AND ENFORCEMENT PROGRAM WITH REGARDS TO THE UNAUTHORISED CLEARING OF BUSHLAND ON THE CUMBERLAND PLAIN		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**
Ongoing	**Enforcement & Parking Services (LEAD)** Sustainable Environment NSW OEH	Track outcomes of enforcement actions taken for illegal clearance of Cumberland Plain vegetation Develop register of land with CP vegetation remnants. Letters sent to all landowners advising of importance of CPW and penalties for breaching legislation.
ACTION LWM 20 : AS PER OEH PRIORITY ACTION STATEMENT, USING LOCAL PROVENANCE MATERIAL, SEEK TO ESTABLISH A VIABLE SELF SUSTAINING POPULATION OF *Dillwynia tenuifolia* IN NEARBY HABITAT THAT IS UNDER SECURE TENURE		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**
Ongoing	Sustainable Environment Recreation & CBD Services	Number of successfully germinated seedlings Number of successfully transplanted individuals over the short, medium and long term Number of self germinated individuals over the short, medium and long term
ACTION LWM 21 : AS PER OEH PRIORITY ACTION STATEMENT, USING LOCAL PROVENANCE MATERIAL, SEEK TO ESTABLISH A VIABLE SELF SUSTAINING POPULATION OF *Marsdenia viridiflora* IN NEARBY SECURE HABITAT THAT IS UNDER SECURE TENURE		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator(s)**
Ongoing	Sustainable Environment Recreation & CBD Services	Number of successfully germinated seedlings Number of successfully transplanted individuals over the short, medium and long term

		Number of self germinated individuals after 2 years, 5 years, 10 years
ACTION LWM 22 : DEVELOP A SPATIALLY LINKED DATABASE OF EXISTING ECOLOGICAL STUDIES CONDUCTED WITHIN LCC AND UPDATE REGULARLY AS NEW STUDIES COMPLETED		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator(s)**
Ongoing	**Sustainable Environment (LEAD)** Statutory Planning Information Management	Data to be used in subsequent biodiversity values mapping Data to be used in environmentally sensitive land layer mapping in LEP Updates GIS Layers updated annually to reflect new studies completed in that year (can be linked to DA tracking system)
ACTION LWM 24 : DEVELOP BIODIVERSITY ASSET MANAGEMENT PLAN		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator(s)**
Medium	**Sustainable Environment (LEAD)** Recreation & CBD Services	Biodiversity Asset Management Plan completed and collates information on parks and reserves, street trees, road verges, restoration and revegetation sites

3. Partnerships and Community Engagement

It is well recognised that biodiversity resources and values are available for all to experience and appreciate, and accordingly the delivery and achievement of improved biodiversity outcomes is best achieved through the support and involvement of the local community, guided by LCC and other relevant agencies as required. Generating and harnessing community support and ongoing involvement requires:

- the development and delivery of education and training to improve the general level of understanding of complex biodiversity issues,
- adequate corporate support to enable the use of incentives to encourage beneficial behaviour changes, and conversely discourage environmentally damaging behaviours,
- the recognition and reward of good environmental outcomes, and
- current and accessible data to monitor progress towards identified goals.

Engagement opportunities need to be tailored to the varying levels of experience, exposure, interest and availability of the local community while working towards the overall goal of improving local biodiversity resources and values within the Liverpool LGA. New ways of interacting with all sectors of our community need to be developed to ensure that vital messages remain relevant and accessible.

LCC has a role to play in both the development and utilisation of educational resources, as well as through partnering with others sectors to deliver the most effective on-ground outcomes. Particular target areas for improving knowledge of our community in local biodiversity values includes the concepts of ecosystem services, protection and management of habitat components, threatened species existence and management , and incompatible activities.

ACTION CE1: DEVELOP ACTIVE PARTNERSHIPS WITH EDUCATIONAL INSTITUTIONS TO ENHANCE BIODIVERSITY OUTCOMES		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator**
Ongoing	**Sustainable Environment (LEAD)** Community Services Local Schools	Quantum of funds specifically directed to biodiversity related projects Number / Proportion of schools and students involved in funded projects Improving biodiversity resources / values at 'partner' sites

ACTION CE 2: SUPPORT JOINT RESEARCH PROJECTS INTO BEST PRACTICE BIODIVERSITY MANAGEMENT WITH APPROPRIATE TERTIARY INSTITUTIONS IN THE SOUTH-WEST SYDNEY REGION.		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator**

Ongoing	**Sustainable Environment (LEAD)** Recreation & CBD Services University of Sydney, Rossmore Research Facility, University of Western Sydney , TAFE	Outcomes of joint research published and utilised in subsequent land management guidelines LCC staff utilise resultant cost effective best practice methodology and techniques in all public land management activities Student employment / Honours Projects / Scholarships investigated as mechanism for delivering outcome

ACTION CE 3: DEVELOP FORMAL AND RECOGNISED PARTNERSHIPS WITH LOCAL ABORIGINAL LAND COUNCILS TO ENSURE THAT TRADITIONAL KNOWLEDGE IS INCORPORATED INTO LAND MANAGEMENT PRACTICES AND THAT SIGNIFICANT ABORIGINAL SITES ARE KNOWN, ACKNOWLEDGED AND APPROPRIATELY PROTECTED

Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator**
Short	**Community Services (LEAD)** Sustainable Environment Liverpool Aboriginal Consultation NSW OEH Cultural Heritage Unit	Communication protocol and partnership with relevant Local Aboriginal Land Councils (LALCs) formalised within 12 months Representation LALCs on LCC's Environment Advisory Committee Representation of LCCs environment subcommittee on LCCs aboriginal group Knowledge about Local Aboriginal people's customs and land management practices within Liverpool LGA is incorporated into management practices

ACTION CE 4: INVESTIGATE PARTNERSHIPS WITH LOCAL COMMERCIAL ENTERPRISES THAT ENHANCE BIODIVERSITY OUTCOMES

Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**
Ongoing	**Sustainable Environment (LEAD)** Corporate Services Statutory Planning Local Businesses	Number of partnerships developed and maintained Adequate funds acquired to sponsor community events, forums etc

ACTION CE 5: DEVELOP AND UTILISE SUITE OF COMMUNITY FACT SHEETS AND OTHER RESOURCES SPECIFICALLY TARGETED AT BIODIVERSITY PROTECTION, MANAGEMENT AND ENHANCEMENT.		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator**
Ongoing	**Sustainable Environment (LEAD)** Communications Community Planning HNCMA and SMCMA	Fact sheets and other resources reviewed regularly. All fact sheets and resources available from LCC website. Number of 'hits' on website facts sheets monitored and increases. All fact sheets and resources translated into languages used by 90% of Liverpool's CALD community languages

ACTION CE 6: DEVELOP AND IMPLEMENT CONSOLIDATED COMMUNITY EDUCATION AND ENGAGEMENT PROGRAM THAT SPECIFICALLY ADDRESSES BIODIVERSITY MANAGEMENT ISSUES AND TARGETS KEY 'COMMUNITY SECTORS' THAT CAN IMPACT ON BIODIVERSITY		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**
Ongoing	**Sustainable Environment (LEAD)** Community Planning Communications Environment Advisory Committee Georges River CCC, HNCMA, SMCMA	Increased local understanding and appreciation of biodiversity issues among the general community Website 'hits' on biodiversity information monitored and increases through time Interpretative signage system and branding developed. Signage installed at key sites. Local media partnerships explored for eg: regular newspaper column space, regular (ie annual, quarterly) environment / biodiversity features, Reduced instances / severity of (biodiversity related) environmental breaches within LGA Biodiversity 'celebrations' held at key reserves on days such as World Wetlands Day, National Tree Day, Clean Up Australia Day, Earth Hour, International Day for Biodiversity, World Environment Day Increase links between Biodiversity Management and Sustainability Program through messages about local in season produce, food miles concepts, organic production, integrated pest management to reduce / avoid pesticides and herbicides, Number of information activities held and level of attendance and engagement

ACTION CE 7: CONTINUE AND EXPAND THE CO-OPERATIVE PARTNERSHIPS BETWEEN LCC AND COMMUNITY CONSERVATION GROUPS TO MAXIMISE OUTCOMES AND EFFECTIVENESS OF LCC ENVIRONMENT RESTORATION PLAN		
Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicator**

Ongoing	**Sustainable Environment (LEAD)**	Number of completed Environment Restoration Plan activities Area of land restored and managed is monitored and increases annually Number of Community restoration groups supported by LCC Number of registered volunteers within community restoration groups Number of volunteer hours contributed to restoration works Improving biodiversity resources / values at partner sites Number of participants nominated and successful at LCC Volunteer Awards Program Funds through LCC Environment Levy to complete Environment Restoration Plan program of works

ACTION CE 8 : INCREASE LCC STAFF UNDERSTANDING AND ENGAGEMENT IN BIODIVERSITY MANAGEMENT

Timeframe	**Lead &** Supporting **Role**	**Key Performance Indicators**
Ongoing	**Sustainable Environment (LEAD)** All other sections of LCC	Relevant, tailored biodiversity information package for distinct sections of LCC developed and implemented: ie customer services, enforcement staff, development planning staff, strategic planning staff, civil maintenance staff. Links to corporate training program. Completion of training linked to annual performance reviews Increased LCC staff knowledge and understanding Level of participation of LCC staff in training sessions LCC Section-specific guides on managing biodiversity developed and utilised. Improved compliance with LCC's legislative requirements in both planning and operational duties.

5 Appendix 1 - Biodiversity Values of Liverpool Local Government Area

This Section of the Plan informs and supports the Biodiversity Strategy (Section 2), outlining the biodiversity values of the Liverpool LGA. This includes information on important corridors, habitat, species, populations and vegetation communities.

There are a variety of habitat types across the landscape of the Liverpool LGA, many of which are currently isolated and limited in their contribution to maintaining biodiversity. The preservation and re-establishment of linked bushland corridors between core conservation areas is fundamental to maintaining biodiversity values and resources. Corridors allow for the movement of species during times of stress (such as during bushfires or disease), for the exchange of genetic material and for access to additional suitable habitat. The loss of these connections and subsequent habitat fragmentation often results in a decline of species diversity and abundance.

5.1 LOCALLY SIGNIFICANT BIODIVERSITY

Within the Liverpool LGA there are a number of locally significant species. Relationships between different species mean that certain species play a key role in the local ecosystem. For example, Swamp Mahogany (*Eucalyptus robusta*) is one of the few winter flowering Eucalypt species and provides a consistent supply of nectar for a range of nectivorous species such as birds and fruit bats at a time when many other food sources are scarce.

Also of local significance are occurrences of species and vegetation communities which are at the edge of their known geographic distribution in the Liverpool LGA. These occurrences may be of particular importance for the maintenance of genetic diversity, particularly in a changing climate.

The Cumberland Plain of the Greater Sydney Area contains a distinct suite of vegetation communities. The Cumberland Plain has been extensively cleared since European settlement, originally for agriculture and currently for urban development. As a consequence, the vegetation of the Cumberland Plain is now highly fragmented and disturbed, and the vast majority of vegetation types present are listed as either endangered or critically endangered ecological communities on State and National Legislation. This makes a high proportion of the native bushland occurring within Liverpool LGA of high significance and a priority for protection and restoration.

5.2 REGIONALLY SIGNIFICANT BIODIVERSITY

Regionally significant species and communities include those that do not have an adequate area of habitat reserved or protected in the region to ensure their security. It also includes species and communities that may be diminishing in the region, but not recognised as threatened by statutory mechanisms. A list of regionally significant species in the Liverpool LGA is provided in the *Western Sydney Urban Bushland Biodiversity Survey* (NSW NPWS, 1997).

5.3 STATE AND NATIONALLY THREATENED FLORA

A list of threatened flora species that have been recorded in the Liverpool LGA is provided in Table 11.

Table 11: Threatened Flora Species Recorded within Liverpool LGA

SPECIES NAME	COMMON NAME	TSC ACT STATUS#	EPBC ACT STATUS^	RECOVERY PLAN	SOURCE*
Acacia pubescens	Downy Wattle	V	V	Approved	1, 2, 3
Allocasuarina glareicola		E1	E	CPRP	2
Asterolasia elegans		E1	E	National Approved	3
Caladenia tessellata	Thick Lip Spider orchid	E1	V	National Approved	3
Callistemon linearifolius	Nettled Bottle Brush	V		None	1, 2
Cynanchum elegans	White Flowered Wax Plant	E1	E	None	3
Dillwynia tenuifolia		V	V	CPRP	1, 2
Diuris aequalis	Doubletail Buttercup	E1	V	None	1
Eucalyptus benthamii	Camden White Gum	V	V	NSW Approved	2
Grevillea juniperina subsp. *Juniperina*	Juniper-leaved Grevillea	V	—	CPRP	1, 2
Grevillea parviflora subsp. *Parviflora*	Small-flower Grevillea	V	V	None	1, 3
Gyrostemon thesioides		E1		None	1
Leucopogon exolasius	Woronora Beard-Heath	V	V	None	1 , 2
Leucopogon fletcheri subsp fletcheri		E		None	1, 2
Melaleuca biconvexa	Biconvex Paperbark	V	V	None	3
Melaleuca deanei	Deane's Paperbark	V	V	NSW Approved	2
Persoonia hirsuta	Hairy Geebung	E1	E	None	1
Persoonia nutans	Nodding Geebung	E1	E	NSW Approved	1, 2, 3
Pimelea curviflora curviflora		V	V	None	3
Pimelea spicata	Spiked Rice-flower	E1	E	National Approved	1 , 2
Pomaderris brunnea	Rufous Pomaderris, Brown Pomaderris	V	V	National Approved	3
Pterostylis gibbosa	Illawarra Greenhood Orchid	E	E	NSW Approved	3
Pterostylis saxicola	Sydney Plains Greenhood	E1	E	CPRP	1, 2, 3
Pultenaea parviflora		E1	V	CPRP	1 , 2, 3
Pultenaea pedunculata	Matted Bush-pea	E1	—	None	1, 2
Thelymitra sp kangaloon	Kangaloon Sun Orchid		CE	None	3
**Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	None	1, 2
**Eucalyptus scoparia*	Wallangarra White Gum	E1	V	None	1, 2, 3
**Pterostylis nigricans*	Dark Greenhood	V		None	1

*__Source__: 1 = NSW Bionet (NSW OEH 2012; search area Liverpool LGA);

2 = UBBS (NSW NPWS, 1997);

3 = EPBC Protected Matters Search Tool (search area Liverpool LGA).

