Conservation Plan
for the
Yarrawonga Landscape Zone

Biodiversity Action Planning in the Shepparton Irrigation Region

Department of Sustainability and Environment
Department of Primary Industries

Developed By:

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Front cover: River Red Gums (Eucalyptus camaldulensis), Chinaman's Lagoon, Cobram East (Rebecca Heard 2005).
Inset & Page Banner: Grey-crowned Babbler (Pomatostomus temporalis) (Daniel Hunter 2006).

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EXECUTIVE SUMMARY

The **ultimate aim** of Biodiversity Action Planning (BAP) is to achieve broad-scale conservation of native biodiversity. BAP identifies priorities for the conservation of native biodiversity, as part of the implementation of the Victorian Biodiversity Strategy 1997. It is not a 'stand-alone' project; rather a process for translating objectives set out in Victoria's Biodiversity Strategy to Regional, Catchment and Local level (Victoria's Biodiversity Strategy fulfils a statutory requirement under Section 17 of the *Flora and Fauna Guarantee Act 1988* and provides the biodiversity action plan for Victoria).

To **translate objectives** from State to Regional, Catchment and Local Landscape level, Victoria was first divided on a bioregional basis (bioregions) and then at a Landscape level (landscape zones). The 'Murray Fans Bioregional Plan' and the 'Shepparton Irrigation Region North Landscape Zone Plan' outline biodiversity priorities at the bioregional level. This 'Conservation Plan for the Yarrawonga Landscape Zone' has been developed at the local (Landscape) level and is intended to assist government agencies (primarily extension staff) and the community, to work in partnership towards achieving Catchment targets, by setting priority areas for protection and enhancement of native biodiversity. This Plan is also intended to enable biodiversity priorities, data and advice, to be disseminated through existing planning processes, to landholders and agencies.

The **methodology** used to develop this Plan is according to the 'Developer's Manual for Biodiversity Action Planning in the Goulburn Broken Catchment (GBCMA 2004a)'. Two important components of the BAP process are the 'focal species' approach and the 'key biodiversity assets' approach. The **focal species** approach uses the habitat requirements of a particular species, or a group of species, to define the attributes that must be present in a landscape, for these species to persist. Seven focal species have been identified in the Zone including Grey-crowned Babbler (*Pomatostomus temporalis*), Bush Stone-curlew (*Burhinus grallarius*), Superb Parrot (*Polytelis swainsonii*), Diamond Firetail (*Stagonopleura guttata*), Tree Goanna (*Varanus varius*), Brolga (*Grus rubicunda*) and Murray Cod (*Maccullochella peelii peelii*).

The **key biodiversity asset** approach is a method of grouping biodiversity assets (e.g. birds, animals and plants) that use the same type of habitat. Seven key biodiversity assets were identified for the Yarrawonga Landscape Zone including, Waterways, Wetlands, Public Land, Plains Woodlands, Riverine Woodlands, Open Woodlands/Grasslands and Sand Woodlands. The grouping of these assets will assist in targeting the Very High value sites first, down to the lowest priority sites.

The **Yarrawonga Landscape Zone** is located within the Goulburn Broken Catchment of Victoria. The Zone, which is approximately 111,830 hectares, is within the Murray Fans Bioregion and the Local Government area of Moira Shire. Since European settlement much of the vegetation in the Zone has been cleared, leaving a fragmented landscape, with many of the remnant that remains being highly modified.

Two hundred and sixty-six **priority environmental sites** have been identified within the Yarrawonga Landscape Zone. The priority sites have been determined and ranked (Very High, High, Medium or Low) based on factors such as; size, quality, Ecological Vegetation Class (EVC) conservation status, threatened species, landscape context and field surveying. These sites contain remnant vegetation and vary greatly in size, from a stand of paddock trees, to areas such as the Barmah State Forest. In general, the surveyed sites within the Zone were found to have low understorey or fallen timber and a high component of pest plants and animals.

Management actions (advisory only) have been developed for the Yarrawonga Landscape Zone, based on the results of desktop analysis and surveying. It is intended that government agencies and the community, work together to incorporate these actions, into existing documents, for the benefit of biodiversity conservation in the Yarrawonga Landscape Zone, as well as the Shepparton Irrigation Region and the Goulburn Broken Catchment.

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1.0 BACKGROUND

1.1 INTRODUCTION

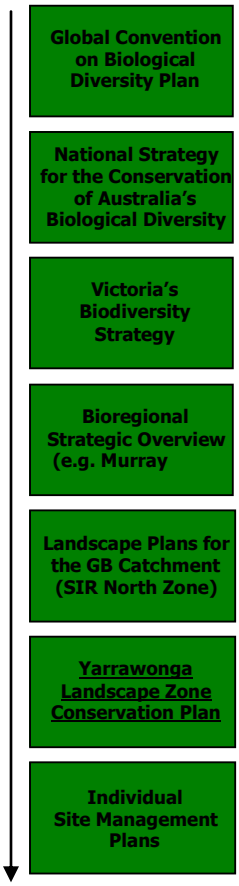

Figure 1: BAP Process

The ultimate aim of Biodiversity Action Planning (BAP) is to achieve broad-scale conservation of native biodiversity. BAP identifies priorities for the conservation of native biodiversity as part of the implementation of the Victorian Biodiversity Strategy (Crown 1997). In particular, it aims to;

- Conserve native biodiversity[1] by maintaining viable examples of the range of ecosystems that occur naturally in Victoria,
- Promote a more strategic and cost-effective expenditure of public funds for the protection, restoration and ongoing management of priority biodiversity sites, and
- Achieve community support for biodiversity landscape planning and the conservation of strategic assets in rural landscapes (Platt & Lowe 2002).

In order to achieve these aims, effective planning for native biodiversity also requires detailed planning at a Bioregional and Landscape level. Therefore, Victoria was first divided on a Bioregional basis (Appendix 1) and then at a Landscape level (Landscape Zones) (Appendix 2).

At the Regional scale the 'Bioregional Strategic Overview for the Murray Fans Bioregion' and more specifically (to the Shepparton Irrigation Region (SIR)), the 'Landscape Plan for the Goulburn Broken Catchment – SIR - North Zones', identify the broad priorities for biodiversity conservation in the Region. They also provide the foundation for producing detailed plans, such as the 'Conservation Plan for the Yarrawonga Landscape Zone' (Ahern *et al* 2003). At the Landscape level, this Plan is intended to provide a biodiversity conservation resource for the community. Figure 1 illustrates the BAP process and where the Conservation Plan for the Yarrawonga Landscape Zone (as per underlined) fits within a policy context.

1.2 OBJECTIVES

The 'Conservation Plan for the Yarrawonga Landscape Zone' has been developed at the local (Landscape) level and is intended to assist agencies and the community, to work in partnership towards achieving Catchment targets and set priority areas for the protection and enhancement of native biodiversity. This Plan aims to assist in private and public resources being expended and targeted to priority sites for priority actions. It identifies 266 priority sites, ranging across Very High, High, Medium or Low value. The protection and management of these priority sites is important for the conservation of flora and fauna in the Zone. This Plan is intended primarily for use by extension officers, as well as the community, to guide the strategic and coordinated management of conservation in the area.

Broadly, this Plan details;

- The landscape, vegetation and significant flora and fauna of the Yarrawonga Landscape Zone,
- Conservation vision for the Yarrawonga Landscape Zone,
- Priority assets to be conserved, their biodiversity value and threatening processes,
- Actions to protect and restore these assets, and
- Monitoring opportunities for the Zone.

[1] Biodiversity: the natural variety of life: the sum of our native plants and animals, the genetic variations they contain, and the natural ecosystems they form (GBCMA 2000).

1.3 A VISION FOR CONSERVATION

The Goulburn Broken Regional Catchment Strategy (RCS) identifies a vision for biodiversity in the Catchment. The vision is that "the community will work in partnership with Federal and State Governments and other agencies, to protect and enhance ecological processes and genetic diversity, to secure the future of native species of plants, animals and other organisms in the Catchment" (GBCMA 2003a p87). The Conservation Plan for the Yarrawonga Landscape Zone aims to assist in achieving this vision through providing a strategic coordinated approach, for the conservation of priority assets.

The RCS also identifies targets and priorities for the Catchment (refer to Appendix 3 for further detail). It is intended that the actions outlined in this Plan will complement the targets of the RCS and other policy/strategies pertinent to the State, Catchment and Region (e.g. Victoria's Native Vegetation Management – A Framework for Action (NRE 2002a); Goulburn Broken Native Vegetation Management Plan (GBCMA 2000); and the Victorian River Health Strategy (NRE 2002b)). This Plan is also intended to integrate such policies (e.g. targets and legislative requirements) into the one document, for use by local communities. For example this Plan incorporates aspects of legislation (e.g. Action Statements prepared under the *Flora and Fauna Guarantee Act 1988*), into recommended on-ground actions, for the conservation of threatened species and communities.