#Key to Status

E1: Endangered species under Schedule 1 of the NSW *TSC Act 1995*.

V: Vulnerable species under Schedule 2 of the NSW *TSC Act 1995*.

^Key to Status

CE = Critically Endangered Species, E = Endangered species, V = Vulnerable Species under Part 3, Division 1 of the Commonwealth EPBC Act (1999)

Two of the 29 threatened flora species which are listed in Table 11: Threatened Flora Species Recorded within Liverpool LGA (marked with an asterisk*) do not naturally occur within the Liverpool LGA. *Eucalyptus nicholii* (Narrow Leave Black Peppermint) only occurs naturally in the New England Tablelands of NSW, while *Eucalyptus scoparia* (Wallangarra White Gum) only occurs naturally in Queensland and far northern NSW. However, both species have been widely planted in landscaped areas and gardens, including within the Liverpool LGA. Similarly, the recording of *Pterosylis nigricans* (Dark Greenhood Orchid) may not be accurate and may be a mis-identification given its usual habitat on the NSW North Coast.

5.4 STATE AND NATIONALLY THREATENED FAUNA

A list of state and nationally threatened fauna species that have been recorded in the Liverpool LGA is provided in Table 12.

Table 12 : Threatened Fauna Species Recorded within Liverpool LGA.

SPECIES NAME	COMMON NAME	TSC ACT STATUS#	EPBC ACT STATUS^	RECOVERY PLAN	SOURCE*
MOLLUSCS					
Meridolum corneovirens	Cumberland Plain Land Snail	E1	—	Cumberland Plain RP	1
MAMMALS					
Cercartetus nanus	Eastern Pygmy-possum	V	—	None	1, 2
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	None	2, 3
Dasyurus maculatus	Spotted-tailed Quoll	V	E	None	1, 3
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	—	None	1
Isoodon obselus obselus	Southern Brown Bandicoot	E1	E	Approved	3
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	—	None	1, 2
Mormopterus norfolkensis	Eastern Freetail-bat	V	—	None	1
Myotis macropus	Southern Myotis	V		none	2
Petaurus norfolcensis	Squirrel Glider	V	—	None	1, 2
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	V	NSW Approved	1, 2, 3
Phascolarctos cinereus	Koala	V	—	NSW	1, 2

SPECIES NAME	COMMON NAME	TSC ACT STATUS#	EPBC ACT STATUS^	RECOVERY PLAN	SOURCE*
				Approved	
Potorous tridactylus tridactylus	Long-nosed Potoroo	V	V	None	3
Pseudomys novaehollandiae	New Holland Mouse	-	V	None	3
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	National Approved	1, 2, 3
Saccolaimus flaviventris	Yellow-bellied Sheathtail bat	V	—	None	1, 2
Scoteanax rueppellii	Greater Broad-nosed Bat	V	—	None	1, 2
AMPHIBIANS					
Heleioporus australiacus	Giant Burrowing Frog	V	V	None	2, 3
Litoria aurea	Green and Golden Bell Frog	E1	V	NSW Approved	1, 2, 3
Litoria littlejohnii	Littlejohn's Tree Frog	V	V	None	3
Litoria raniformis	Growling Grass Frog	E1	V	Approved	1, 3
Mixophyes balbus	Barred Frog	E1	V	None	3
Pseudophryne australis	Red-crowned Toadlet	V	—	None	1, 2
BIRDS					
Anthochaera phrygia	Regent Honeyeater	E4A	E and M	National Approved	1, 2, 3
Botaurus poiciloptilus	Australasian Bittern	V	E	National Approved	1, 3
Burhinus grallarius	Bush Stone-curlew	E1		NSW Approved	1, 2
Cacatua leadbeateri	Pink Cockatoo	V		None	1
Callocephalon fimbriatum	Gang-gang Cockatoo	V	—	None	1, 2
Calyptorhynchus lathami	Glossy Black-cockatoo	V	—	None	1, 2
Circus assimilis	Spotted Harrier	V		None	1
Daphoenositta chrysoptera	Varied Sitella	V		None	1
Dasyornis brachypterus	Eastern Bristlebird	E1	E	None	1, 3
Ephippiorhyncus asiaticus	Black-necked Stork	E1	V	None	1, 2, 3
Epthianura albifrons	White-fronted Chat	V		None	2
Glossopsitta pusilla	Little Lorikeet	V	-	None	1, 2
Grus rubicunda	Brolga	V	-	None	1
Hieraaetus morphnoides	Little Eagle	V	-	None	1, 2, 3
Ixobrychus flavicollis	Black Bittern	V	—	None	2
Lathamus discolor	Swift Parrot	E1	Endangered	National	1 , 2, 3

SPECIES NAME	COMMON NAME	TSC ACT STATUS#	EPBC ACT STATUS^	RECOVERY PLAN	SOURCE*
				Approved	
Lophoictinia isura	Square-tailed Kite	V	—	None	1 , 2
Melanodryas cucullata cucullata	Hooded Robin	V	—	None	1 , 2
Melithreptus gularis gularis	Black Chinned Honeyeater (eastern subsp.)	V	—	None	1 , 2
Nettapus coromandelianus	Cotton Pigmy Goose	E1	-	None	1
Ninox connivens	Barking Owl	V	—	NSW Draft on exhibition	1, 2
Ninox strenua	Powerful Owl	V	—	NSW Approved	1, 2
Petroica boodang	Scarlet Robin	V		None	1, 2
Petroica phoenicea	Flame Robin	V		None	1, 2
Ptilinopus magnificus	Wompoo Fruit Dove	V		None	1
Pyrrholaemus sagittatus	Speckled Warbler	V	—	None	1, 2
Rostratula benghalensis	Painted Snipe	E1	—	None	2
Sternula nereis nereis	Fairy Tern		V	None	3
Tyto capensis	Grass Owl	V		None	1

***Source**: 1 = NSW Bionet (NSW OEH 2012; search area Liverpool LGA);

2 = UBBS (NSW NPWS, 1997),

3 = EPBC Protected Matters Search Tool (search area Liverpool LGA)

#Key to Status

E4A = Critically Endangered Species Under Schedule 1A of the *NSW TSC Act 1995*

E1 = Endangered species under Schedule 1 of the *NSW TSC Act 1995*.

V = Vulnerable species under Schedule 2 of the *NSW TSC Act 1995*.

^Key to Status

CE = Critically Endangered, E = Endangered and V = Vulnerable under Part 3, M = Migratory (Division 1 of the EPBC Act 1999)

There are 52 threatened fauna species listed from the data base searches completed in January 2012. This list is comprised of 1 invertebrate, 16 mammals, 6 frogs and 29 bird species.

5.5 STATE AND NATIONALLY THREATENED POPULATIONS

Endangered populations are listed under Schedule 1 of the NSW *TSC Act 1995*. A population is eligible to be listed as endangered if, in the opinion of the NSW Scientific Committee:

- Numbers have been reduced to a critical level.
- Habitat has been so drastically reduced that it is in immediate danger of extinction.
- It is not a population of a species already listed in Schedule 1 or 1A of the Act.
- It is disjunct or near the limit of its geographic range.

- It is likely to be genetically, morphologically or ecologically distinct, or it is otherwise of significant conservation value (NSW *TSC Act 1995* and NSW *Threatened Species Conservation Regulation 2002*).

The NSW *TSC Act 1995* currently lists the following 2 endangered flora populations within the Liverpool LGA:

- *Dillwynia tenuifolia* at Kemps Creek, in the northwest of the Liverpool LGA.
- *Marsdenia viridiflora* R. Br. Subsp*. Viridiflora* in Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs.

There are no endangered fauna populations listed for the Liverpool LGA.

5.6 INTERNATIONALLY SIGNIFICANT BIODIVERSITY

The agreement between the Government of Australia and the Government of Japan for the protection of migratory birds and birds in danger of extinction is commonly referred to as the Japan-Australia Migratory Bird Agreement (JAMBA), which was signed on 6 February 1974.

The agreement between the Government of Australia and the Government of the People's Republic of China for the protection of migratory birds and their habitat is commonly referred to as the China-Australia Migratory Bird Agreement (CAMBA), which was signed on 20 October 1986 (Environment Australia Biodiversity Group, 2000).

The agreement between the Government of Australia and the Government of the Republic of Korea for the protection of migratory birds and their habitat is commonly referred to as the Republic of Korea – Australia Migratory Bird Agreement (ROKAMBA), which was signed on 6 December 2006.

Table 13 lists the migratory birds which have been recorded in Liverpool LGA and are protected under these agreements (NSW).

Table 13: Migratory Birds protected under International Agreements which have been recorded within Liverpool LGA

SPECIES NAME	COMMON NAME	JAMBA / CAMBA / ROKAMBA LISTING
Actitis hypoleucos	Common Sandpiper	JAMBA, CAMBA
Ardea alba	Great Egret	JAMBA, CAMBA
Ardea ibis	Cattle Egret	JAMBA, CAMBA
Apus pacificus	Fork-Tailed Swift	JAMBA, CAMBA, ROKAMBA
Arenaria interpres	Ruddy Turnstone	JAMBA, CAMBA, ROKAMBA
Charadrius mongolus	Mongolian Plover	JAMBA, CAMBA, ROKAMBA
Charadrius veredus	Oriental Plover	JAMBA, CAMBA, ROKAMBA
Gallinago hardwickii / Rostratula benghalensis	Latham's Snipe, Painted Snipe	JAMBA, CAMBA, ROKAMBA
Haliaeetus leucogaster	White-bellied Sea-eagle	CAMBA
Hirundapus caudacutus	White-throated Needletail	JAMBA, CAMBA
Limicola falcinellus	Broad-billed Sandpiper	JAMBA, CAMBA, ROKAMBA
Numenius madagascariensis	Eastern Curlew	JAMBA, CAMBA, ROKAMBA
Numenius phaeopus	Whimbrel	JAMBA, CAMBA, ROKAMBA
Sterna albifrons	Little Tern	JAMBA, CAMBA, ROKAMBA

Sterna bergii	Crested Tern	JAMBA
Sterna hirundo	Common Tern	JAMBA, CAMBA, ROKAMBA

5.7 VEGETATION COMMUNITIES PRESENT IN LIVERPOOL LOCAL GOVERNMENT AREA

The biodiversity of the Liverpool LGA and the surrounding region has been identified as a conservation priority by the NSW OEH as the South-West Sydney region is one of the most rapidly growing areas in NSW (2021 South-Western Sydney, Regional Action Plan). The bushland of this region and the fauna species it supports comprise a variety of different vegetation communities which has been extensively cleared since European settlement, originally for agricultural uses and most recently for housing and urban infrastructure.

Table 14 outlines the vegetation communities that have been identified within Liverpool LGA, and their conservation status. The mapping which accompanied the 2008 (Draft) Biodiversity Management Plan used vegetation community nomenclature that was consistent with the NSW NPWS Cumberland Plain Vegetation Maps (NSW NPWS, 2002). This mapping has been reviewed and vegetation communities have now been mapped according to their NSW Biometric Vegetation Type, in accordance with current practice for vegetation mapping within NSW. Subsequently, Table 14: Vegetation Communities present within Liverpool LGA contains both the original (2008) vegetation community title, and the new Biometric vegetation type title.

Unclassified vegetation and plantings are not described below as there is substantial variation in composition and it is unlikely that they represent or replicate a naturally occurring vegetation community.

Earlier in this management plan, Figure 4 showed the vegetation communities and their current extant within Liverpool LGA and Figure 5 shows the condition of this vegetation. Figure 6 showed the area of vegetation cleared since the 2007 mapping was completed. These vegetation communities are mapped according to their Biometric Vegetation Types.

Table 14: Vegetation Communities present within Liverpool LGA

BIOMETRIC VEGETATION TYPE[3]	NSW *TSC ACT*	COMMONWEALTH *EPBC ACT*	TEC Name	PREVIOUSLY USED VEGETATION COMMUNITY NAME[4]
Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	Endangered	-	River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (incorporating the previously listed Sydney Coastal River-flat Forest)	1. Alluvial Woodland 2.Riparian Forest
Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin	Vulnerable	-	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	3. Castlereagh Scribbly Gum Woodland
Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin	Endangered	-	Castlereagh Swamp Woodland Community	4. Castlereagh Swamp Woodland
Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin	Endangered	-	Cooks River / Castlereagh Ironbark Forest in the Sydney Basin Bioregion	5. Cooks River / Castlereagh Ironbark Forest
Shale Hills Woodlands = Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin **Shale Plains Woodland** = Grey Box – Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin	Critically Endangered	Critically Endangered	Cumberland Plain Woodland	6. Cumberland Plain Woodland (including Shale Hills Woodland and Shale Plains Woodland)
Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin	Endangered	-	Moist Shale Woodland in the Sydney Basin Bioregion	7. Moist Shale Woodland
Broad-leaved Ironbark – Grey Box – Melaleuca	Endangered	Critically Endangered	Shale Gravel Transition Forest in the Sydney Basin	8. Shale Gravel Transition Forest

[3] Nomenclature used in the Biometric vegetation community descriptions.