The BAP process uses current scientific knowledge to produce an 'ideal' landscape for biodiversity conservation. This 'ideal' landscape provides for the current levels of species abundance, diversity and interactions. BAP attempts to take a strategic approach to the conservation of threatened and declining species and vegetation types, by looking for opportunities to conserve groups of species in appropriate or 'ideal' ecosystems (Platt & Lowe 2002). The approaches used in BAP (e.g. focal species and assets) also provide additional tools for the community and allow for the use of principles of landscape ecological science to conserve biodiversity. It is therefore intended that this Conservation Plan for the Yarrawonga Landscape Zone will assist government agencies and the community to work in partnership towards achieving Catchment targets and an 'ideal' landscape, by setting priority areas for protection and enhancement of native biodiversity.

This Plan is not intended to be a method of 'taking over' land, but rather a resource document that assists with identifying priority assets and methods of action, to protect or restore valuable assets, through voluntary extension principles. This document may be used by agencies and community groups for informing existing projects and for strategic planning. However, it must be remembered that this document is by no means 'comprehensive', as the BAP process relies on the regular updating of information, to keep it accurate and timely. This Plan has therefore been developed to be adaptive so as to enable management actions and information to be modified, in response to further information (e.g. monitoring). This Plan also forms the basis for the explanation of the BAP process and the associated mapping tool.

Therefore this Plan will be reviewed when necessary to ensure that it remains a 'living' document. It is also intended that extension staff will utilise Geographical Information System (GIS) programs, databases and other agency staff, to fully identify and understand the BAP process and to provide further information to the community. Consultation (refer to Appendix 4) and extension with relevant stakeholders, including agencies and community groups, was conducted (and will continue to occur) throughout the development and implementation of this Plan. A Communication Plan was also developed in order to guide Biodiversity Action Planning. In summary, it is envisaged that this Plan will be a valuable resource for identifying priority biodiversity sites and initiating further conservation works in the Zone and that at a later stage will lead to further sites and projects being identified by interested individuals and groups.

2.0 THE STUDY AREA

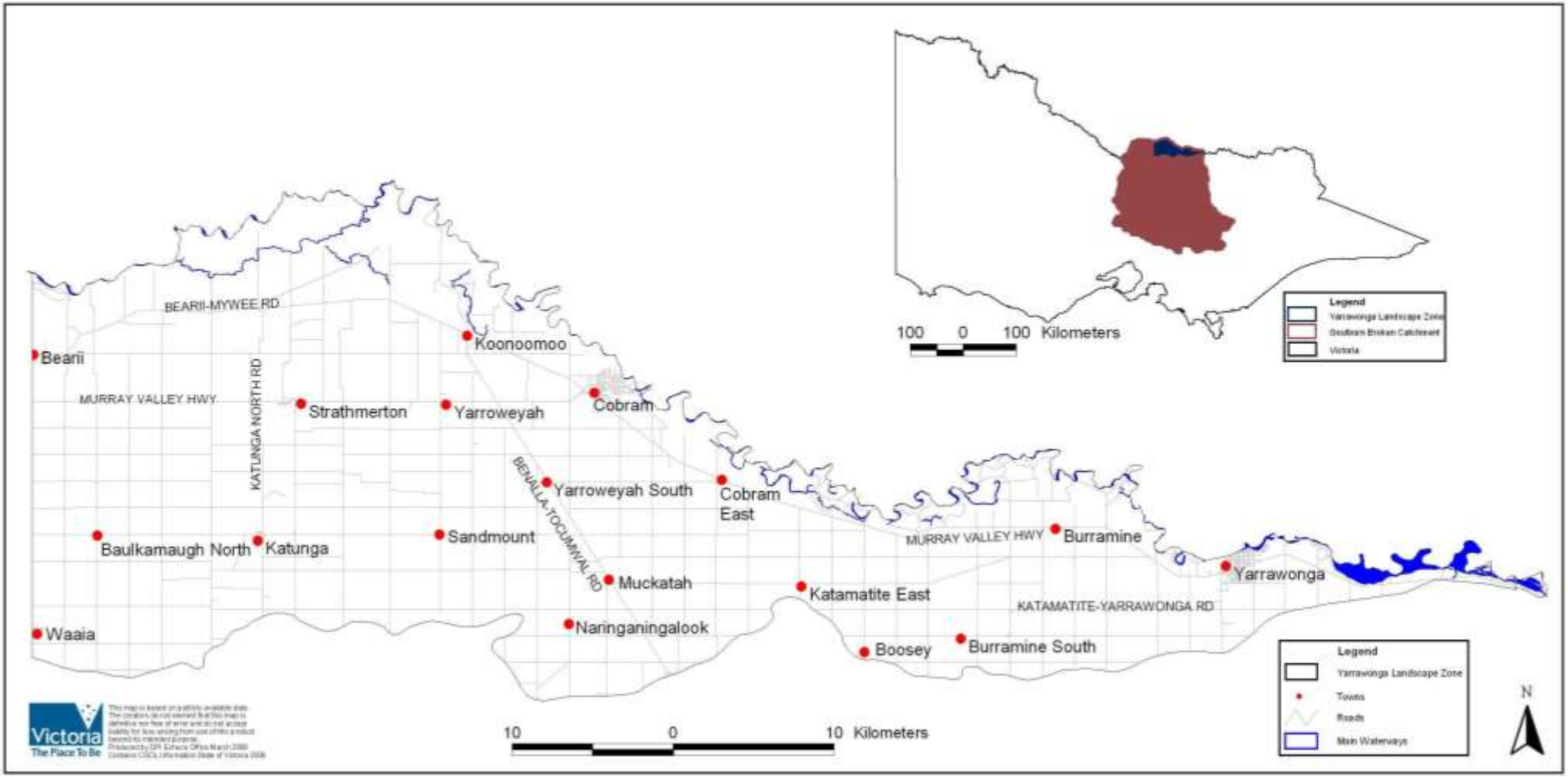

Figure 2a: (Main) Yarrawonga Landscape Zone
Figure 2b: (Inset) Victoria, with the Goulburn Broken Catchment and the Yarrawonga Landscape Zone

2.1 LANDSCAPE

The Yarrawonga Landscape Zone (Figure 2a) is located within the Goulburn Broken Catchment of Victoria (Figure 2b). The Zone (approximately 111,830 hectares) falls within the Murray Fans Bioregion and the Local Government area of Moira Shire. It is bounded to the North by the Murray River, to the South by the Murray Fans Bioregional boundary and to the West by the Waaia-Bearii Road. Bundalong (South of Lake Mulwala) is at the Eastern extremity of the Zone. The Murray Valley Highway and the Goulburn Valley Highway are the major regional roads traversing the Zone (Ahern *et al* 2003).

The Zone is comprised of two main land systems – floodplain and riverine plain. Both land systems consist of quaternary alluvial sediments, with the floodplain deposits being more recent (LCC 1983). The floodplain landform is approximated by the distribution of River Red Gum *(Eucalyptus camaldulensis*) forests along the Murray River. The riverine plain occupies most of the Zone, and is characteristically well-drained, with leveed prior streams and wind-blown sand dunes (Ahern *et al* 2003).

The entire Zone lies within the Broken River Basin (LCC 1989). It is a relatively flat plain, and is serviced by an extensive network of drains and irrigation channels. Irrigation is primarily delivered from the Yarrawonga Weir, via the Yarrawonga channel, with most outflows leading back to the Murray River. However a natural East-west drainage line (the Muckatah Depression) also exists across the southern end of the Zone and drains South-east of Yarrawonga, toward the Broken Creek (Ahern *et al* 2003).

Private land covers approximately 90% of the Zone, with extensive clearing having taken place, predominantly in the South and East of the Zone. The native vegetation remaining on private (freehold) land in these parts of the Zone is highly fragmented, and usually occur as isolated remnants. Larger stands of remnant vegetation, predominantly River Red Gum, are evident on private land, primarily toward the North of the Zone (e.g. around Bearii, Mywee and Koonoomoo). Within the freehold land area, land use is varied due to the differing soils and the large extent of the Zone (e.g. from Waaia to Bundalong). Some examples of land-use include dairy, cropping, mixed cropping and grazing (sheep and beef), horticulture, sheep and alternative farming (e.g. honey production and yabbies) (Ahern *et al* 2003).

Public land covers the remaining 10% of the Zone and is predominantly associated with the floodplain land systems, along the Murray River (e.g. reserved forests - Barmah State Park). This is due to the floodplain's periodic flooding and heavier soils, making it generally less suitable for farming purposes. Other public land areas within the Zone include creek frontages (e.g. Ulupna Creek), roadsides (e.g. Murray Valley Highway and Old Coach Road) and Bushland/Rail Reserves (e.g. H42 & Strathmerton-Mywee Rail Reserve). Some other notable public land areas within the Zone include River Murray Reserve, Regional Parks (Cobram, Tocumwal, Yarrawonga), Big Reedy Lagoon Wildlife Reserve and Lake Mulwala (Ahern *et al* 2003).

Plate: River Red Gums (Eucalyptus camaldulensis) on public land in the Barmah Forest

2.2 VEGETATION

Ecological Vegetation Class (EVC) is a vegetation classification system, derived from groupings of vegetation communities based on floristic, structural and ecological functions. Mosaics (combinations of EVCs) are a mapping unit, where the individual EVCs could not be separated, at the scale of 1:100,000 (Berwick, 2003).