[4] Nomenclature used in NPWS 2002 Western Sydney Mapping, Liverpool Biodiversity Strategy (2003) and (Draft) Liverpool Biodiversity Management Plan (2008)

BIOMETRIC VEGETATION TYPE[3]	NSW *TSC ACT*	COMMONWEALTH *EPBC ACT*	TEC Name	PREVIOUSLY USED VEGETATION COMMUNITY NAME[4]
decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin			Bioregion	
Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	Endangered	Endangered	Shale/Sandstone Transition Forest	9. Shale Sandstone Transition Forest (including high and low sandstone influence)
Coastal freshwater lagoons of the Sydney Basin and South East Corner	Endangered	-	Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and Southeast Corner Bioregions	10. Freshwater Wetlands
Saltmarsh in estuaries of the Sydney Basin and South East Corner/ Mangrove forest in estuaries of the Sydney Basin and South East Corner	Endangered	-	Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregion	11. Mangrove/ Saltmarsh
Water Gum - Coachwood riparian scrub along sandstone streams, Sydney Basin	-	-		12. Riparian Scrub
Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin	-	-		13. Sandstone Ridgetop Woodland & Woodland Heath Comnplex
Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin	-	-		14. Upper Georges River Sandstone Woodland
Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin	-	-		15. Western Sandstone Gully Forest

NB: Vegetation communities listed as 1 – 9 are all located on the Cumberland Plain and the management of vegetation communities 1 and 3 – 9 is guided by the Cumberland Plain Recovery Plan (DECCW, 2010).

5.7.1 Vegetation Community Condition Classes

The detailed mapping procedure followed for this management plan is described in Section 6 following. The extant of vegetation communities present in Liverpool LGA was mapped using a combination of DECCW (2009) vegetation data for Western Sydney and the SMCMA (2009) vegetation data. The data was analysed to provide statistics on the extent of each vegetation community now and is compared to

the statistics presented in the 2008 (Draft) Biodiversity Management Plan which analysed mapping data from 2002.

In accordance with the NPWS 2002 mapping of Western Sydney and the 2008 (Draft) Biodiversity Management Plan the vegetation condition classes have been defined as follows:

A = Canopy cover is greater than 10%

B= Canopy cover is less than 10%, Scattered trees with native understorey

C = Canopy cover is less than 10%, Scrub

Tx = Less than 10% Canopy cover, scattered trees.

In the tables for each vegetation community below, each row which measures '***good condition***' vegetation is the sum of vegetation conditions classes A, B and C. Essentially, 'good condition' vegetation excludes all vegetation mapped as 'TX' condition which is defined as canopy cover of less than 10%, scattered trees and exists in either an agricultural, rural-residential or urban landscape.

In the following tables of each vegetation community:

- 2007 figures for the Liverpool LGA are based on the 2007 mapping (in Liverpool Draft Biodiversity Management Plan 2008);
- The total extent data from 2002 is based on NPWS 2002 data;
- 2012 figures are based on the 2012 vegetation community mapping update;
- Total extent and pre-1750 areas are sourced from NSW NPWS, 2002.

The use of canopy cover to determine condition classes for vegetation communities can be problematic for vegetation communities which exist in a diverse range of structural formations (such as open grassy, almost treeless areas or densely timbered stands).

The terminology used in the vegetation condition map (Figure 5) relates to the condition descriptions developed by NSW NPWS during the mapping of Native vegetation of the Cumberland Plain, Western Sydney. The Liverpool Biodiversity Strategy (2003) defined "Good Condition" vegetation as all vegetation in condition classes A, B and C, "Poor Condition" vegetation was defined as all vegetation in condition classes Tx, TXu, Txr and X. The classification of vegetation into these condition classes ***does not*** correlate to the condition classes used in the biometric vegetation assessment protocol associated with the NSW Biobanking process.

5.7.2 Planning Protection of Vegetation Communities

For 2007 mapping results in regards to land determined to have 'land-use protection', it is assumed that land use protection referred to the land use zonings under Liverpool LEP 1997 which included National Park, Environment Conservation and Management for Open Space.

The comparison analysis in 2012 has considered that land with planning protection includes land zoned under Liverpool LEP 2008 as E1 – National Park and Nature Reserve, E2 (Environment Conservation), E3 Environment Management, and RE 1 – Public Recreation and WSP (Western Sydney Parklands).

In addition, to recognise the protection from inappropriate land-uses and negative environmental impacts afforded by the designation of Riparian Corridors in the Liverpool DCP, an additional analysis has been completed based on vegetation community extent within designated Riparian Corridors (as per Liverpool DCP 2008) has been calculated.

5.7.3 Forest Red Gum – Rough Barked Apple Grassy Woodland on alluvial flats of the Cumberland Plain, Sydney (EEC).

Forest Red Gum – Rough Barked Apple Grassy Woodland on alluvial flats of the Cumberland Plain, Sydney is the Biometric vegetation community name for the River Flat Eucalypt Forest (RFEF) on the Coastal Floodplains of the NSW North Coast, Sydney basin and South-East Corner Bioregions endangered ecological community. RFEF is comprised of the two previously named vegetation sub-communities of Alluvial Woodland and Riparian Forest.

i) Alluvial Woodland Sub-community Description

The canopy species of this vegetation community varies greatly. Cabbage Gum (*Eucalyptus amplifolia*) and Forest Red Gum (*Eucalyptus tereticornis)* are the more common species, with Rough-barked Apple (*Angophora floribunda)* occurring slightly less frequently. Alluvial Woodland occurs along or near minor watercourses that drain soils derived from Wianamatta Shale and on the floodplains of the Hawkesbury-Nepean River (NSW NPWS, 2002). For a detailed description of this community, refer to NSW NPWS (2002).

Extent and Distribution

River-flat Eucalypt Forest occurs within NSW North Coast, Sydney Basin and South East Corner Bioregions.

Within the Liverpool LGA, this community frequently occurs along creeklines such as Cabramatta Creek, Hinchinbrook Creek, Kemps Creek and South Creek. The extent of Alluvial Woodland within Liverpool LGA is shown in Table 15: Extant of Forest Red Gum – Rough Barked Apple Grassy Woodland on alluvial flats of the Cumberland Plain .

i) Riparian Forest Sub-community Description

Bangalay (*Eucalyptus botryoides*), River Peppermint (*Eucalyptus elata*), Broad-leaved Apple (*Angophora subvelutina*) and Rough-barked Apple (*Angophora floribunda*) often dominate Riparian Forest. Riparian Forest is mainly found on soils derived from Holocene Alluvium along the banks and terraces of major rivers (NSW NPWS, 2002). For a detailed description of this community, refer to NSW NPWS (2002).

Extent and Distribution

This community type is not widely distributed, predominantly only occurring on the banks of the Hawkesbury-Nepean River and on the terraces immediately adjacent to the River (NSW NPWS, 2002).

Within the Liverpool LGA, this community is mainly restricted to the Georges River and Nepean River. The extant of Riparian Forest vegetation is outlined in Table 15.

Table 15: Extant of Forest Red Gum – Rough Barked Apple Grassy Woodland on alluvial flats of the Cumberland Plain

ALLUVIAL WOODLAND TOTAL EXTENT Estimated total area occupied pre-1750	**36, 173 ha**
EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	**3, 376 ha**
ALLUVIAL WOODLAND TOTAL EXTANT	**2002**
Total area (all condition classes)	8, 466 ha
Total area with a canopy cover of >10%	4, 729 ha
Extant with planning protection	1, 523 ha (18%)

EXTANT WITHIN THE LIVERPOOL LGA	2002	2012
Area (all condition classes)	802 ha	796 ha
Area of 'Good Condition'	663 ha	659 ha
Extent of 'Good Condition' with planning protection	234 ha (35%)	203 ha (30%)
RIPARIAN FOREST TOTAL EXTENT Estimated total area occupied pre-1750	**2, 989 ha**	
RIPARIAN FOREST EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	710 ha	
RIPARIAN FOREST TOTAL EXTANT	**2002**	
Total area (all condition classes)	1, 149 ha	
Total area with a canopy cover of >10%	717 ha	
Extent with planning protection	344 ha (30%)	
RIPARIAN FOREST EXTANT WITHIN THE LIVERPOOL LGA	**2002**	**2012**
Area (all condition classes)	104ha	104 ha
Area of 'Good Condition'	99 ha	99 ha
Extent of 'Good Condition' with planning protection	40 ha (40%)	30 ha (30%)

5.7.4 Hard-leaved Scribbly Gum –Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin (TEC)

Castlereagh Scribbly Gum Woodland (TEC) is now known as "Hard-leaved Scribbly Gum –Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin" under the Biometric vegetation classification system.

Description

Hard-leaved Scribbly Gum –Parramatta Red Gum heathy woodland of the Cumberland Plain is dominated by Parramatta Red Gum (*Eucalyptus parramattensis* subsp. *Parramattensis)*, Narrow-leaved Apple (*Angophora bakeri)* and Hard-leaved Scribbly Gum (*Eucalyptus sclerophylla)*. It occurs almost exclusively on soils derived from Tertiary Alluvium (NSW NPWS, 2002). For a detailed description of this community, refer to NSW NPWS (2002).

Extent and Distribution

Hard-leaved Scribbly Gum –Parramatta Red Gum heathy woodland of the Cumberland Plain is restricted to the Sydney Basin Bioregion. The main occurrence is in the Castlereagh locality, with small patches occurring at Kemps Creek and Longneck Lagoon. This community is also present around Holsworthy (NSW NPWS, 2002).

Within the Liverpool LGA, this community predominantly occurs in the Holsworthy area, with a small patch at Kemps Creek. The extent of Castlereagh Scribbly Gum Woodland is outlined in Table 16 .

Table 16: Extant of Hard-leaved Scribbly Gum –Parramatta Red Gum heathy woodland of the Cumberland Plain

TOTAL EXTENT Estimated total area occupied pre-1750	5,852 ha
EXTENT WITHIN THE LIVERPOOL LGA	368 ha

Estimated area occupied pre-1750		
TOTAL EXTANT	**2002**	
Total area (all condition classes)	4,182 ha	
Total area with a canopy cover of >10%	3,083 ha	
Extant with planning protection	1170 ha (28%)	
EXTANT WITHIN THE LIVERPOOL LGA	**2002**	**2012**
Area (all condition classes)	291 ha	291 ha
Area of 'Good Condition'	228 ha	228 ha
Extent of 'Good Condition' with planning protection	49 ha (21%)	44 ha (19%)

5.7.5 Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin (EEC)

Castlereagh Swamp Woodland (EEC) is now known as "Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin" under the Biometric vegetation classification system.

Description

Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain is a low woodland, often having dense stands of White Feather Honeymyrtle (*Melaleuca decora)* along with other canopy trees such as Drooping Red Gum (*Eucalyptus parramattensis*). Red Ironbark (*Eucalyptus fibrosa),* Broad-leaved Apple *(Angophora subvelutina)* and Flax-leaved Paperbark (*Melaleuca linariifolia)* also occur, but less frequently. The shrub layer is not well developed and is usually made of up young Melaleuca plants. The groundcover has a diversity of plants that tolerate waterlogged conditions, such as Swamp Pennywort (*Centella asiatic*a), Common Rush (*Juncus usitatus*) and *Goodenia paniculata*.

The community occurs in poorly drained depressions on soils derived from ancient river systems, or on adjacent shale soils where there is a strong Tertiary Alluvium influence (NSW NPWS, 2002). The community is highly adapted to seasonal fluctuations of water levels. For a detailed description of this community, refer to NSW NPWS (2002).

Extent and Distribution

The distribution of Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain is highly restricted, being recorded from the local government areas of Hawkesbury, Liverpool and Penrith (NSW Scientific Committee, 2008). The 2 main occurrences of this community are located in the Castlereagh and Holsworthy areas, while isolated patches are also present at Kemps Creek and north of Camden near the Nepean River (NSW NPWS, 2002). Within the Liverpool LGA, this community predominantly occurs in the Holsworthy area. The extent of Castlereagh Swamp Woodland is outlined in Table 17.

Table 17: Extant of Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin.

TOTAL EXTENT Estimated total area occupied pre-1750	**1006ha**
EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	271ha
TOTAL EXTENT	**2002**
Total area (all condition classes)	671 ha
Total area with a canopy cover of >10%	616 ha
Extant with planning protection	322ha (48%)

EXTANT WITHIN THE LIVERPOOL LGA	2027	2012
Area (all condition classes)	27 ha	27ha
Area of 'Good Condition'	25 ha	25ha
Extant of 'Good Condition' with planning protection	<1 ha (0%)	0 ha (0%)

5.7.6 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin (EEC)

Cooks River Castlereagh Ironbark Forest is now known as "Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin" under the Biometric vegetation classification system.

Description

Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin varies from open forest to low woodland formations, with a canopy dominated by Red Ironbark (*Eucalyptus fibrosa)* and White Feather Honeymyrtle (*Melaleuca decora)* and Woollybutt (*Eucalyptus longifolia).* The dense shrubby understorey consists of *Melaleuca nodosa* and Peach Heath (*Lissanthe strigosa*). The sparse ground layer contains a range of grasses and herbs.

The community has a very restricted natural distribution, primarily occurring on clay soils derived from ancient Tertiary Alluvium, or on shale soils of Wianamatta shales (NSW NPWS, 2002). For a detailed description of this community, refer to NSW NPWS (2002).

Extent and Distribution

Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin is restricted to the Sydney Basin Bioregion and has been recorded in the Auburn, Bankstown, Blacktown, Canterbury, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Strathfield local government areas (NSW Scientific Committee, 2008). The most extensive stands of this community occur in the Castlereagh and Holsworthy areas (NSW NPWS, 2002).

Within the Liverpool LGA, this community predominantly occurs in the Holsworthy and Kemps Creek area, on the eastern edge of the Cumberland Plain. The extant of Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin is outlined in Table 18.

Table 18: Extant of Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin

TOTAL EXTENT Estimated total area occupied pre-1750	**12, 185 ha**	
EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	1204 ha	
TOTAL EXTANT	**2002**	
Total area (all condition classes)	1761 ha	
Total area with a canopy cover of >10%	1012 ha	
Extant with planning protection	5126 ha (40%)	
EXTANT WITHIN THE LIVERPOOL LGA	**2002**	**2012**
Area (all condition classes)	279 ha	269 ha
Area of 'Good Condition'	220 ha	213 ha

Extant of 'Good Condition' with planning protection	99 ha (45%)	63 ha (29%)

5.7.7 Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin (CEEC)

Cumberland Plain Woodland (CPW) is now known as Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin under the Biometric vegetation classification system. CPW is also listed under the Commonwealth EPBC Act, where the community is known as Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest.

Two forms of this community are mapped within Liverpool LGA:

- Shale Hills Woodland
- Shale Plains Woodland

Both sub-communities of this overall community are equally protected under both NSW and Commonwealth legislation. Each of these sub-community forms is described below, and details of the extent of each sub-community are provided.

(i) Shale Hills Woodland

Shale Hills Woodland is now known as "Grey Box – Forest Red Gum grassy woodland on shale hills of the southern Cumberland Plain, Sydney Basin."

Description

Shale Hills Woodland is typically dominated by Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*Eucalyptus tereticornis),* with Narrow-leaved Ironbark (*Eucalyptus crebra)* occurring less frequently. Shale Hills Woodland occurs almost exclusively on soils derived from Wianamatta Shale (NSW NPWS, 2002). For a detailed description of this community, refer to NSW NPWS (2002).

Extent and Distribution

Cumberland Plain Woodland 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 (NSW Scientific Committee, 2008).

The Shale Hills Woodland form of Cumberland Plain Woodland is generally confined to the undulating country in the southern half of the Cumberland Plain, reaching its northern limit at Mulgoa Nature Reserve and Prospect Reservoir (NSW NPWS, 2002).

Within the Liverpool LGA, this community predominantly occurs to the west of Bringelly and Badgerys Creek. Smaller occurrences of the community are scattered through the remainder of the LGA, including near Denham Court, West Hoxton and Casula. The extant of Shale Hills Woodland is outlined in Table 19.

(ii) Shale Plains Woodland

Shale Plains Woodland Grey Box is now known as "Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin".

Description

Shale Plains Woodland is dominated by Forest Red Gum (*Eucalyptus tereticornis)* and Grey Box (*Eucalyptus moluccana*). Narrow-leaved Ironbark (*Eucalyptus crebra)*, Thin-leaved Stringybark (*Eucalyptus eugenioides)* and Spotted Gum (*Corymbia maculata)* occur less frequently. It

predominantly occurs on soils derived from Wianamatta Shale, but also occurs on Holocene Alluvium in well drained areas that are infrequently inundated (NSW NPWS, 2002). For a detailed description of this community, refer to NSW NPWS (2002).

Extant and Distribution

The Shale Plains Woodland form of Cumberland Plain Woodland is the most widely distributed vegetation community on the Cumberland Plain (NSW NPWS, 2002).

This community is relatively widespread within the Liverpool LGA. However, it mainly occurs as highly disturbed and fragmented stands. The extant of Shale Hills and Shale Plains Woodland is outlined in Table 19.

Table 19 : Extant of Shale Hills and Shale Plains Woodland

SHALE HILLS TOTAL EXTENT Estimated total area occupied pre-1750	**38,274 ha**	
SHALE HILLS TOTAL EXTENT	**2002**	
Total area (all condition classes)	10, 336 ha	
Total area with a canopy cover of >10%	4, 309 ha	
Extent with planning protection	2584 ha (25%)	
SHALE HILLS EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	5, 216 ha	
SHALE HILLS EXTANT WITHIN THE LIVERPOOL LGA	**2002**	**2012**
Area (all condition classes)	1, 215 ha	1, 211 ha
Area of 'Good Condition'	611 ha	611 ha
Extant of 'Good Condition' with planning protection	129 ha (21%)	51 ha (8%)
SHALE PLAINS TOTAL EXTENT Estimated total area occupied pre-1750	**87, 172 ha**	
SHALE PLAINS EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	12, 884 ha	
SHALE PLAINS TOTAL EXTANT	**2002**	
Total area (all condition classes)	17, 839 ha	
Total area with a canopy cover of >10%	6, 745ha	
Extant with planning protection	3, 924 ha (22%)	
SHALE PLAINS EXTANT WITHIN THE LIVERPOOL LGA	**2002**	**2012**
Area (all condition classes)	2, 317 ha	2, 273 ha
Area of 'Good Condition'	1, 003 ha	991 ha
Extant of 'Good Condition' with planning protection	389 ha (38%)	214 ha (21%)

5.7.8 Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin

Moist Shale Woodland is now known as "Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin" under the Biometric vegetation classification system.

Description

Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin is usually dominated by Forest Red Gum (*Eucalyptus tereticornis)* and Grey Box (*Eucalyptus moluccana)*, with Narrow-leaved Ironbark (*Eucalyptus crebra)* and Spotted Gum (*Corymbia maculata)* occurring less frequently. Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin occurs exclusively on soils derived from Wianamatta Shale, and is restricted to rugged areas (NSW NPWS, 2002).

For a detailed description of this community, please refer to NSW NPWS (2002).

Extant and Distribution

Moist Shale Woodland is restricted to areas at higher elevations in the southern half of the Cumberland Plain (NSW NPWS, 2002). The community has been recorded in Camden, Campbelltown, Fairfield, Holroyd, Liverpool, Penrith, and Wollondilly Local Government Areas (NSW Scientific Committee, 2008).

This vegetation type is very restricted within the Liverpool LGA, only being recorded at Cecil Park. The extant of Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin is outlined in Table 20.

Table 20: Extant of Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin

TOTAL EXTENT Estimated total area occupied pre-1750	**2, 034 ha**	
EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	56 ha	
TOTAL EXTANT	**2002**	
Total area (all condition classes)	1, 149 ha	
Total area with a canopy cover of >10%	604 ha	
Extant with planning protection	379 ha (33%)	
EXTANT WITHIN THE LIVERPOOL LGA	**2002**	**2012**
Area (all condition classes)	7 ha	7 ha
Area of 'Good Condition'	0 ha	0 ha
Extant of 'Good Condition' with planning protection	0 ha (100%)	0 ha (0%)

5.7.9 Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin (EEC)

Shale Gravel Transition Forest is now known as "Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin" under the Biometric vegetation classification system.

Description

Red Ironbark (*Eucalyptus fibrosa*) is usually the dominant species of Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, with Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*Eucalyptus tereticornis*) being present, but occurring less frequently. This forest community occurs primarily where shallow deposits of Tertiary Alluvium overlie shale soils (NSW NPWS, 2002).

For a detailed description of this community, please refer to NSW NPWS (2002).

Extent and Distribution

This community is restricted to the Sydney Basin Bioregion, and has been recorded from Auburn, Bankstown, Baulkham Hills, Blacktown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta and Penrith Local Government Areas (NSW Scientific Committee, 2008).

Within the Liverpool LGA, this community predominantly occurs in the Holsworthy, Prestons and Kemps Creek areas. The extant of Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain is outlined in Table 20.

Table 21: Extant of Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain.

TOTAL EXTENT Estimated total area occupied pre-1750	**5, 427 ha**	
EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	768 ha	
TOTAL EXTANT	**2002**	
Total area (all condition classes)	3, 298 ha	
Total area with a canopy cover of >10%	1, 721 ha	
Extant of remaining area with planning protection	37.4 ha (%)	
EXTANT WITHIN THE LIVERPOOL LGA	**2002**	**2012**
Area (all condition classes)	829 ha	825 ha
Area of 'Good Condition'	683 ha	683ha
Extant of 'Good Condition' with planning protection	122 ha (17%)	117 ha (17%)

5.7.10 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (EEC)

Shale / Sandstone Transition Forest is now known as "Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin" under the Biometric vegetation classification system.

Two forms of this community were mapped within Liverpool LGA:

- Low Sandstone Influence,
- High Sandstone Influence.

Each of these sub-community forms are described below.

(i) Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (Low Sandstone Influence)

Description

Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (Low Sandstone Influence) is usually dominated by Forest Red Gum (*Eucalyptus tereticornis),* with Thin-leaved Stringybark (*Eucalyptus eugenioides*), Narrow-leaved Ironbark *(Eucalyptus crebra),* Red Ironbark *(Eucalyptus fibrosa)* and Grey Gum *(Eucalyptus punctata)* occurring less frequently. It is only found in close proximity to a transition in parent geology from Wianamatta

Shale to high-quartz sedimentary substrates such as Hawkesbury and Narrabeen Group Sandstones (NSW NPWS, 2002). For a detailed description of this community, refer to NSW NPWS (2002).

Extant and Distribution

Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain is restricted to the Sydney Basin Bioregion, and has been recorded in the Bankstown, Baulkham Hills, Blue Mountains, Campbelltown, Hawkesbury, Liverpool, Parramatta, Penrith, and Wollondilly Local Government Areas (NSW Scientific Committee, 2008). Shale / Sandstone Transition Forest (Low Sandstone Influence) is located around the margins of the Cumberland Plain (NSW NPWS, 2002) and was extensive prior to European settlement.

Within the Liverpool LGA, Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (Low Sandstone Influence) predominantly occurs in the Holsworthy area.

(ii) Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (High Sandstone Influence)

Description

Grey Gum (*Eucalyptus punctata*) and Narrow-leaved Ironbark (*Eucalyptus crebra*) typically dominate Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (High Sandstone Influence). Red Ironbark (*Eucalyptus fibrosa)*, Red Bloodwood (*Corymbia gummifera)* and Turpentine (*Syncarpia glomulifera*) occur less frequently. It mainly occurs on shallow residual clay soils derived from Wianamatta Shale (NSW NPWS, 2002). For a detailed description of this community, refer to NSW NPWS (2002).

Extant and Distribution

Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (High Sandstone Influence) occurs on the boundary between shale and sandstone geology types, particularly in the southeast and southwest portions of the Cumberland Plain (NSW NPWS, 2002).

Within the Liverpool LGA, Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (Low Sandstone Influence) is very restricted, predominantly occurring in the Holsworthy and Greendale areas. The extant of Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (Low and High Sandstone influence) is outlined in Table 22.

Table 22: Extant of Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, (Low and High Sandstone Influence)

SHALE / SANDSTONE (LOW SANDSTONE INFLUENCE) TOTAL EXTENT Estimated total area occupied pre-1750	**12, 828 ha**
SHALE / SANDSTONE (LOW SANDSTONE INFLUENCE) EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	334 ha
SHALE / SANDSTONE (LOW SANDSTONE INFLUENCE) TOTAL EXTANT	**2002**
Total area (all condition classes)	3, 325 ha

Total area with a canopy cover of >10%	1, 234 ha	
Extant of remaining area with planning protection	365 ha (11.2%)	
SHALE / SANDSTONE (LOW SANDSTONE INFLUENCE) EXTANT WITHIN THE LIVERPOOL LGA	**2027**	**2012**
Area (all condition classes)	172 ha	169 ha
Area of 'Good Condition'	105 ha	102 ha
Extant of 'Good Condition' area with planning protection	11 ha (10%)	11 ha (10%)
SHALE / SANDSTONE (HIGH SANDSTONE INFLUENCE) TOTAL EXTENT Estimated total area occupied pre-1750	**31, 162 ha**	
SHALE / SANDSTONE (HIGH SANDSTONE INFLUENCE) EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	813 ha	
SHALE / SANDSTONE (HIGH SANDSTONE INFLUENCE) TOTAL EXTANT	**2002**	
Total area (all condition classes)	16, 028 ha	
Total area with a canopy cover of >10%	8, 707 ha	
Extant of remaining area with planning protection	3045 ha (19%)	
SHALE / SANDSTONE (HIGH SANDSTONE INFLUENCE) EXTANT WITHIN THE LIVERPOOL LGA	**2002**	**2012**
Area (all condition classes)	17 ha	17 ha
Area of 'Good Condition'	3 ha	3 ha
Extant of 'Good Condition' remaining area with planning protection	0 ha (0%)	0 ha (0%)

The Cumberland Plain Recovery Plan was adopted by NSW DECCW in January 2011. It is a multi species and multi community plan which applies to all of the vegetation communities described above. Further detail on the recovery plan is provided in Section 5.10.1.

5.7.11 Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and Southeast Corner Bioregions

Freshwater Wetlands are now known as "Coastal freshwater lagoons of the Sydney Basin and South East Corner" under the Biometric vegetation classification system.

Description

Wetlands are areas that are wet by surface water or groundwater, or both, for long enough periods of time that the plants and animals in them are adapted to and depend on moist conditions for at least part of their lifecycle. Freshwater wetlands typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Some wetlands are ephemeral, and their extent will vary somewhat depending on climatic conditions.

Wetlands that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation. Areas that are subject to regular inundation and drying may include large

emergent sedges as well as emergent or floating herbs. As standing water becomes deeper or more permanent, amphibious and emergent plants become less abundant, while floating and submerged aquatic herbs become more abundant (NSW Scientific Committee, 2008).

For a detailed description of this community, refer to the Final Determination for this community (NSW Scientific Committee, 2008).

Extant and Distribution

Freshwater Wetlands, as listed under the NSW *TSC Act 1995*, occur in the NSW North Coast, Sydney Basin and South East Corner Bioregions. This community is very restricted within the Liverpool LGA, mainly occurring in the vicinity of the Georges River.

The extant of Freshwater Wetlands is outlined in Table 23Table 23 :.