Prior to European settlement, approximately 20 EVCs[2] were known to have been present within the Yarrawonga Landscape Zone (Figure 3). The floodplain system consisted of a mixture of River Red Gum (*Eucalyptus camaldulensis*) dominated EVCs, including Riverine Grassy Woodland/Sedgy Riverine Forest/Wetland Formation Mosaic, flanked in places by patches of Sand Ridge Woodland. Parts of the Riverine Plain directly adjacent to the floodplain system (e.g. Bearii and Mywee area) typically supported Riverine Grassy Woodland, Riverine Chenopod Woodland or Riverine Grassy Woodland/Plains Woodland/Riverine Chenopod Woodland Complex. More southerly parts of the riverine plain would have typically supported Plains Woodland, Riverine Grassy Woodland/Riverine Chenopod Woodland/Wetland Mosaic, or Shallow Sand Woodland/Plains Woodland Mosaic (Ahern *et al* 2003).

Plains Woodland communities on the riverine plains would typically have consisted of open woodlands, with an understorey of scattered shrubs and a high species diversity of grasses, lilies, orchids, herbs and sedges. The overstorey component was generally comprised of Grey Box (*Eucalyptus microcarpa*), White Box (*Eucalyptus albens*) and/or Yellow Box (*Eucalyptus melliodora).* Wattles (*Acacia spp*) and Pea species provide the majority of the understorey component, whilst the groundcover was generally composed of grasses (e.g. *Austrodanthonia* and *Stipa spp*) and chenopods (e.g. *Atriplex spp*) (Berwick, 2003).

Creekline Grassy Woodland and Drainage Line Complex EVC were typically located along ephemeral drainage lines (e.g. creeks) on the riverine plains and floodplains. The creeks and major depressions typically supported an overstorey of River Red Gum, an understorey of Wattles and were generally lined with tall sedges (e.g. *Carex spp*). The Drainage Line Complexes typically varied from grassy wetlands to open herblands, sedgelands and may have developed to Red Gum Wetlands in some areas (Berwick, 2003).

Plains Wetlands typically differed in their structure due to seasonal and temporal variations. Red Gum Wetlands were typically dominated by River Red Gum, sedges (e.g. *Eleocharis spp*) and rushes (e.g. *Juncus spp*). Plains Grassy Wetlands would have occurred in shallow depressions on the alluvial plains, where meanders of prior steams occurred. These shallow seasonal wetlands were typically treeless, with a grassland structure grading into sedgeland or herbland (Berwick, 2003).

The current extent of native vegetation in the Yarrawonga Landscape Zone has dramatically reduced (Figure 4) since European settlement. Figures 3 and 4 are included primarily to illustrate the comparison between the vegetation cover from European settlement to the current extent. Table 1 further identifies the EVCs in the Yarrawonga Landscape Zone, including their Bioregional Conservation Status (BCS), their pre-European settlement extent and current (as of 2003) extent (in hectares and % cover). Table 1 also identifies the area of 'Private Land No Tree Cover' and Unknown/Unclassified EVCs (Ahern *et al* 2003).

The Goulburn Broken Regional Catchment Strategy (RCS) identifies goals and targets that have been set for the vegetation communities within the Catchment (Appendix 3). This includes "increasing the cover of all 'Endangered' and 'Vulnerable' (where applicable[3]) EVCs to at least 15% of their pre-European vegetation cover by 2030" (GBCMA 2003a). The majority of EVCs within the Yarrawonga Landscape Zone are below the 15% target (Table 1) and are therefore considered 'Endangered' (17) or 'Vulnerable' (3) at the Bioregional level (Ahern *et al* 2003).

[2] For further information on each EVC, refer to the Department of Sustainability and Environment website at www.dse.vic.gov.au
[3] Applicable to Ecological Vegetation Classes that are 'Vulnerable' and are below 15%

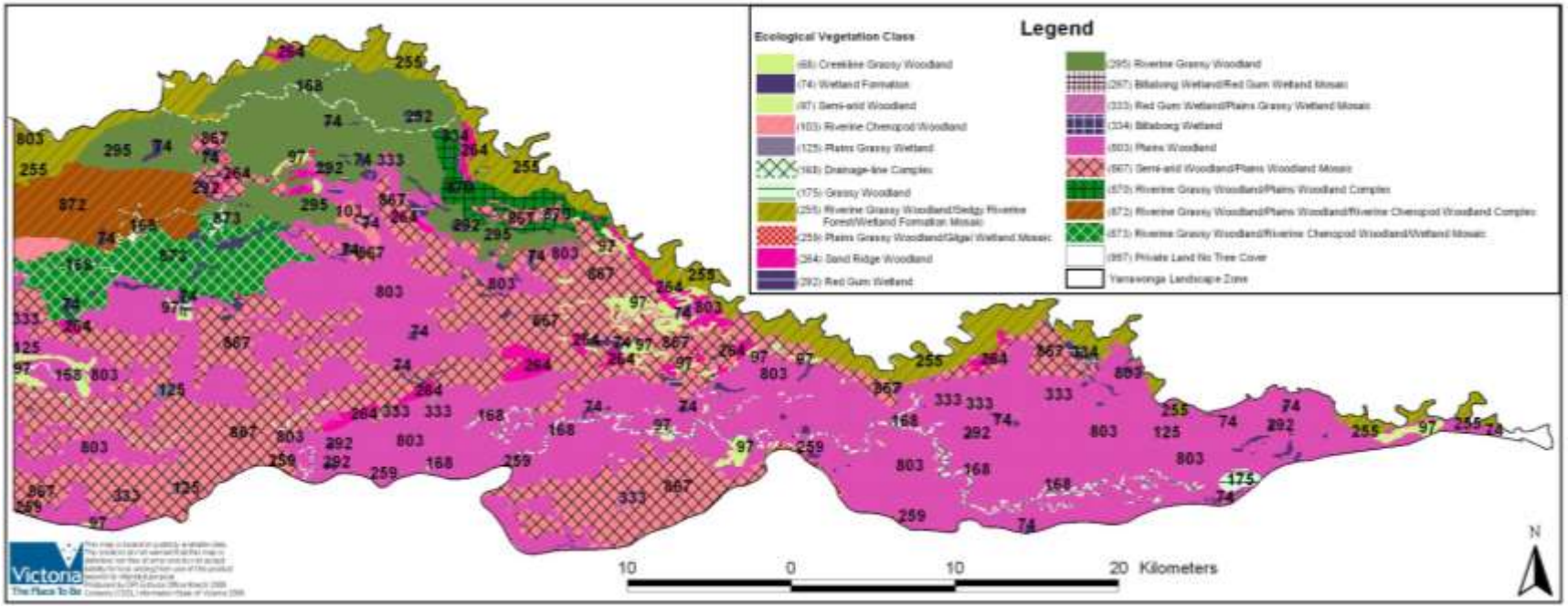

Figure 3: Pre-European Native Vegetation Cover in the Yarrawonga Landscape Zone

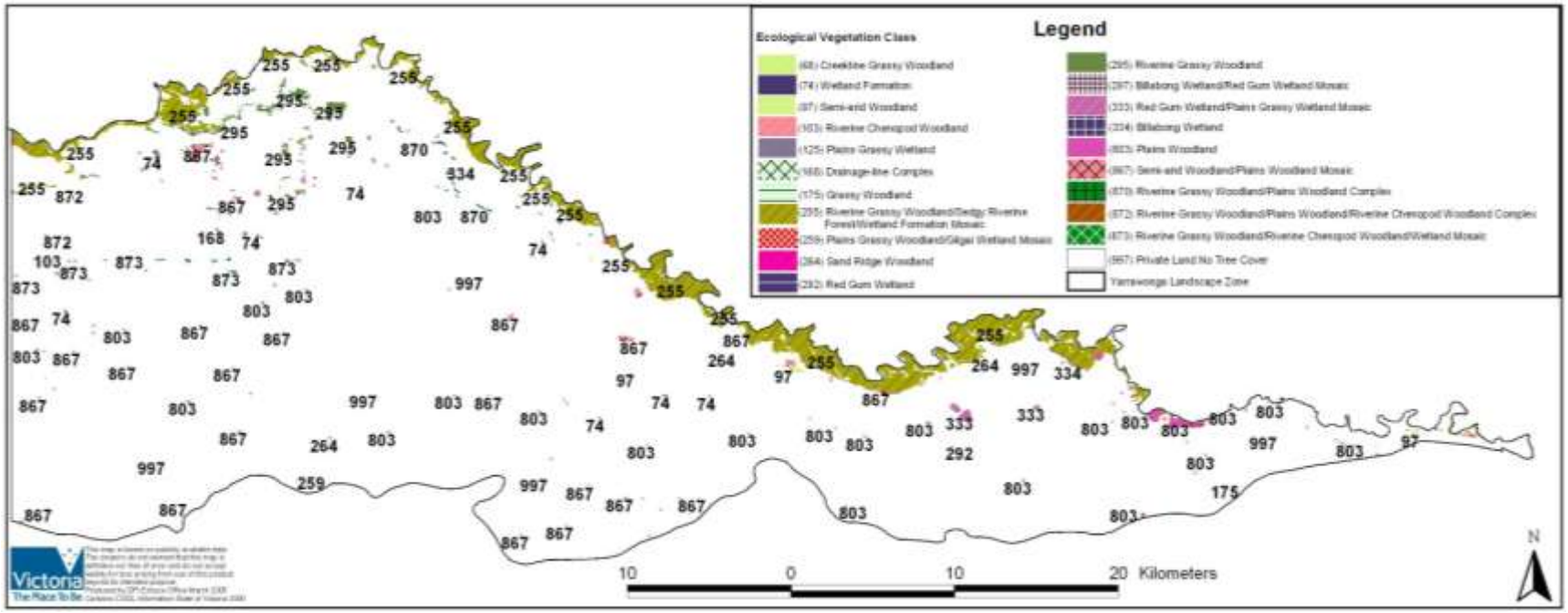

Figure 4: Current Extent of Native Vegetation Cover in the Yarrawonga Landscape Zone