Table 23 : Extant of Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and Southeast Corner Bioregions

TOTAL EXTENT Estimated total area occupied pre-1750	**1, 552 ha**	
EXTENT WITHIN THE LIVERPOOL LGA Estimated area occupied pre-1750	93 ha	
TOTAL EXTANT	**2002**	
Total area (all condition classes)	666 ha	
Total area with a canopy cover of >10%	664 ha	
Extant with planning protection	446 ha (67%)	
EXTENT WITHIN THE LIVERPOOL LGA	**2002**	**2012**
Area (all condition classes)	4 ha	4 ha
Extant with 'formal' planning protection	1 ha	1ha (25%)

Management Recommendations

The NSW Scientific Committee concluded that Freshwater Wetlands are likely to become extinct in nature unless factors threatening its survival or evolutionary development cease to operate (NSW Scientific Committee, 2008).

The recovery actions required to manage and improve this vegetation community are contained in Table 24.

Table 24: Priority Actions for Freshwater Wetlands (Source: NSW OEH Threatened Species Profiles, 2012)

ACTION
Install stormwater control mechanisms to prevent off-site impacts from adjacent development
Control access to remnant wetland areas by installing fencing and signage and rationalising both formal and informal access tracks
Undertake weed control as required using removal methods that will not harm the native community
Protect and actively manage remnants through conservation mechanisms such as covenanting and the preparation / implementation of site-specific vegetation management plans
Improve vegetative connectivity within and between remnants through

ACTION
revegetation / regeneration projects and provide vegetative buffers around these remnants
Restore natural drainage conditions

In addition, the NSW Wetlands Policy (DECCW, 2010) outlines the following 12 guiding principles for the management of wetlands in NSW:

- Wetlands are valued as significant parts of NSW landscapes – their conservation and management are most appropriately considered at the catchment scale.
- Water regimes needed to maintain or restore the ecological resilience of wetlands should be provided through water management planning, water recovery and water purchase, recognising that a balance between environmental and human requirements must be reached.
- Floodplains should be managed to maintain the natural distribution of water to and from wetlands, and to allow for the movement of aquatic biota,
- Wetlands of international, national and regional significance should be identified and given priority for conservation and investment.
- Land management practices should maintain or improve wetland habitats, ecosystem services and cultural values.
- Wetlands should be recognised as places with important cultural values, in particular wetlands are an important part of Country for Aboriginal people.
- Degraded wetlands and their habitats should be rehabilitated and their ecological processes improved as far as is practicable.
- The potential impacts of climate change should be considered in planning for wetland conservation and management.
- Research into wetland ecology should be encouraged to better support water and land use planning and management.
- Natural wetlands should not be destroyed or degraded. If social or economic imperatives in the public interest result in a wetland being degraded or destroyed, the establishment and protection of a wetland offset that supports similar biodiversity and ecological functions will be needed.
- Co-operation and incentives among land managers, government authorities, catchment management authorities, non-government organisations and the general community are essential for effective wetland management.
- Regular reporting of wetland extent and condition is vital to assess management performance and to understand wetland dynamics.

The NSW State Plan, which the NSW Wetlands Policy is aligned with, sets a target for improving the ecological condition of important wetlands so that “By 2015, there is an improvement in the condition of important wetlands, and the extent of those wetlands is maintained.” Important wetlands have been defined as being those listed under the RAMSAR Convention or in the Directory of Important Wetlands of Australia (NRC, 2005). A wetland located within the Liverpool Military Training Area and the Voyager Point wetland are both listed on the Directory of Important Wetlands in Australia.

5.7.12 Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South-East Corner Bioregion (EEC) and Mangrove Forest in estuaries of the Sydney Basin and South-East Corner

Of the mangroves and saltmarsh vegetation previously described together, the saltmarsh component is known as "Saltmarsh in estuaries of the Sydney Basin and South East Corner" and the mangrove component is now known as "Mangrove forest in estuaries of the Sydney Basin and South East Corner" under the Biometric vegetation classification system.

Description

This mixed vegetation community occurs in estuarine environments and form a complex of mangrove plants and saltmarsh herblands. Saltmarsh areas generally exist on the landward side of mangrove areas and are generally not inundated daily by tides but instead rely on king or spring tides.

Mangroves are not listed as an EEC, however saltmarsh is listed as an EEC under the NSW TSC Act.

Characteristic saltmarsh plants include Beaded Glasswort (*Sarcocornia quinqueflora)*, Saltwater Couch (*Sporobolus virginicus)*, Streaked Arrowgrass (*Triglochin striata)*, Sea Rush (*Juncus krausi)i*, and Austral Seablite (*Suaeda australis)*. For a detailed description of the saltmarsh community, please refer to NSW NPWS (2002). Species composition of the saltmarsh area depends on elevation and degree and regularity of inundation. Occasionally mangroves will be scattered through the saltmarsh area. Many fauna species depend on saltmarsh areas for foraging, breeding and roosting habitat including shorebirds who feed on the invertebrates at low tide.

Extant and Distribution

Mangrove stands are widespread in most estuarine habitats of NSW, however saltmarsh areas only occur in small fragmented patches.

Coastal Saltmarsh as listed under the NSW *TSC Act 1995*, occurs in the NSW North Coast, Sydney Basin and South East Corner Bioregions.

This mixed community is very restricted within the Liverpool LGA, only being recorded immediately adjacent to the Georges River. This community is entirely restricted to 'land' zoned as "Natural Waterway".

The extent of Saltmarsh is outlined in Table 25. Total extent and pre-1750 areas were not calculated by NSW NPWS for this community type.

Table 25: Extant of Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South-East Corner Bioregion.

EXTANT WITHIN THE LIVERPOOL LGA	2002	2012
Area (all condition classes)	1 ha	1.5 ha
Extant with planning protection	0 ha (0%)	0 ha (100%)

Threats to Mangroves and Saltmarsh

Infilling of low lying, swampy areas for urban development as well as modification of natural tidal flows through regulation of rivers and dredging of estuaries also threatens saltmarsh communities. Changes to salinity levels through the introduction of semi-regular stormwater flows through an area also changes the physico-chemical properties of the environment, and favours the encroachment of mangroves further into the saltmarsh areas. The impact from introduced pests and altered fire regimes also threatens this community.

Management Recommendations

The NSW Scientific Committee concluded that Coastal Saltmarsh is likely to become extinct in nature unless factors threatening its survival cease to operate (NSW Scientific Committee, 2008).

The Best Practice Guidelines for Coastal Saltmarsh (DECC 2008) state that effective management and restoration of coastal saltmarsh communities requires:

- Weed management,
- Native vegetation management (particularly mangrove encroachment),
- Planting,
- Fauna management,
- Hydrology management,
- Access management and community awareness and appreciation
- Planning and monitoring,
- Selection of sites for restoration based on their ability to respond to climate change and sea level rise.

The priority management actions for saltmarsh community are listed in Table 26.

Table 26: Priority Actions for Coastal Saltmarsh (Source: *NSW OEH Threatened Species Profiles, 2012)*

ACTION
Protect areas of saltmarsh from runoff that contains high levels of nutrients or pollutants
Reduce the amount of sediment reaching the estuary to reduce the landward migration of Mangroves into saltmarsh areas
Maintain buffer zones of terrestrial vegetation adjacent to saltmarsh to allow for expansion on saltmarsh and to minimise nutrient flow
Protect from clearing and development through protective landuse zonings and appropriate active management such as fencing and signage
Minimise human disturbance by preventing access from recreational vehicles
Erect educational signage to provide information to visitors and residents of the importance of coastal saltmarsh
Undertake week control programs
Prohibit grazing and burning
Restore natural hydrological regimes by removing stormwater drains or artificial structures that restrict tidal flows
Consult with Department of Primary Industries / NSW Fisheries to determine an appropriate mangrove management plan

The following vegetation communities are all described separately given their unique floristic composition and positions in the landscape. However as the threats to each and the recommended management options for each community are very similar, details on threats and management are presented as a summary in Section 3.7.

5.7.13 Water Gum – Coachwood riparian scrub along sandstone streams, Sydney Basin

Water Gum - Coachwood riparian scrub along sandstone streams, Sydney Basin is the revised name for Riparian Scrub under the Biometric vegetation classification system.

Description

This community has a dense to sparse canopy, dominated by Swamp Oak (*Casuarina glauca*), with sporadic other canopy species including Lilly Pilly (*Acmena smithii*), Cheese Tree (*Glochidion spp*) and various Paperbarks (*Melaleuca spp*). The understorey is characterised by frequent vines, a sparse cover of shrubs and a continuous groundcover of forbs, sedges and grasses and thick depths of decomposing leaf litter. For a detailed description of this community, refer to the Final Determination for this community (NSW Scientific Committee, 2008).

Extent and Distribution

This community is found on the NSW North Coast, Sydney Basin and South-East Corner Bioregion. The community is found on coastal floodplains with soils of grey black clay loams and sandy loams where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats. It is usually restricted to a narrow band of land adjacent to saline / brackish creeklines.

DECCW estimates that the remaining areas of Water Gum - Coachwood riparian scrub represents much less than 30% of its original range and extent and that less than 5200 ha exists within the Sydney – South Coast area.

Extant and Distribution

Within the Liverpool LGA, this community is restricted to land adjacent to sandstone creeklines at Holsworthy. The extent of Water Gum - Coachwood riparian scrub is outlined in Table 27. Total extent and pre-1750 areas were not calculated by NSW NPWS for this community type in 2002.

Table 27: Extant of Water Gum – Coachwood riparian scrub

EXTANT WITHIN THE LIVERPOOL LGA	2002	2012
Area (all condition classes)	71 hectares	71 ha
Area of 'Good Condition'	71 hectares	71 ha
Extent of 'Good Condition' with planning protection	0 ha	0 ha (0%)

5.7.14 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin

Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin is the revised name for both the Sandstone Ridgetop Woodland and Woodland Heath Complex vegetation communities under the Biometric vegetation classification system.

Description

This community is dominated by Red Bloodwood (*Corymbia gummifera)* and Hard-leaved Scribbly Gum (*Eucalyptus sclerophylla)* with Old-man Banksia (*Banksia serrata*) frequently present at a lower abundance. This community occurs predominantly on sandstone ridgetops and plateaux, but sometimes extends to the floor of shallow gullies (NSW NPWS, 2002). For a detailed description of this community, refer to NSW NPWS (2002).

Extent and Distribution

Within the Liverpool LGA, this community is restricted to the areas dominated by sandstone geology in the far eastern and western portions of the LGA, such as Greendale and Holsworthy. The extent of Red

Bloodwood - scribbly gum heathy woodland is outlined in Table 28. Total extent and pre-1750 areas were not calculated by NSW NPWS for this vegetation community type in 2002.

Table 28: Extant of Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin

EXTANT WITHIN THE LIVERPOOL LGA	2002	2012
Area (all condition classes)	1 553 ha	1 550
Area of 'Good Condition'	334 ha	334
Extant of 'Good Condition' with planning protection	233 ha (15%)	232 ha (15%)

5.7.15 Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin

Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin is the revised name for Upper Georges River Sandstone Woodland under the Biometric vegetation classification system.

Description

Red Bloodwood - Grey Gum woodland is dominated by Grey Gum (*Eucalyptus punctata)* and Red Bloodwood (*Corymbia gummifera)*, with Stringybark (*Eucalyptus oblonga)* occurring frequently at lower abundance. This community is typically found on upper slopes and ridges on sandy soils (NSW NPWS, 2002). For a detailed description of this community, refer to NSW NPWS (2002).

Extant and Distribution

Within the Liverpool LGA, this community predominantly occurs in the Holsworthy area. The extant of Red Bloodwood - Grey Gum woodland is outlined in Table 29. Total extant and pre-1750 areas were not calculated by NSW NPWS for this community type in 2002.

Table 29: Extant of Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin

EXTANT WITHIN THE LIVERPOOL LGA	2002	2012
Area (all condition classes)	1,629 hectares	1, 606 ha
Area of 'Good Condition'	1,601 hectares	1, 580 ha
Extant of 'Good Condition' with planning protection	20ha (1.2%)	17 ha (1%)

5.7.16 Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin

Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin is the revised name of Western Sandstone Gully Forest under the Biometric vegetation classification system.

Description

Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest is dominated by Sydney Red Gum (*Angophora costata)*, Red Bloodwood (*Corymbia gummifera)* and Blackbutt (*Eucalyptus pilularis*). It occurs on the lower slopes of sandstone gullies (NSW NPWS, 2002).

For a detailed description of this community, refer to NSW NPWS (2002).

Extant and Distribution

Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest occurs on the western side of the Woronora Plateau (NSW NPWS, 2002). Within the Liverpool LGA, this community predominantly occurs in the Holsworthy area.

The extant of Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest is outlined in Table 30. Total extent and pre-1750 areas were not calculated by NSW NPWS for this community type in 2002.

Table 30: Extant of Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin

EXTANT WITHIN THE LIVERPOOL LGA	2002	2012
Area (all condition classes)	1,451 hectares	1, 451 ha
Area of 'good condition'	1,449 hectares	1, 449 ha
Extant of 'Good Condition' with planning protection	0 ha (0%)	0 ha (0%)

5.8 THREATS TO BIODIVERSITY

Both the National Strategy for Biodiversity Conservation (2010) and the (Draft) NSW Biodiversity Conservation Strategy identify the main threats to Biodiversity as being:

- Habitat loss, degradation and fragmentation,
- Invasive plant, animal and disease species,
- Unsustainable use and management of natural resources
- Changes to the aquatic environment and natural water flows,
- Changing fire regimes, and
- Climate change.

Further, climate change is recognised as an 'umbrella' issue that will exacerbate and amplify the impacts from all other threats to biodiversity in addition to its direct effects. There is increased recognition that managing and reducing threats to biodiversity will need to occur at much bigger scales and on longer timeframes than previously envisaged. Traditional approaches to local and regional planning will need to be augmented by landscape and state scale planning, with funding allocations to match.

5.8.1 Key Threatening Processes

The NSW *TSC Act 1995* provides for the listing of Key Threatening Processes (KTPs) and the preparation of Threat Abatement Plans. Key Threatening Processes are listed in Schedule 3 of the NSW *TSC Act* and there are now 36 KTPs listed. The 24 KTPs which are applicable to the Liverpool LGA are listed below:

Human Induced Processes

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
- Anthropogenic climate change.
- Bushrock removal.
- Clearing of native vegetation.
- Competition from feral honey bees (*Apis mellifera*).

- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
- Loss of hollow-bearing trees.
- Removal of dead wood and dead trees.

Pest Plant and Pathogens

- Infection of native plants by *Phytophthora cinnamomi*.
- Invasion and establishment of exotic vines and scramblers.
- Invasion and establishment of Scotch Broom (*Cytisus scoparius*)
- Invasion, establishment and spread of Lantana (*Lantana camara*).
- Invasion of native plant communities by African Olive (*Olea europea L subsp cuspidata*)
- Invasion of native plant communities by *Chrysanthemoides monilifera*.
- Invasion of native plant communities by exotic perennial grasses.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.

Pest Animals and Pathogens

- Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*).
- Competition and habitat degradation by feral goats (*Capra hircus*)
- Infection by *Psittacine circoviral* (beak and feather) Disease affecting endangered psittacine species and populations.
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis.
- Invasion and establishment of the cane toad (*Bufo marinus*)
- Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish).
- Predation by the European Red Fox (*Vulpes vulpes*).
- Predation by the Feral Cat (*Felis catus*).

In addition to the Key Threatening Processes listed under the NSW *TSC Act,* Schedule 6 of the NSW *Fisheries Management Act (1994)* lists the following Key Threatening Processes which are applicable to the Liverpool LGA:

- Degradation of native riparian vegetation along New South Wales water courses.
- Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.
- Introduction of fish to waters within a river catchment outside their natural range.
- Introduction of non-indigenous fish and marine vegetation to coastal waters.
- Removal of large woody debris from New South Wales rivers and streams.

The Commonwealth EPBC Act (1999) also lists Key Threatening Processes which are operating on a National level. Of the 19 listed processes, the following are considered to be potentially impacting biodiversity values and resources within Liverpool LGA:

- Dieback caused by the root-rot fungus *Phytophera cinnamomi*
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis
- Land Clearance

- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants,
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Psittacine Circoviral (beak and feather) disease affecting endangered psittacine species

5.8.2 Additional Threats to Biodiversity

Other threatening processes are likely to exist within Liverpool LGA, but due to their localised nature are not formally listed as a Key Threatening Process for the State. Some additional threats are outlined below:

- *Incompatible land management practices*. Grazing by cattle as well as bushfire fuel management activities cause the mid and understorey layers of a vegetation community to be more thoroughly thinned or removed. This can severely alter both the floristic and structural diversity of communities, while maintaining a relatively intact and functioning canopy level.
- *Edge effects.* Effects which are often pronounced on the boundaries of stands of vegetation include increased weed invasion, rubbish dumping, light and noise levels, wind intrusion and soil and plant desiccation, pedestrian and vehicle access and polluted stormwater. These edge effects can impact upon the composition and structure of the vegetation and can affect the habitat quality of a stand.
- *Altered soil conditions*. Changed soil conditions can occur due to processes such as soil disturbance, raising or lowering of the water table, increasing salinity, activation of acid sulphate soils and introduction of foreign (incompatible) soil material. Compaction of soil by earthmoving equipment, material storage, vehicular and cattle movements can also degrade soil structure and drainage patterns.
- *Water flows and stormwater*. The addition of sediments, nutrients and other pollution can change soil characteristics to create conditions which are often unfavourable to native species which are adapted to low nutrient soils. It can also facilitate weed establishment. The additional of extra water can similarly place native species under stress and promote weed growth. Urban development can also significantly affect the flow behaviour and volume of run-off, subsurface flows and drainage lines.
- *Ineffective reserve planning and management*. Planning of reserves is critical to ensure the long-term sustainability of ecological values and reduce the ongoing management requirements. Reserve planning and management covers such aspects as strategic land acquisitions, formalisation of appropriate landuses, formalisation of access, use of buffer zones, inappropriate fire regimes, minimising edge to area ratios, protecting corridors and undertaking restoration works.

5.8.3 Threat Abatement Plans

LCC is obliged to consider and carry out actions under Threat Abatement Plans which apply to species, populations or ecological communities occurring in the Liverpool LGA. When developing Plans of Management for land under the care, control and management of LCC, the provisions of any Threat abatement plans (and recovery plans, see Section 5.10) must be incorporated into the management prescriptions for the site.

Threat Abatement Plans have been finalised for the following Key Threatening Processes:

- Invasion of native plant communities by *Chrysanthemoides monilifera* (NSW Plan).
- Dieback caused by root-rot fungus Phytophthora cinnamomi (National Plan).
- Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish) (NSW Plan).
- Predation by the European Red Fox (*Vulpes vulpes*) (NSW Plan)
- Beak and Feather (Psittacine Circoviral) disease affecting endangered psittacine species (National Plan)
- Infection of amphibians with chytrid fungus (National Plan)
- Predation by feral cats (National Plan)

5.9 RECOVERY PLANNING

NSW NPWS / OEH have developed a range of *Recovery Plans* to direct and focus the management and restoration actions for a range of State listed Flora, Fauna, Endangered Populations and Threatened Ecological Communities. Previously, the TSC Act required the preparation of a recovery plan for each threatened species, population or ecological community listed and a threat abatement plan for each key threatening process listed.

When developing Plans of Management for public lands which contain listed threatened species, populations and TECs, LCC is obligated to include the provisions of any Recovery Plans that exist for those species, populations or TECs. Further, LCC is required to report on measures undertaken to implement recovery actions and decision making processes need to carefully consider provisions of the Recovery Plans.

NSW Recovery Plans currently exist for the following species recorded within or adjacent to Liverpool LGA:

- *Acacia pubescens* (Downy Wattle)
- *Allocasuarina glareicola*- Cumberland Plain Recovery Plan
- *Asterolasia elegans*
- *Caladenia tessellata* (Thick Lip Spider Orchid)
- *Dillwynia tenuifolia* - Cumberland Plain Recovery Plan
- *Eucalyptus benthamii* (Camden White Gum, Nepean White Gum)
- *Grevillea juniperina* – Cumberland Plain Recovery Plan
- *Persoonia nutans* (Nodding Geebung)
- *Pimelea spicata* (Spiked Rice Flower)
- *Pomaderris brunnea* (Brown Pomaderris)
- *Pterostylis gibbosa* (Illawarra Greenhood Orchid)
- *Pterostylis saxicola* (Sydney Plains Greenhood Orchid) – Cumberland Plain Recovery Plan
- *Pultenaea parviflora* – Cumberland Plain Recovery Plan
- *Meridolum corneovirens* (Cumberland Land Snail) – Cumberland Plain Recovery Plan
- *Isoodon obselus obselus* (Southern Brown Bandicoot)
- *Petrogale penicillata* (Brush Tailed Rock Wallaby)
- *Phascolarctus cinereus* (Koala)
- *Pteropus poliocephalus* (Grey-Headed Flying Fox)
- *Litoria aurea* (Green and Golden Bell Frog)
- *Litoria raniformis* (Growling Grass Frog)
- *Anthochaera phyrygia* (Regent Honeyeater)
- *Botaurus poiciloptilus* (Australasian Bittern)
- *Burhinus grallarius* (Bush Stone Curlew)

- *Ninox connivens* (Barking Owl) – Draft on exhibition
- *Ninox strenua* (Powerful Owl), *Tyto novaehollandiae* (Masked Owl) and *Tyto tenebricosa* (Sooty Owl),

In addition to these State based recovery plans, the Commonwealth Department of Sustainability, Environment, Water, Population and Communities has developed the following Approved and Draft / in-preparation Recovery Plans under the EPBC Act:

Approved:

- *Acacia pubescens* (Downy Wattle)
- *Calladenia tessellata* (Thick Lip Spider orchid)
- *Melaleuca deanei (Deane's Melaleuca)*
- *Persoonia nutans* (Nodding Geebung)
- *Pimelea spicata* (Spiked Rice Flower)
- *Pterostylis gibbosa* (Illawarra Greenhood Orchid)
- *Lathamus discolor* (Swift Parrot)
- *Pteropus poliocephalus (Grey-Headed Flying Fox)*

Draft:

- *Eucalyptus benthamii (*Camden White Gum, Nepean White Gum)
- *Persoonia hirsuta*
- *Helioporus australiacus (*Giant Burrowing frog*)*
- *Litoria aurea* (Green and Golden Bell frog)
- *Litoria raniformis* (Southern Bell frog)
- *Mixophyes balbus (*Stuttering Frog, Southern Barred Frog)
- *Macquaria australasica (*Macquarie Perch)
- *Botaurus poiciloptilus (*Australasian Bittern)
- *Sternula neries neries (*Fairy Tern)
- *Chalinobolus dwyeri (*Large-eared Pied Bat)
- *Isoodon obselus obselus (*Southern Brown Bandicoot)
- *Petrogale pencillata* (Brush Tailed Rock Wallaby)
- *Potorus tridactylus tridactylus* (Long Nosed Potoroo)
- *Pseudomyes novaehollandiae* (New Holland Mouse)

5.9.1 Cumberland Plain Recovery Plan

Many of the vegetation communities described above are covered by the Cumberland Plain Recovery Plan (CPRP), approved and adopted by NSW DECCW in January 2011. This is a multi-species and multi-community recovery plan which covers the following and threatened species which occur within the LGA:

- Castlereagh Swamp Woodland
- Cooks River / Castlereagh Ironbark
- Cumberland Plain Woodland
- Moist Shale Woodland
- River Flat Eucalypt Forest
- Shale Gravel Transition Forest, and
- Shale / Sandstone Transition Forest
- *Allocasuarina glareicola*
- *Dillwynia tenuifolia*
- *Pultenea parviflora*

- Sydney Plains Greenhood Orchid *(Pterostylis saxicola)*
- Cumberland Land Snail *(Meridolum cornerovirens)*

The CPRP is designed to provide for the long term survival and protection of the threatened biodiversity of the Cumberland Plain. It constitutes the formal recovery plan for 20 listed threatened species, populations and ecological communities that exist there.

The CPRP is based on 4 recovery themes:

- Building the Cumberland Plain protected area network, including both public and private lands and concentrating on the identified Priority Conservation Lands,
- Delivering best management practices to prevent degradation of remaining bushland,
- Enhancing the community's understanding and awareness of the values of the Cumberland Plain, and
- Improving our understanding of and capacity to manage the many threats to the biodiversity of the Cumberland Plain.

From the CPRP, the following actions are relevant to Liverpool City Council:

- (Action 1.4) Local Councils will have regard to the priority conservation lands in identifying areas for inclusion in environment protection and regional open space zones
- (Action 1.5) In circumstances where impacts on the threatened biodiversity listed in Table 1 are unavoidable, as part of any consent, approval or license that is issued, ensure that offset measures are undertaken within the priority conservation lands where practicable (Note that offsets for impacts within the Growth Centres will continue to be provided in accordance with the Growth Centres Biodiversity Certification Order.)
- (Action 2.1) Preferentially target any future investment associated with the management of the threatened biodiversity listed in Table 1 to the priority conservation lands where practicable.
- (Action 2.2) Support and promote the adoption of best practice standards for bushland management and restoration (as specified in Appendix 2) on public and private lands within the Cumberland Plain.
- (Action 3.4) Work collaboratively with local government authorities and other organisations to inform communities about the value and role of remnant vegetation on the Cumberland Plain, the best practice standards for its management and any opportunities to participate in the recovery program.
- (Action 3.5) Work with Aboriginal communities, land owners, community groups and students to deliver best practice management in the priority conservation lands, and to identify other opportunities for involvement in the recovery program.
- (Action 3.6) Establish and promote best practice management demonstration sites for the threatened biodiversity listed in Table 1,
- (Action 3.7) Develop interpretative programs for key local reserves that contain examples of the threatened biodiversity addressed in the recovery plan.
- (Action 4.3) DECCW will encourage local councils to prepare or review biodiversity strategies to be consistent with the recovery plan that guide protection, management and strategic investment in threatened biodiversity, both within and outside the priority conservation lands.
- (Action 4.4) DECCW will work collaboratively with local councils to enhance the compliance and enforcement program with regard to the unauthorised clearing of bushland on the Cumberland Plain.

NSW has moved away from the preparation of recovery plans for individual species, populations and EECs and the development of Threat Abatement Plans for each KTP. Instead, NSW has introduced a NSW Threatened Species Priorities Action Statement (DECC 2007). The Priorities Action Statement (PAS) is a strategic approach to the long term survival of the State's most threatened native plants and animals and recognises that many species are affected by a combination of threats and that some threats affect many different species.

The PAS identifies 36 broad strategies to recover threatened plants and animals and establishes relative priorities to implement those strategies. The PAS also establishes performance indicators to report the effectiveness of implementing the recovery and threat abatement strategies within the nominated timeframes.

Appendix 2 - Mapping Methodology

This section describes the mapping methodology used to generate the data on vegetation community extant, the conversion to biometric vegetation types and the conservation significance assessment undertaken. Overall the methodology is consistent with the methodology used by Hyder in 2007 to ensure greater comparability of both data sets. The maps produced are contained at the end of this section and throughout relevant sections of the Plan.

5.10 MAPPING LIMITATIONS

In mapping the "Vegetation Communities" and "Condition" there is a heavy reliance on the data prepared as part of earlier editions of the Biodiversity Management Plan. Due to the nature of land use changes in the Liverpool LGA and the likely impacts of this on vegetation communities and particularly condition, it is highly recommended that Council consider undertaking field work to validate mapping of vegetation communities and condition prior to further revisions of the Biodiversity Management Plan.