Table 1: Yarrawonga Landscape Zone - Ecological Vegetation Classes (pre-1750 and current)

EVC Number	EVC Bioregional Conservation Status	Ecological Vegetation Class (EVC) Name#	Pre-1750 Vegetation Area (ha) *	Current Area of Vegetation (ha)*	Current Area of Vegetation (%)	Catchment (15%) Target (ha)*
68	E	Creekline Grassy Woodland	<1	<1	<1	<0.15
74	E	Wetland Formation	1499	33	2.20%	225
97	V	Semi-arid Woodland	2109	51	2.42	316
103	E	Riverine Chenopod Woodland	572	2	0.35%	86
125	E	Plains Grassy Wetland	164	0	0.00%	25
168	E	Drainage Line Complex	1813	115	6.34%	272
175	E	Grassy Woodland	198	0	0.00%	30
255	V	Riverine Grassy Woodland/Sedgy Riverine Forest/Wetland Formation Mosaic	9510	5223	54.92%	1427
259	E	Plains Grassy Woodland/Gilgai Wetland Mosaic	235	<1	<1	35
264	E	Sand Ridge Woodland	2048	24	1.17%	307
292	E	Red Gum Wetland (Swamp)	408	6	1.47%	61
295	V	Riverine Grassy Woodland	10710	409	3.82%	1607
297	E	Billabong Wetland/Red Gum Wetland Mosaic	32	0	0.00%	5
333	E	Red Gum Wetland/Plains Grassy Wetland Mosaic	386	63	16.32%	58
334	E	Billabong Wetland (Aggregate)	174	28	16.09%	26
803	E	Plains Woodland	46809	247	0.53%	7021
867	E	Shallow Sand Woodland/Plains Woodland Mosaic	26846	233	0.87%	4027
870	E	Riverine Grassy Woodland/Plains Woodland Complex	1410	32	2.27%	212
872	E	Riverine Grassy Woodland/Plains Woodland/Riverine Chenopod Woodland Complex	3599	15	0.42%	540
873	V	Riverine Grassy Woodland/Riverine Chenopod Woodland/Wetland Mosaic	4355	46	1.06%	653
		TOTAL	**112877**	**6527**	**5.78%**	**16932**
997	NA	Private Land No Tree Cover	0	104991	N/A	N/A
999	NA	Unknown/Unclassified	257	256	N/A	N/A
Table Information including column A & B modified from Ahern *et al* 2003 & CGDL 2005			*A*	*B*	*C*	*D*

Column C derived from (column B divided by column A) multiplied by 100 (for %)

Column D derived from (column A divided by 100) multiplied by 15

* *Rounded to Nearest Whole Number*

\# *EVC names have altered since Ahern et al 2003 & are listed according to current corporate date (CGDL 2005)*

Explanation of Terms:

- 'EVC Number' - the unique number attributed to that EVC in available literature (e.g. CGDL 2005).
- 'EVC Bioregional Conservation Status' (BCS) - the threatened status of the EVC. Endangered (E) means 'less than 10% of the pre-European extent remains and Vulnerable (V) is defined as 'less than 10-30% pre-European extent remaining' (Platt 2002).
- 'Ecological Vegetation Class (EVC) Name' - the name given to that unique community.
- 'Pre-1750 Vegetation Area' - vegetation cover (ha) prior to substantial clearance (e.g. Pre-European Settlement).
- 'Catchment (15%) Target (ha)' - the Goulburn Broken Regional Catchment Strategy target of "increasing the cover of all 'Endangered' and 'Vulnerable' EVCs to at least 15% of their pre-European vegetation cover by 2030" (GBCMA 2003a) (refer to Appendix 3 for further information).

2.3 SIGNIFICANT FLORA AND FAUNA

2.3.1 Flora

Plate: Chocolate Lily (Arthropodium strictum) – An example of a plant species recorded within the Yarrawonga Landscape Zone (NRE 2002e)

A range of native flora is found within the Yarrawonga Landscape Zone. Some overstorey species include River Red Gum (*Eucalyptus camaldulensis*), Grey Box (*Eucalyptus microcarpa*), Black Box (*Eucalyptus largiflorens*), Yellow Box (*Eucalytpus melliodora*), White Cypress-pine (Murray Pine) (*Callitrus glaucophylla*) and Buloke (*Allocasuarina luehmannii*). The range of small trees and shrubs includes species such as Lightwood Wattles (*Acacia implexa*), Mallee Wattle (*Acacia montana*), Golden Wattle (*Acacia pycnantha*), Gold-dust Wattle (*Acacia acinacea*), Emubush *(Eremophila longifolia*) and Lignum (*Muehlenbeckia spp*). The Zone also contains a range of groundcover plants including Wallaby Grass (*Austrodanthonia spp*) and Spear Grass (e.g. Corkscrew Spear-grass (*Austrostipa setacea*)), herbs (e.g. Leafless Bluebush (*Maireana aphylla*)) and Lilies (e.g. Chocolate Lily (*Arthropodium strictum*)). Plants that favour moist environments, such as Common Spike-Rush (*Eleocharis acuta*) and Nardoo (*Marsilea drummondii*) may also be found (Ahern *et al* 2003).

There are twenty-nine species of threatened flora recorded within the Yarrawonga Landscape Zone (NRE 2002e). These species are noted in Appendix 5, along with their threatened status (as per the Flora Information System), the State Level (*Flora and Fauna Guarantee Act (FFG Act) 1988*) and the National Level (*Environmental Protection and Biodiversity Conservation Act (EPBC) 1999*) (Ahern *et al* 2003).

Examples of threatened plant species recorded in the Yarrawonga Landscape Zone include:

- Yarran Wattle (*Acacia omalophylla*) (endangered in Victoria),
- Small-leaf Bluebush (*Maireana microphylla*) (endangered in Victoria),
- Spiny-fruit Saltbush (*Atriplex spinibractea*) (endangered in Victoria),
- Small Scurf-pea (*Cullen parvum*) (Endangered *EPBC Act 1999* and endangered in Victoria),
- Mueller Daisy (*Brachyscome muelleroides*) (Vulnerable Australia and endangered in Victoria),
- Small-spike Rush (*Eleocharis pusilla*) (rare in Victoria), and
- River Swamp Wallaby-grass (*Amphibromus fluitans*) (Vulnerable in Australia) (Ahern *et al* 2003).

Plate: Small Scurf-pea (Cullen parvum) is an example of a threatened plant species recorded in the Yarrawonga Landscape Zone (John Eichler (NRE 2002e))

2.3.2 Fauna:

There are thirty-four recorded threatened (fauna) species recorded in the Yarrawonga Zone (NRE 2002f) (refer to Appendix 6 for a list of species, their threatened status and relevant acts) (Ahern *et al* 2003).

Examples of threatened woodland species recorded in the Yarrawonga Landscape Zone include:

- Bush Stone-curlew (*Burhinus grallarius*) (Threatened in Australia and endangered in Victoria),
- Superb Parrot (*Polytelis swainsonii*) (Vulnerable in Australia and endangered in Victoria),
- Barking Owl (*Ninox connivens*) (Threatened in Australia and endangered in Victoria),
- Grey-crowned Babbler (*Pomatostomus temporalis*) (endangered in Victoria and listed under *FFG Act 1988*), and
- Diamond Firetail (*Stagonopleura guttata*) (Threatened Australia and vulnerable in Victoria) (Ahern *et al* 2003).

Plate: Barking Owl (Ninox connivens) is an example of a threatened species recorded in the Yarrawonga Landscape Zone (NRE 2002f)

Some other notable birds also include White-browed Babblers (*Pomatostomus superciliosus*) (Declining) and the migratory Rainbow Bee-eater (*Merops ornatus*).

Examples of threatened species recorded within the Yarrawonga Landscape Zone, predominantly associated with wetlands include:

- Brolga (*Grus rubicunda*) (vulnerable in Victoria),
- Hardhead (*Aythya australis*) (vulnerable in Victoria),
- Australasian Shoveller (*Anas rhynchotis*) (vulnerable in Victoria),
- Musk Duck (*Biziura lobata*) (vulnerable in Victoria),
- Freckled Duck (*Stictonetta naevosa*) (endangered in Victoria) and
- Little Egret (*Egretta garzetta*) (endangered in Victoria) (Ahern *et al* 2003).

Plate: Freckled Duck (Stictonetta naevosa) is an example of a threatened species recorded in the Yarrawonga Landscape Zone (Peter Rogers (NRE 2002f))

Examples of threatened fish recorded within the Yarrawonga Landscape Zone includes:

- Golden Perch (*Macquaria ambigua*) (vulnerable in Victoria),
- Trout Cod (*Maccullochella macquariensis*) (Endangered in Australia), and
- Murray Cod (*Maccullochella peelii peelii*) (Vulnerable *EPBC Act* and endangered in Victoria) (Ahern *et al* 2003).

Note: Other mammals (e.g. Bats, Possums and Koalas) and Reptiles (e.g. Tree Goanna (*Varanus varius*) (vulnerable in Victoria)) are also notable species, which have been found in the Yarrawonga Landscape Zone. Surveys for bats in the Northern Plains area (includes the Yarrawonga Landscape Zone area) in the past, have identified a diversity of bats in the area (e.g. Chocolate Wattled Bat (*Chalinolobus morio*) and Gould's Wattled Bat (*Chalinolobus gouldii*)) (Bennett 1998).

3.0 PREPARING A CONSERVATION PLAN

3.1 METHODOLOGY

The methodology used to develop this Conservation Plan is based on the 'Goulburn Broken Biodiversity Action Planning Developer's Manual' (GBCMA *in prep.*). This document provides the background information relating to BAP in the Goulburn Broken Catchment, and is designed to ensure consistency during the development of the Plans.

The methodology used to prepare this plan contained eight main elements. These were,
1) Identification of Conservation Features and Threatened Species,
2) Ground-truthing of Potential BAP Sites,
3) Field Surveying of BAP sites,
4) Prioritisation of BAP sites,
5) Generation of Focal Species List,
6) Generation of Key Biodiversity Asset List,
7) Development of Actions for Key Biodiversity Assets, and
8) Landscape Context Analysis.

Step 1. Identification of Conservation Features and Threatened Species
Features in the landscape that are of potential priority for conservation were identified, as well as flora and fauna species of conservation significance (e.g. threatened under State or Commonwealth legislation). This involved desktop analysis of data (e.g. literature review; spatial data (e.g. EVC, trees cover, wetlands, flora and fauna records, aerials); corporate databases (e.g. Biosites, Victorian Fauna Display and Flora Information Systems); local knowledge investigations; and the Landscape Context Model (refer to Step 8). From this analysis, a series of sites likely to have conservation values and threatened species, were identified and mapped using GIS (CGDL 2005).

Step 2. Ground-Truthing of Potential BAP Sites
This involved surveying the Zone from the roadside to compare desktop analysis data (Step 1) to the actual on-ground area, in regard to presence/absence, type of vegetation and raw condition.

Step 3. Field Surveying of BAP Sites
Sites were prioritised for survey as per the 'Goulburn Broken Biodiversity Action Planning Developer's Manual' (GBCMA *in prep.*). This prioritisation method is shown in Appendix 7. One hundred of the sites requiring ground-truthing were field surveyed (on-site or from the nearest public land). This involved:
3.1) Bird Surveys: Undertaken in accordance with the Birds of Australia – Atlas Search Method of 'Area Search' (1 hectare (as per VQA survey), twenty minutes, any shape) (Birds Australia 2001).
3.2) Vegetation Quality Assessment (VQA)(DSE 2004): Site-based habitat and landscape components were assessed against a pre-determined 'benchmark' relevant to the vegetation type being assessed (e.g. grasslands, wetlands, plains grassy woodlands) (Refer to Appendix 8 for form).
3.3) Threat Identification: Whilst undertaking the Vegetation Quality Assessment (DSE 2004), a list of threatening processes (e.g. pest plants and animals) at the priority sites, were recorded according to the Actions for Biodiversity Conservation (ABC) database (DSE 2005a).

Step 4. Prioritisation of BAP Sites
The 100 sites were given a ranked value of Very High (VH), High (H), Medium (M) or Low (L), based on a range of factors (e.g. conservation status of the EVC, presence of threatened species, size and VQA score). Sites not surveyed, nor automatically ranked (as per Appendix 7), were given a ranked value to the lesser of the available options (until surveying occurs).

Step 5. Generation of Focal Species List

The focal species approach (Lambeck 1997) uses the habitat requirements of a particular species, or group of species, to define the attributes that must be present in a landscape for these species to persist. It is acknowledged that the approach will not ensure the conservation of all biota. However, broadly the concept recognises that if a species that requires the largest remnant size is selected, then fulfilling the needs of that species may assist in the conservation of other species, with smaller remnant size requirements (GBCMA *in prep.*). Huggett 2007 identifies the strengths of the approach as; its ability to provide quantitative and spatial advice for strategically restoring landscapes; its use of landscape ecological principles to build new habitat for targeted taxa; and its ability to provide a tool that can be applied in the community (social values).

Therefore, focal species were identified for each Zone based primarily on landscape ecological science principles (e.g. species with particular spatial, composition or functional requirements that may help address the functionality of the systems in the Zone) (GBCMA *in prep.*). Other factors such as social values (e.g. to entice the community to conserve biodiversity) and the practical application of the species in the community (e.g. for on-ground works) were also considered.

Step 6. Generation of Key Biodiversity Asset List

The identified environmental or managerial features, including flora and fauna species, were categorised into a series of 'nested' environmental assets. For example, similar species or environmental features may be located in 'nested assets' such as creeklines, wetlands or ecological vegetation classes. Public land (e.g. reserves) whilst not a biodiversity asset *per se*, has been included as an asset category, primarily due to their function in the landscape and their practical application in the field. Where sites have been identified as 'public land', attempt has been made to also identify an environmental asset category (e.g. 'riverine woodland') to allow querying of information in the data (Appendix 12).

Step 7. Development of Actions for Key Biodiversity Assets

This step involved the development of a list of actions aimed at protecting and enhancing the biodiversity values in the Zone by reducing the identified threats for each key biodiversity asset (as determined in Step 6). Actions were based on improving the size/extent of a site, the condition of the site and landscape processes (e.g. habitat connectivity). Available information (e.g. Actions for Biodiversity Conservation (ABC) database) (DSE 2005a) and the SIR North Landscape Plan (Ahern *et al* 2003) were also used to compile suggested actions.

Step 8. Landscape Context Analysis

To achieve long-term viability of the priority 'BAP' sites, they need to be linked and/or increased in size and total tree cover to form a viable functioning landscape. The Landscape Context Model (LCM) (Ferwerda 2003) uses a model of "known habitat" (based on mapping for tree cover, wetland and major watercourses) to identify large remnants, key remnant clusters and the key linkages between them. However, because of potential limitations of the input data, areas of conservation significance (particularly grasslands and sparse woodlands) may not be identified. Similarly, areas with minimal conservation significance may be included, because habitat quality data is not included in the model.

However, the Landscape Context Model is useful as a background to BAP mapping, as it identifies areas that have the highest (or least) probability of containing additional sites of conservation interest (as per Step 1). Therefore the model can be used to identify areas of the landscape that should be used to link and strengthen a network of conservation sites, and create a sustainable landscape. The model can also be used to further determine the major linkages between BAP sites. The Yarrawonga Landscape Zone priority (BAP) sites and Landscape Context Model are shown in Appendix 9.

4.0 IDENTIFYING PRIORITY SITES

In the Yarrawonga Landscape Zone 266 sites have been identified as Biodiversity Action Planning (BAP) priority sites for conservation management. These sites are termed BAP sites. They contain remnant vegetation and vary greatly from a stand of paddock trees, to large forested areas such as the Barmah State Forest. One hundred of these BAP sites have been ground-truthed and surveyed. A summary of these results is provided in Section 5.0.

In order to identify the BAP sites, each site was assigned a number that identifies its location and the associated data. This unique number has been calculated using the map-index (map reference) number (1:25,000 map) and a site number (e.g. 1-266). An example of the site identification numbering system (e.g. how the site(s) are identified using the site number system) is illustrated below (Figure 5). An example of the data that is contained in the database (referred to as 'Attribute Table') for each BAP site is detailed below (Figure 6). For further information on how to obtain data for the 266 BAP sites refer to Appendix 12.