The terminology used in the vegetation condition map (Figure 5) relates to the condition descriptions developed by NSW NPWS during the mapping of Native vegetation of the Cumberland Plain, Western Sydney. The Liverpool Biodiversity Strategy (2003) defined 'Good Condition" vegetation as all vegetation in condition classes A, B and C, "Low Condition" vegetation was defined as all vegetation in condition classes Tx, TXu, Txr and X. The classification of vegetation into these condition classes ***does not*** correlate to the condition classes used in the biometric vegetation assessment protocol associated with the NSW biobanking process.

There are also limitations in converting Vegetation Communities as per NPWS (2002) to Biometric Vegetation Types. In some cases more than one Biometric Vegetation type can be used to describe a vegetation community as described in NPWS (2002). For example "Riparian Forest" may be either "River Flat Forest" or "Swamp Oak Floodplain Forest" depending on the floristics of the polygon in question. Without floristics information, ELA have allocated the most likely Biometric vegetation type for this community in this region. This is further justification for field validation of vegetation communities in Liverpool LGA.

Whilst every effort was made to accurately identify vegetation that has been cleared since 2007 using recent high resolution imagery, it is possible that errors may have been made. Again field validation would increase accuracy of the area of "extant vegetation".

Nominating an adjacency rule can be a limitation of establishing patch size and connectivity. In this case an adjacency rule of 15 metres was applied, and as such, vegetation polygons were dissolved and then buffered by 8 metres to identify vegetation patches within 15 metres of each other. It is possible however that some biodiversity linkages could be made for distances even greater than 15 metres, depending on the biodiversity value (eg fauna habitat for particular species) that is being assessed.

5.11 EXTANT VEGETATION

The vegetation data layer provided by Liverpool City Council was intersected with DECCW (2009) and SMCMA (2009) Vegetation mapping layers.

The intersected vegetation layer was validated against recent high-resolution (~1 metre) aerial imagery (NearMap 2012). This desktop process was conducted at a scale of 1:5,000 and using a 1km x 1km "fishnet" to ensure that the entire Liverpool Local Government Area was validated equally.

Where vegetation appeared to have been cleared since the previous (draft) 2008 Biodiversity Management Plan, this was noted as "Cleared" in an additional "Status 2012" attribute.

5.12 BIOMETRIC VEGETATION TYPES

An attribute "Biometric" was added to the existing vegetation community type data and Biometric Vegetation Types entered according to DECCW's "Definitions of vegetation types for CMA Areas" (http://www.environment.nsw.gov.au/projects/biometrictool.htm) and with reference to NPWS (2002) vegetation descriptions.

For polygons where vegetation communities were defined as "Unclassified" in the original Liverpool Council vegetation data, the Biometric Vegetation types were entered based on DECCW or SMCMA vegetation communities for these polygons. Despite the availability of this more recent mapping, there are still a number of polygons for which the vegetation community is "unclassified" due to a lack of ground-truthed information. In these areas none of the vegetation data layers used were able to provide information for vegetation community type and they have remained classified as "unknown".

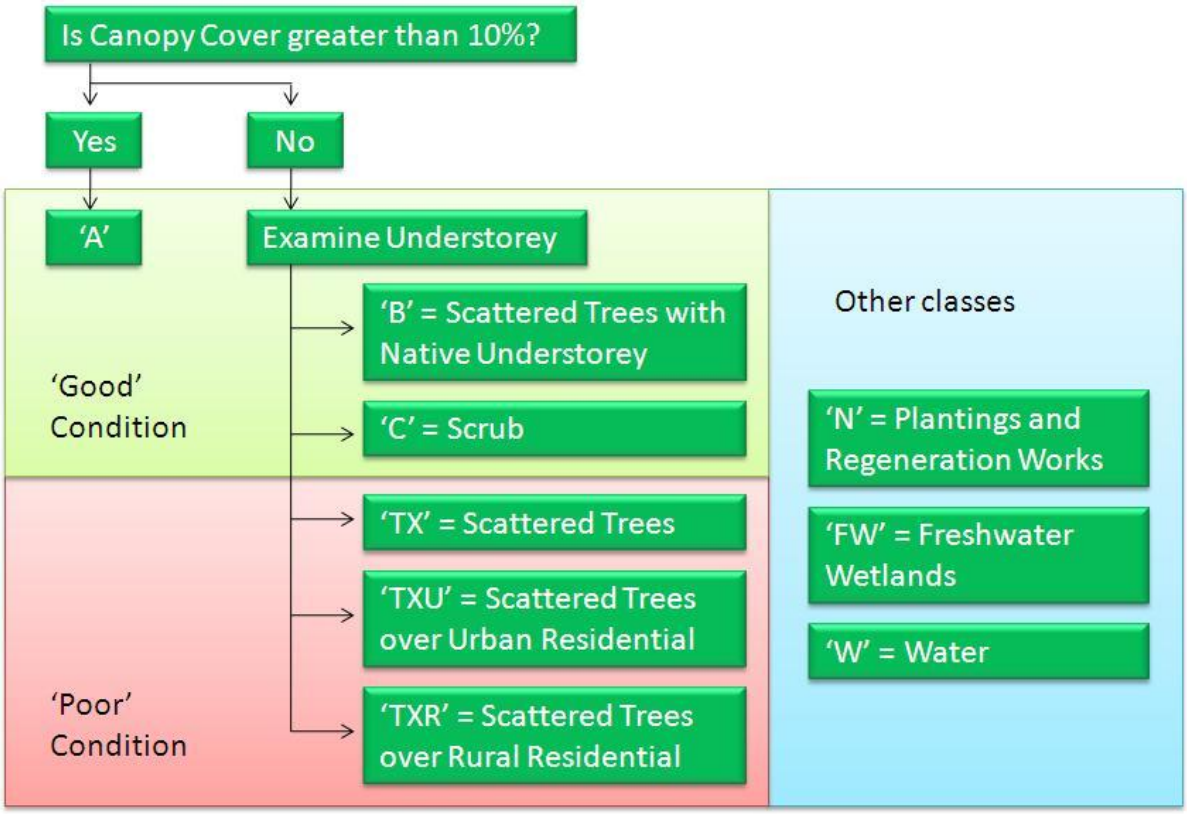
It is highly recommended that Council undertake field validation of all vegetation communities mapped as present to ensure accuracy of vegetation community types listed and mapped in the LGA, and to define a vegetation community for those areas that are currently unclassified.

5.13 VEGETATION CONDITION

The original Vegetation Condition in the Liverpool Council vegetation dataset (based on the NPWS 2002 mapping data) was used as a basis for vegetation condition. During the process of validating extant versus cleared vegetation, an attempt was made to also validate vegetation condition. No changes were made due to the difficulty in determining vegetation condition via desktop mapping only. Given the ability of undisturbed vegetation to grow and canopy cover to expand, it is highly recommended that field validation be conducted to ensure accuracy of vegetation condition information.

The decision tree followed for the assigning of vegetation condition classes is presented in Figure 9.

Figure 9: Decision tree for assigning Vegetation Condition Classes



5.14 VEGETATION PATCH SIZE

Patch size was generated by applying a buffer of 8 metres to all extant vegetation and then dissolving this data into discrete patches. A "Patch ID" number and the area in hectares of each Patch was then added to the attribute table of the "Extant Vegetation" data layer.

The Patch size map was prepared using the following categories:

- 0-1 ha
- >1-2 ha
- >2-5 ha
- >5-10 ha
- >10-100 ha
- >100 ha

5.15 CONSERVATION SIGNIFICANCE ASSESSMENT

A Conservation Significance Assessment uses vegetation community mapping and supporting ecological information to evaluate a number of biodiversity variables as being present or absent for each mapped polygon (area) of vegetation. The evaluation produces a *relative* ranking of areas of native vegetation in terms of their ecological significance and contribution to overall biodiversity values and resources. Traditionally these categorises are defined as follows:

CORE: These lands are considered significant to achieving the local conservation management goals and should be protected. These lands can be further subdivided into Regional Core, Local Core and Core (Urban Remnant).

SUPPORT FOR CORE: These patches are in *relatively* poorer condition (compared to Core lands and based on pre-determined criteria) but are adjacent to Core lands. They have values in buffering, and in the longer term with adequate management, increasing the size of Core lands. They should be retained and where possible, protected and restored. If clearing is unavoidable, loss of vegetation on these lands should be offset accordingly.

RIPARIAN CORRIDOR: These streamside areas of vegetation provide valuable stream-bank habitat, prevent soil erosion and downstream sedimentation and provide an important area transitional link between terrestrial and aquatic habitat.

REGIONAL CONNECTIVITY: Areas of vegetation that contain or are in close proximity to remnant vegetation of a large size and represent the best opportunities to consolidate existing vegetation into large blocks of habitat through acquisition, restoration and revegetation.

OTHER Native vegetation: Native vegetation that does not fall into the above categories but is considered important for the maintenance and improvement of biodiversity values. This category also includes native vegetation of which the composition and hence vegetation community is yet to be determined without field validation.

Overall conservation objectives for these lands, i.e. what they aim to achieve, are presented in **Table 10: Objectives for lands of Conservation Significance** below.

The following rule sets were developed and utilised to determine the appropriate conservation significance class and also to help generate the objectives listed above for each class.

(i) Regional Core Lands

CONDITION	COMMUNITY	PATCH SIZE	CONNECTIVITY
ABC	Critically Endangered Ecological Communities	All	
	Threatened and Endangered Ecological Communities	>10 ha	
	Non Listed Communities	>100 ha	
	Non Listed Communities	<100 ha	Adjacent to other core (15 metre adjacency rule)
TX, TXR	Critically Endangered Ecological Communities	All	
Any	Freshwater Wetlands (Coastal freshwater lagoons of the Sydney Basin and SE Corner)	All	

There are 10,322 ha of "Regional Core" vegetation mapped in Liverpool LGA.

(ii) Local Core Lands

CONDITION	COMMUNITY	PATCH SIZE	CONNECTIVITY
ABC	Threatened and Endangered Ecological Communities	2-10 ha	

There are 164 ha of "Local Core" vegetation mapped in Liverpool LGA.

(iii) Core Urban remnants

CONDITION	COMMUNITY	PATCH SIZE	CONNECTIVITY
TXU	Critically Endangered Ecological Communities	All	

There are 124 ha of "Core – Urban Remnant" vegetation mapped in Liverpool LGA

(iv) Support for Core

CONDITION	COMMUNITY	PATCH SIZE	CONNECTIVITY
TX, TXR	Threatened and Endangered Ecological Communities (other)	All	Adjacent to core (15 metre adjacency rule)
	Non Listed Communities		

There are 30 ha of "Support for Core" vegetation mapped in Liverpool LGA.

(v) Other Native Vegetation

The remainder of native vegetation to be classified as "Other Native Vegetation"

There are 102 ha of "Other Native" vegetation mapped in Liverpool LGA.

(vi) For "***Unclassified***" vegetation, Conservation Class is mapped as "Unknown".

There is 166 ha of "unknown' vegetation mapped in Liverpool LGA.

5.16 REGIONAL CONNECTIVITY

Vegetation mapped "Regional Connectivity" includes:

- All Regional Core Vegetation
- All Local Core Vegetation
- All vegetation adjacent to Regional Core or Local Core Vegetation (using 15 metre adjacency rule).

There are 10,506 ha mapped as "Regional Connectivity".

5.17 RIPARIAN CORRIDORS

This map illustrates the "Riparian Corridors" as per LCCs' DCP (2008) requirements (Part 1.1 (Section 7 Development near Creeks and Rivers). These requirements include the provision of a buffer of at least 40m on each bank (measured from Top of Bank) for all watercourses, and for watercourses with a Strahler Stream Order greater than 2, a 50 m buffer is required.

There is 10, 165 ha of land mapped as riparian corridor within Liverpool LGA.