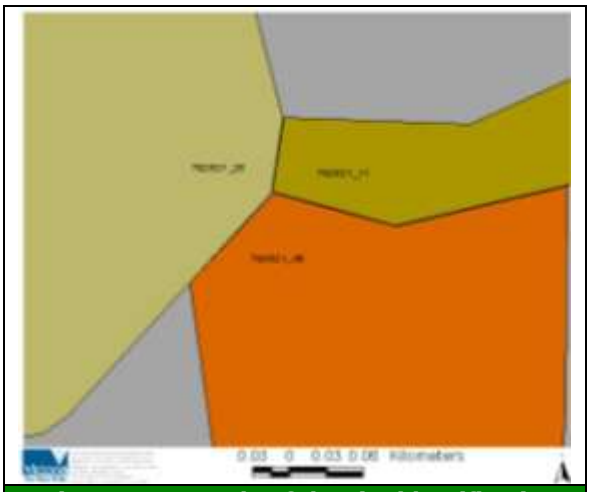

Figure 5: Example of the site identification numbering system

Site Number:	792623_1
Biodiversity Asset	Plains Woodland (Section 6.2)
Priority Status	Very High
Bioregion	MF (Murray Fans)
EVC	803 (Section 2.2)
EVC Conservation Status	E (Endangered)
Focal Species	Bush Stone-curlew *(Burhinus grallarius)* (Section 6.1)
Threatened Flora	*Marieana microphylla*
Threatened Fauna	Bush Stone-curlew (*Burhinus grallarius*)
Vegetation Quality Score	16/20 (Section 5.1)
Landholder	Private
Threats	Pest Plants (23), Land Clearance (293)

Figure 6: Example of the data contained in the data (Attribute Table)

5.0 SUMMARY OF SITE SURVEYING

5.1 VEGETATION QUALITY ASSESSMENTS

One hundred[4] of the 266 BAP sites were assessed based on habitat features of, 1) Large trees, 2) Canopy Cover, 3) Understorey, 4) Weediness, 5) Recruitment, 6) Organic Litter, 7) Logs (and Landscape Component Scores 8) Size, 9) Neighbourhood and 10) Core Area). They were scored out of a maximum score of 20 (assumed intact habitat). An example of the assessment sheet is provided in Appendix 8. Graphical illustration of the results is also provided in Appendix 10.

The one hundred surveyed sites in the Yarrawonga Landscape Zone scored between 4 and 17 (Appendix 10). The highest scored site was in the Koonoomoo area (North of the Zone). The lowest scored site was in the South-western corner of the Zone, which is highly modified and fragmented.

The graphical results (Appendix 10) highlight some of the challenges and opportunities for biodiversity conservation in the Yarrawonga Landscape Zone. In summary, the assessments identified that;

- Only 25% of surveyed[5] sites had more than 7 large trees per hectare,
- 3% of surveyed sites scored the highest for understorey (>75% and more than two forms),
- Only 7% of surveyed sites scored less than 25% weed cover,
- Only 27% of surveyed sites had adequate regeneration (10% or more total species population),
- Only 27% of surveyed sites have adequate number of logs (25m/ha),
- 35% of surveyed sites were larger than 10 hectares and 62% between 2-10 hectares, and
- 14% of surveyed sites were surrounded (1km radius) by more than 50% vegetation.

Therefore the surveys indicate (generally) that there is limited understorey or regeneration, a high percentage of pest plants, low connectivity, small sized remnants (2-10 hectares) and a low number of large (less than 7 per/ha) trees. However, no surveys were conducted in Barmah Forest, as it was automatically prioritised as Very High (refer to Appendix 7). However, for the remainder of the site these habitat elements should be targeted (e.g. on private land). The VQA scores for each of the surveyed sites provide a valuable monitoring system that can be repeated over time. It is also intended that the remaining 166 priority sites will also be assessed.

5.2 BIRD SURVEYS

One hundred of the 266 priority sites had bird surveys completed. Ninety-eight species of birds were sighted during surveying. A list of birds sighted at each of the 100 sites is provided in Appendix 11.

A number of threatened species were identified during surveying including Superb Parrot (*Polytelis swainsonii*), Grey-crowned Babbler (*Pomatostomus temporalis*), White-browed Babbler (*Pomatostomus superciliosus*), Bush Stone-curlew (*Burhinus grallarius*) and Brolga (*Grus rubicunda*). A list of threatened fauna (including birds) recorded in the Zone, is shown in Appendix 6. For further information on how to obtain data on the birds surveyed at each site refer to Appendix 12.

[4] The majority of the one hundred sites that were surveyed are sites that were not automatically given a Very High value status during prioritisation (see Appendix 7). However, a few sites that received Very High value were surveyed to compare the assessment system with the prioritisation system.
[5] Surveyed sites scored in relation to requirements for Ecological Vegetation Class Benchmark. Refer to Appendix 8 for further information on surveying.

5.3 CONSERVATION THREATS

Whilst undertaking the Vegetation Quality Assessment (DSE 2004), a list of threatening processes (e.g. pest plants and animals) at the priority sites, were recorded according to the Actions for Biodiversity Conservation (ABC) database (DSE 2005a). These included;

- Vegetation Clearance (Land Clearance – removal of native vegetation),
- Habitat Fragmentation/Edge Effects (includes 'Adjacent Land Use Practices'),
- Waterways (instream barriers) (Changes in hydrological regimes e.g. wetlands),
- Animals – Domestic Stock (Inappropriate[6] grazing management (e.g. timing, stocking rate)),
- Firewood Collection & Cleaning Up (Removal of Habitat)
- Animals – e.g. Pest Species - Foxes and Rabbits,
- Invasion by Environmental Weeds (Pest Plants),
- Recreational Activities – motorised (Transport and Recreation), and
- Removal of Rocks/Soil (Impacts of Roadworks on Roadside Vegetation).

The overall threat of salinity (e.g. high watertable levels) is also discussed below, although not listed against sites. It is an example of an overarching threat that is primarily a result of historical activities and can have repercussions on biodiversity in the Zone.

Vegetation/Land clearance (a key threatening process under the *EPBC Act 1999*) (Wierzbowski *et al* 2002) continues to be a threat to conservation values within the Zone. Practices such as inappropriate[7] earth works (e.g. removal of natural depressions/wetlands, removal of native vegetation cover) and development of infrastructure is a threat to native vegetation. Less than 25% of wetlands identified as being present prior to European settlement were evident in the field, primarily due to land clearance.

Habitat fragmentation (a potentially threatening process for fauna in Victoria under the *FFG Act 1988* (Wierzbowski *et al* 2002)) is primarily the result of land clearance. A range of species such as the Superb Parrot (*Polytelis swainsonii*) and Grey-crowned Babbler (*Pomatostomus temporalis)* are detrimentally affected by habitat fragmentation. It affects their ability to source food and suitable habitat required for their survival (e.g. leads to less effective immigration, emigration and breeding success). Development of infrastructure (e.g. estates, roads/highways) can also lead to fragmentation and gradual loss of species. Habitat fragmentation also favours species such as Noisy Miners (*Manorina melanocephala*) (Bennett 1993). Elevated competition from these aggressive species (although native to Australia) threatens species diversity, by the exclusion of less aggressive species (e.g. Grey-crowned Babblers) from remnants.

Adjacent land use practices (e.g. intensive irrigation and inappropriate earthworks (refer to footnote 7), can also lead to the colonisation of fragmented remnant areas by weeds, water logging of vegetation, high watertable depths, nutrient run-off and an increase in sediment input to rivers and streams (DPI 2005).

Changes in hydrology (e.g. hydrological regimes) can be a threat to native vegetation, particularly for wetlands, which have evolved to function with the natural cycles of flood and drought. Alteration to natural flow regimes of rivers and streams is listed as a threat to Victorian waterways under the *FFG Act 1988* (Wierzbowski *et al* 2002). A change in water regimes (including temperature and water quality) can dramatically alter system appearance and functioning, disrupt natural productivity cycles and cause changes in vegetation and habitat. This in turn affects the fauna that rely on wetlands (e.g. for resources and breeding) (Howell 2002). The reduction in numbers of Brolga (*Grus rubicunda*) from the Zone could be attributed to the loss of breeding habitat (from land clearance and altered hydrology), pest animals and changes in flow regimes.

[6] The term inappropriate (in this sense) refers to grazing native vegetation without consideration of stock capacity, time of year or length of time.
[7] The term inappropriate (in this sense) refers to the purposeful movement of soil/vegetation without consideration of the natural landscape (e.g. water flow).

Inappropriate grazing management affects biodiversity conservation through soil compaction; removal of vegetation; changed nutrient levels in and around native vegetation; tree dieback and results in competition for fodder by native animals, which require tussocky grass for shelter (Wilson & Lowe 2002). A high percentage (more than 80%) of private land remnants (that were surveyed) within the landscape are heavily grazed, often resulting in minimal shrub or ground cover (only 3% (of 100) surveyed sites had adequate understorey). A number of isolated trees in paddocks were stressed and showing signs of dieback (e.g. dead limbs and loss of trunk bark). It is important to retain these trees for habitat for a range of species (e.g. birds, bats, reptiles and insects).

The removal of fallen timber (or 'cleaning up') was evident along roadsides and within private remnants. Removal of fallen timber can result in a loss of habitat for birds; mammals, reptiles and insects, exposing them to predation by introduced predators. With a reduction in insect populations, timber removal also reduces the number of insect-eating birds in an area. For example, the Bush Stone-curlew (*Burhinus grallarius*) is just one of the species that is severely impacted upon by timber removal, due to loss of insects and the loss of fallen timber that is used as habitat and camouflage for the protection of chicks (DSE 2005a).

Pest Animals are a threat to conservation values of the area. Predation of native wildlife by the Cat (*Felis catus*) and by the introduced Red Fox (*Vulpes vulpes*) are listed as potentially threatening processes under the *FFG Act 1988* (Wierzbowski *et al* 2002), due to their impact on native species. The European Rabbit *(Oryctolagus cuniculus*) and European Hares (*Lepus europaeus*) compete for habitat, remove native vegetation and disturb soil structure.

Pest Plants (Weeds) are a major threat to biodiversity because they compete with native species, for essentials (e.g. space, light and nutrients). Invasion of native vegetation by environmental weeds is listed as a potentially threatening process under the *FFG Act 1988* (Wierzbowski *et al* 2002). Examples of weeds evident in the Zone include Paterson's Curse (*Echium plantagineum*), Horehound (*Marrubium vulgare*), Olives (*Olea europaea*), Peppercorns *(Schinus molle*), Boxthorn (*Lycium ferocissimum*), Bridal Creeper (*Asparagus asparagoides*), African Love-grass (*Eragrostis curvula*), Willows (*Salix spp*) and Poplars (*Poplar spp*). Weeds are especially evident on roadsides due to escaped garden/agricultural plants, machinery disturbance (e.g. **Roadworks**) and poor vehicle hygiene. Pest plants invading remnants can also be a result of adjacent land practices (e.g. agricultural weeds) and animal movement (e.g. birds). **Transport** and **Recreational** Pursuits (e.g. motorised activities) can also lead to increased weeds and loss of native vegetation).

Salinity is an overarching potential threat to the area as a result of high watertable (DSE 2005c). In 1996, watertable depths in the Zone ranged from 0-1 metres (South-western areas) to more than 3 metres (in the surrounding areas) (CGDL 2005). Further loss of vegetation and biodiversity in the Zone (especially in the southern sections) will degrade the capacity of the natural ecosystem to support essential landscape functions (DSE 2005c).

Plate: Firewood collection is an example of a threatening process observed within the Yarrawonga Landscape Zone

5.4 SITE PRIORITISATION

Figure 7 illustrates the 266 BAP sites that have been given a priority status (ranked value) of Very High (VH), High (H), Medium (M) or Low (L), based on a range of factors (conservation status of the EVC, presence of threatened species, size and VQA score). This prioritisation occurred at 3 stages; prior to surveying; following surveying and for unsurveyed sites. For example prior to surveying, large sites with an EVC conservation status and threatened species that did not require ground-truthing, were automatically given a priority status of Very High (VH). Following surveying (refer to 5.1, 5.2 & 5.3) the sites were given a priority status based on the three factors above and the Vegetation score (Appendix 8). Unsurveyed sites that required ground-truthing but were not able to be surveyed (e.g. more than 100 sites that required ground-truthing), nor able to be automatically ranked as Very High prior to surveying, were given a ranked value to the lesser of the available rankings until surveying can be conducted. Further information on the method used to prioritise the sites is identified in Appendix 7. As identified below, the majority of Very High value sites are located in the North of the Zone.

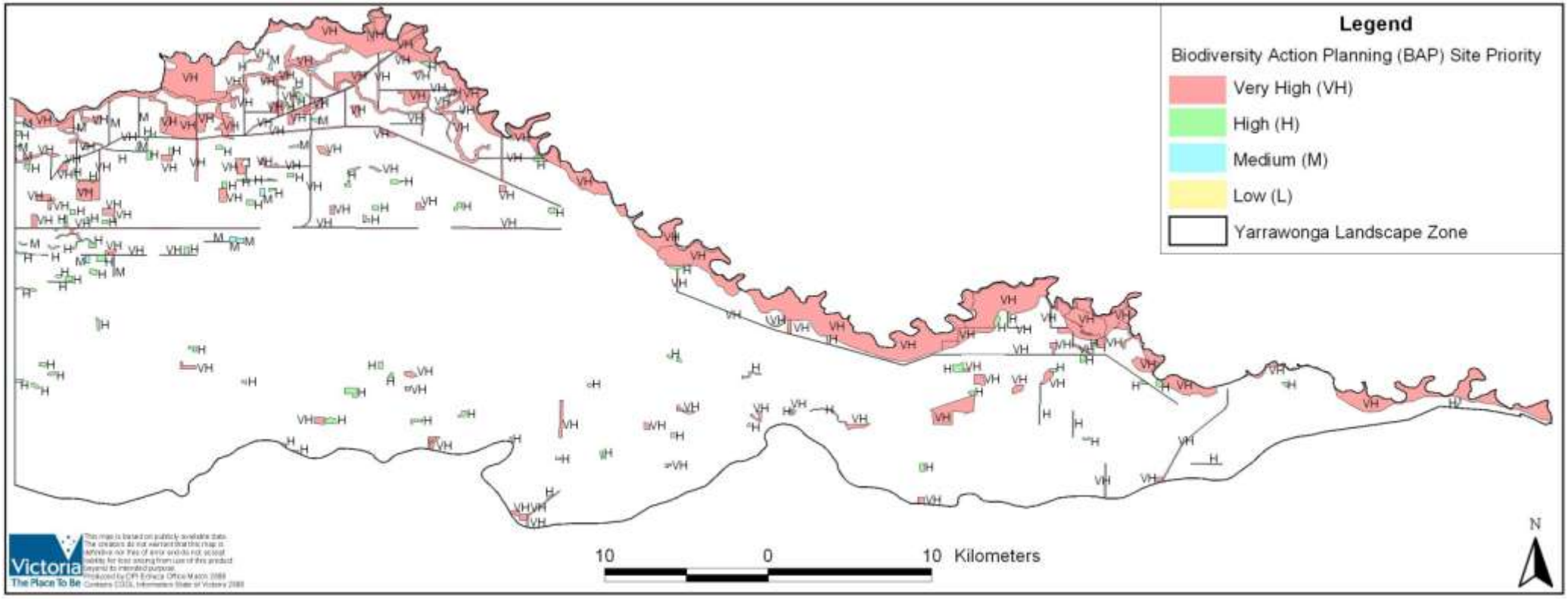

Figure 7: Biodiversity Action Planning (BAP) Sites prioritised from Very High to Low Priority for the Yarrawonga Landscape Zone

6.0 BIODIVERSITY ASSETS

6.1 FOCAL SPECIES

Research shows that different species have different types of responses to landscape change. The focal species approach (Lambeck 1997) uses the habitat requirements of a particular species or group of species, to define the attributes that must be present in a landscape for these species to persist. Broadly, the concept recognises that is a species which requires the largest remnant size is selected then fulfilling the needs of that species may assist in the conservation of other species, with smaller remnant size requirements. The focal species are also predicted to be the most sensitive species (in a given landscape) to a threat or ecological process, such that, their conservation should also conserve other less-sensitive species found in the same vegetation type (GBCMA *in prep*.).

Whilst it is acknowledge that the focal species approach will not ensure the conservation of all biota (Huggett 2007), its key strengths and ability to define and guide targets (e.g. patch size and connectivity) for our landscape restoration strategies (Lambeck 1997) is recognised. Other strengths of the approach is its ability to provide quantitative and spatial advice for strategically restoring landscapes and its use of landscape ecological science principles to build new habitat for targeted taxa (Huggett 2007). The approach also allows for the monitoring of actions (e.g. can undertake regular surveys to establish if focal species are increasing in number and/or using new sites) and it provides the community with an 'iconic/focal' species (a 'social-hook') (Huggett 2007) to enhance enthusiasm for implementing works.

The seven focal species identified in the Yarrawonga Landscape Zone and their ecological requirements (thresholds[8]) are identified below (Table 2). Definitions of the ecological terms used include;

- Minimum patch size (patch size threshold) – refers to the minimum patch size of vegetation required for the species to maintain viable populations,
- Critical distance between habitat patches (isolation threshold) – refers to the size of the gap between habitats, beyond which, on a daily basis, the animal doesn't generally cross (GBCMA *in prep.*),
- Dispersal threshold – refers to the distance (km) for which the species has been known to travel (e.g. for breeding and migration), but generally does not on a daily basis,
- Ecological Vegetation Class (EVC) – the vegetation community that the species prefers, and
- Other requirements – identifies some other known requirements (not comprehensive) for the species to survive, or to inhabit an area.

An example of a focal species project already occurring in the Bearii, Mywee and Strathmerton area of the Zone is the Grey-crowned Babbler (*Pomatostomus temporalis*) project. In the first year of the project 28,000 indigenous plants were planted and 10 kilometres of fencing constructed. If we look at the patch size required to maintain viable Grey-crowned Babbler populations, then the minimum patch size of vegetation required is 2 hectares, preferably with mature trees, with less than a 500-metre gap (critical distance) between remnants, then this valuable information can assist in the future direction of on-ground works for such projects (e.g. we can model the best places to increase existing patch size or create new patches, through BAP and the Landscape Context Model approach).

It is envisaged that community groups and agencies may target one, or a combination of the focal species identified (Table 2) for planning and implementation of on-ground works in the Zone.

[8] Thresholds refer to the point at which relatively rapid change occurs (e.g. loss of species). Therefore, these should be used as a minimum target only.