Liverpool Biodiversity Management Plan- Conservation Class

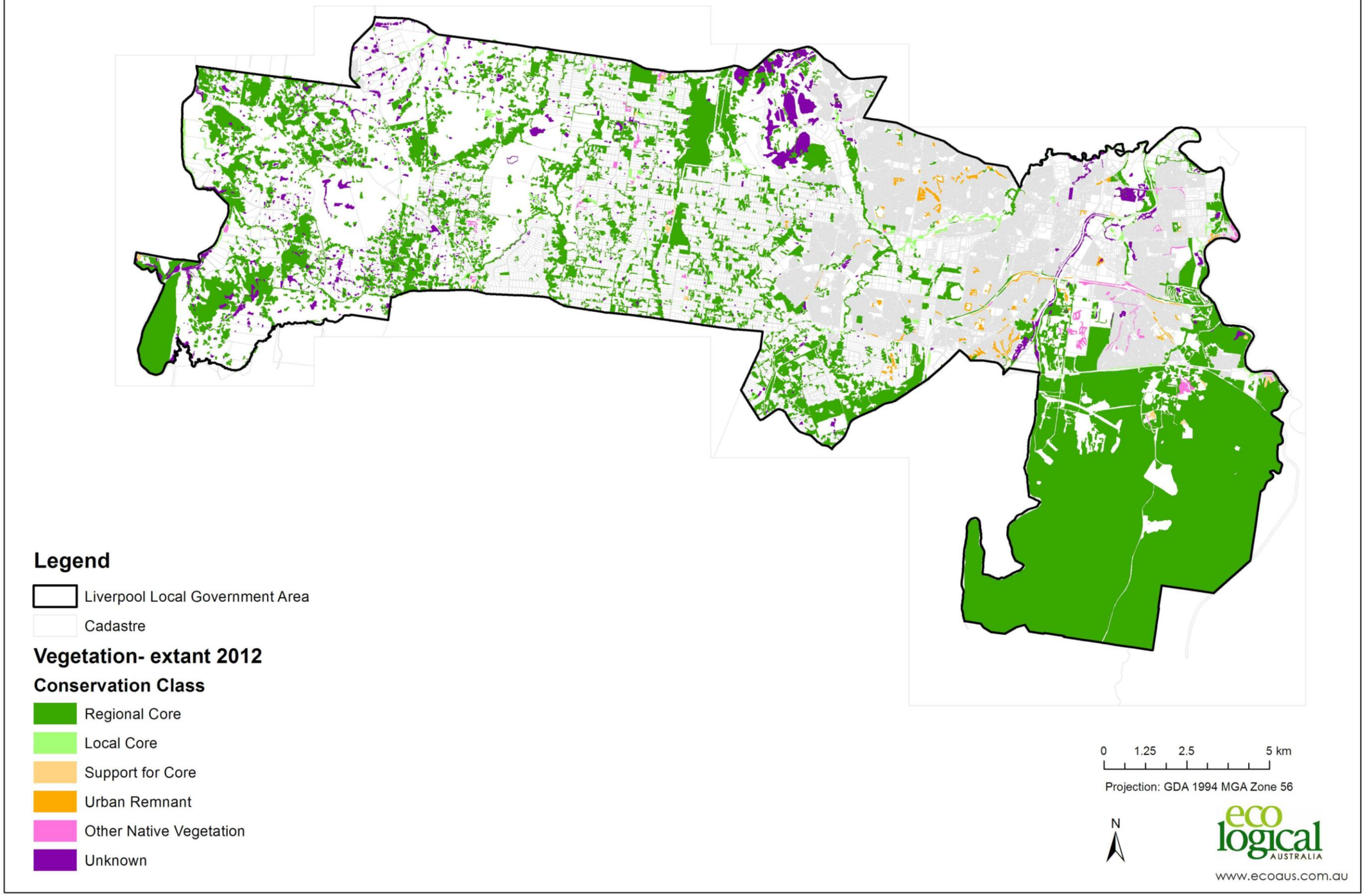
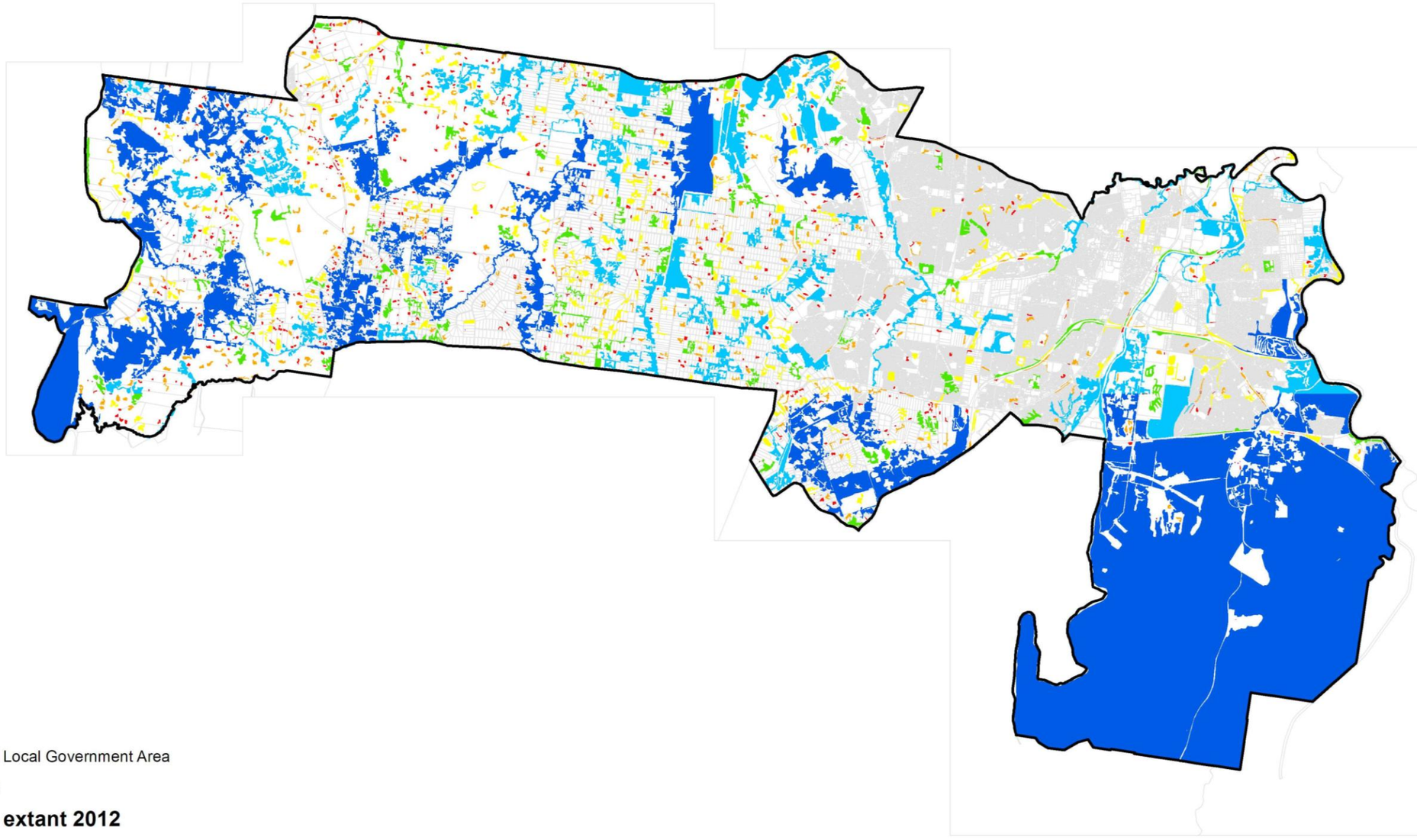


Figure 10: Conservation Significance Assessment land classes

Liverpool Biodiversity Management Plan- Patch Area



Legend

- Liverpool Local Government Area
- Cadastre

Vegetation- extant 2012

PATCH_HA

- 0 - 1
- >1 - 2
- >2 - 5
- >5 - 10
- >10 - 100
- >100

0 1.25 2.5 5 km

Projection: GDA 1994 MGA Zone 56

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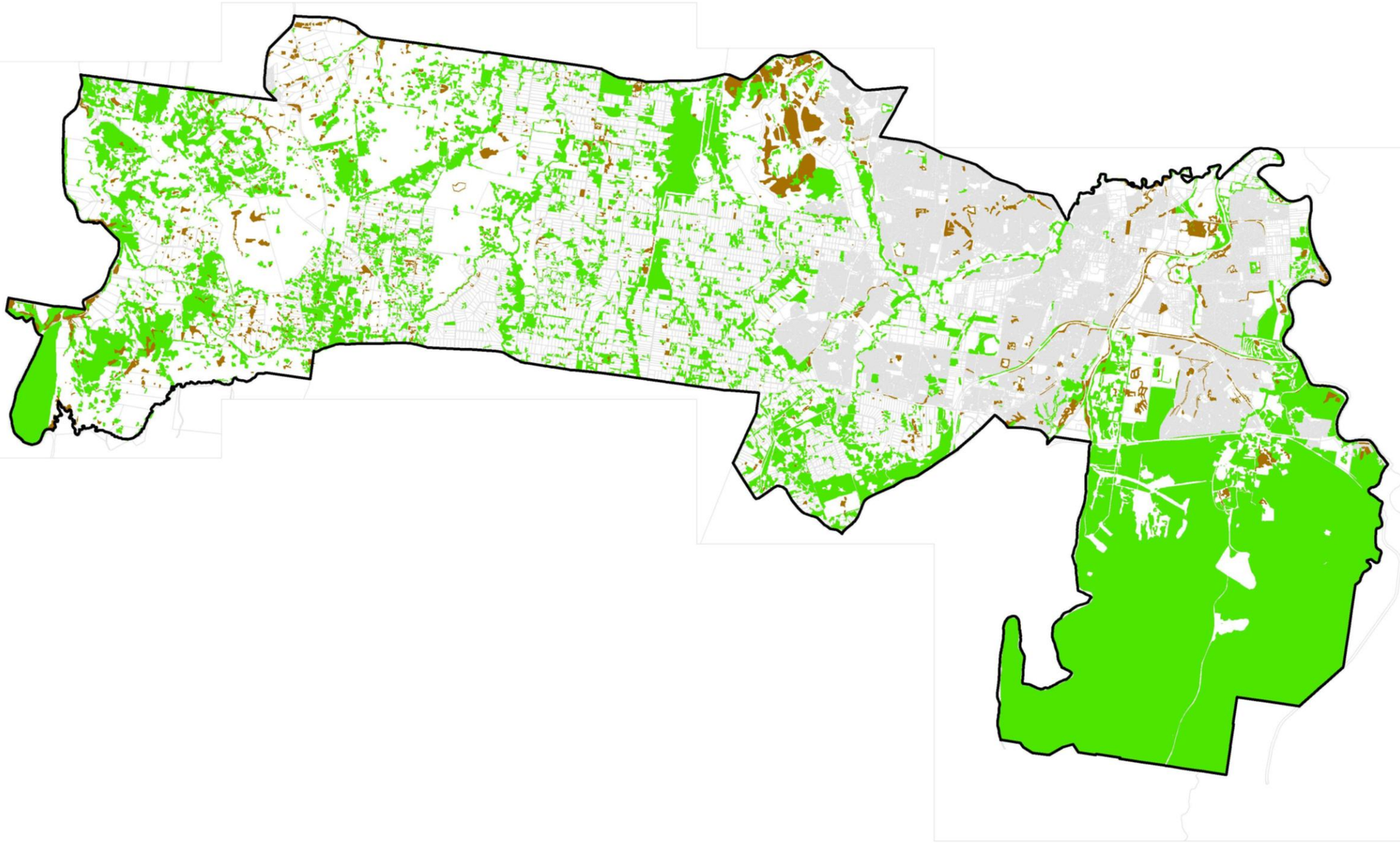
Figure 11: Patch Size of Remnant Native Vegetation

Liverpool Biodiversity Management Plan- Regional Connectivity



Legend

- Liverpool Local Government Area
- Cadastre
- Regionally Connected Vegetation
- All other vegetation

0 1.25 2.5 5 km

Projection: GDA 1994 MGA Zone 56

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Figure 12: Regional Connectivity

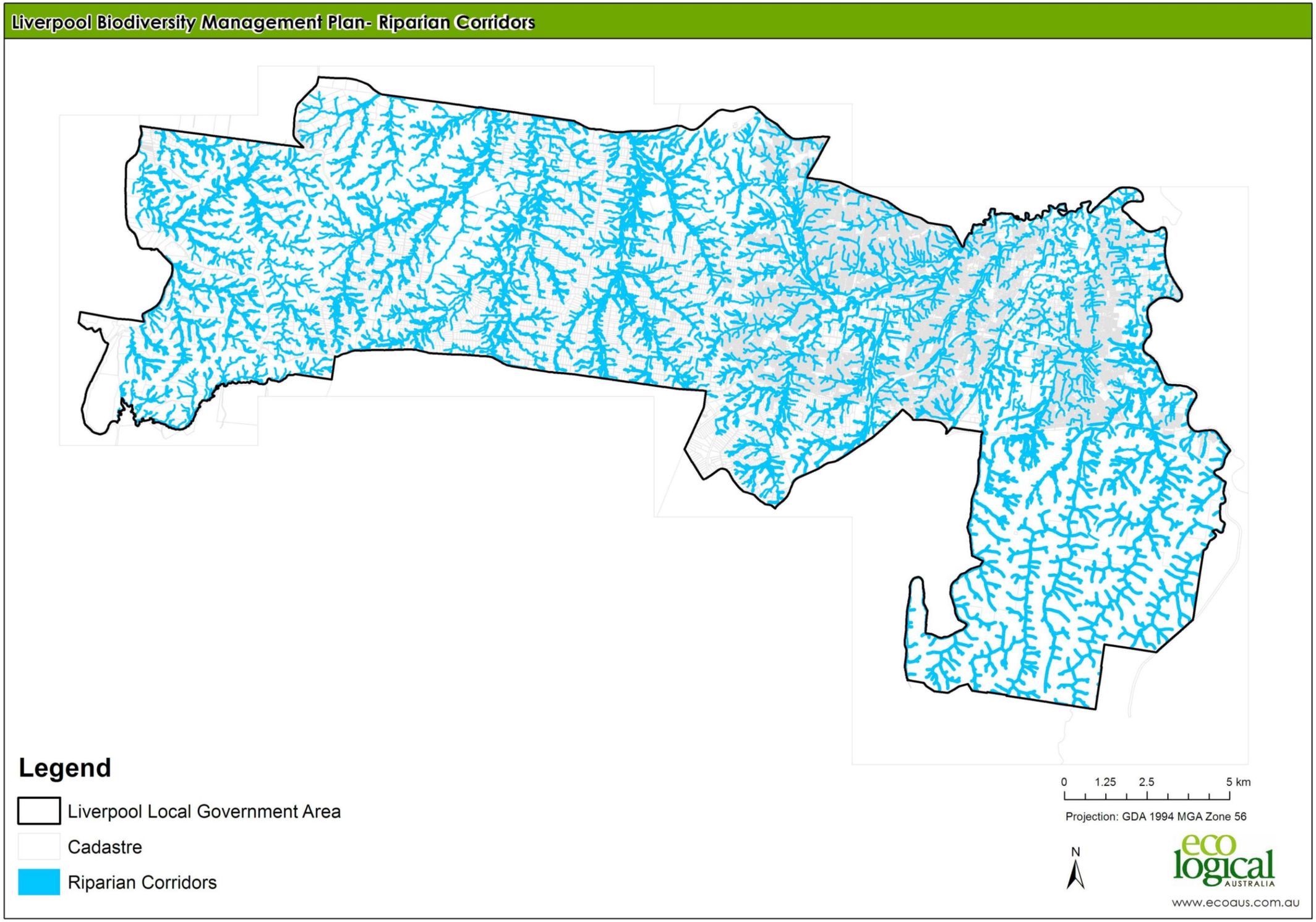

Figure 13: Riparian Corridors

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