Table 2: Focal Species and their Habitat Requirements – Yarrawonga Landscape Zone

	**Grey-crowned Babbler (*Pomatostomus temporalis*) (e)**	
	Minimum patch size (threshold)	>2ha, >1km continuous roadside
	Critical distance between patches	<500m from known site
	Dispersal threshold	<2km, very few records >10km
	Ecological Vegetation Class	Woodlands
	Some other requirements (general)	Mature trees, shrubs (>6m), linkages
	**Bush Stone-curlew (*Burhinus grallarius*) (e)**	
	Minimum patch size (threshold)	>1ha, >40m wide
	Critical distance between patches	<1km
	Dispersal threshold	<2km from known site
	Ecological Vegetation Class	Creeklines, Woodlands
	Some other requirements (general)	Ground timber, fox control
	**Superb Parrot (*Polytelis swainsonii*) (e)**	
	Minimum patch size (threshold)	Larger the better
	Critical distance between patches	varies for breeding/non breeding
	Dispersal threshold	varies for breeding/non breeding
	Ecological Vegetation Class	Woodlands, Forests (River Red Gum)
	Some other requirements (general)	Hollows, shrubs, corridors, dead trees
	**Diamond Firetail *(Stagonopleura guttata)* (v)**	
	Minimum patch size	>10ha
	Critical distance between patches	<1km
	Dispersal threshold	>10km (seasonally for food)
	EVC utilised	Woodlands
	Some other requirements (general)	Mobile seasonally, fox/cat control
	**Tree Goanna (*Varanus varius*) (v)**	
	Minimum patch size (threshold)	>2km roadside/streamside patches
	Critical distance between patches	<2km
	Dispersal threshold	<2km
	Ecological Vegetation Class	Most except wetlands
	Some other requirements (general)	Mature trees, fox control, logs
	**Brolga (*Grus rubicunda*) (v)**	
	Minimum patch size (threshold)	>50ha or clusters of wetlands
	Critical distance between patches	Varies
	Dispersal threshold	Varies
	Ecological Vegetation Class	Wetland (ephemeral, 20-30cm depth)
	Some other requirements (general)	Fox control, Canegrass, *Eleocharis spp*
	**Murray Cod (*Maccullochella peelii peelii*) (e)**	
	Minimum patch size (threshold)	same reach*
	Critical distance between patches	same reach*
	Dispersal threshold	same reach*
	Ecological Vegetation Class	Waterways
	Some other requirements (general)	Logs, carp management

** The GBCMA uses reaches as one of its management reporting units. These are partly defined by natural environmental or human divisions, which are also likely to affect fish distributions (GBCMA 2004b).*

Victorian threatened status definitions: (e) = endangered, (v) = vulnerable.

Habitat Requirement Source: Variety of Sources (GBCMA in prep.) and DSE 2005a

Photo Credits: Grey-crowned Babbler (Graeme Chapman), Bush Stone-curlew & Diamond Firetail (Ian McCann), Superb Parrot (Peter Rogers), Tree Goanna (Peter Robertson), Brolga and Murray Cod (NRE 2002f).

6.2 KEY BIODIVERSITY ASSETS

BAP attempts to take a more strategic approach toward the conservation of threatened and declining species and vegetation types, by looking for opportunities to conserve groups of species in appropriate ecosystems. The identification of the appropriate biodiversity assets to focus conservation effort is an important part of the process. This approach has been used to group together species that utilise the same type of habitat. By protecting these assets we aim to conserve habitat for a suite of threatened species associated with that habitat (Table 3). Specific actions (Section 7.0) based on the requirements of each asset can then be developed and implemented (GBCMA *in prep.*). The 266 BAP sites have been categorised according to seven key biodiversity assets (Figure 8). Public Land (e.g. roadsides), whilst not a biodiversity asset *per se*, have been included as an asset category, primarily due to their function in the landscape and for practical application in the field. A number of sites can be grouped based on two assets (e.g. forests). Note: only the primary asset type is identified on the below map (Figure 8). Refer to Appendix 12 on how to obtain further data for each site.

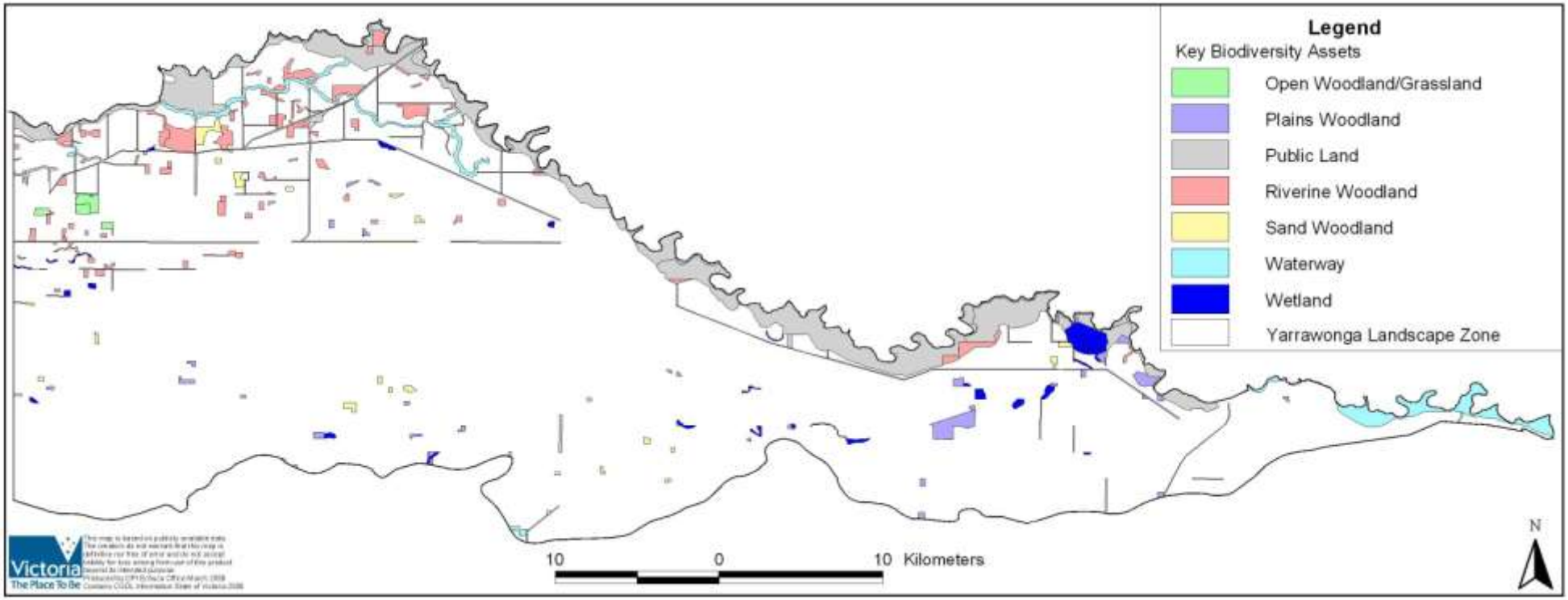

Figure 8: Location of Key Biodiversity Assets in the Yarrawonga Landscape Zone

Table 3: Key Biodiversity Assets in the Yarrawonga Landscape Zone

Key Biodiversity Assets	Examples of Threatened and Notable Species
***1) Waterways** Major bioregional and local habitat links for terrestrial fauna. Includes areas such as Murray River, Ulupna Creek, Sheepwash Creek, Lake Mulwala and Torgannah Lagoon.	Bush Stone-curlew (*Burhinus grallarius*), Hardhead (*Aythya australis*), Musk Duck (*Biziura lobata*), Golden Perch (*Macquaria ambigua*) and Murray Cod *(Maccullochella peelii peelii*)
2) Wetlands Distinctive ecosystems primarily associated with the Barmah Forest and adjacent floodplains (e.g. Big Reedy Lagoon Wildlife Reserve). Wetlands on private land particularly in Cobram and Naringaningalook/Katamatite area (e.g. Muckatah Depression).	Nationally significant Barmah Forest Wetlands; Wetland of National Importance; Brolga (*Grus rubicundus*), Australasian Bittern (*Botaurus poicilopiilus*), White-bellied Sea-Eagle (*Aquila audax*), Latham's Snipe *(Gallinago hardwickii*), Great Egret (*Ardea alba*), Hardhead, Freckled Duck (*Stictonetta naevosa*), Barking Marsh Frog (*Limnodynastes fletcheri*) and Small-spike rush *(Eleocharis pusilla)*
3) #Public Land The most extensive and intact remnant vegetation areas within the Yarrawonga Landscape Zone. Nationally significant and contains diversity of habitat and species.	Golden Perch, Murray Cod, Barking Owl (*Ninox connivens*), White-bellied Sea-Eagle, Tree Goanna (*Varanus varius),* Grassland flora and Woodland birds (e.g. Superb Parrot (*Polytelis swainsonii*))
4) Plains Woodlands Incorporates Plains Woodland and Plains Grassy Woodland/Gilgai Wetland Mosaic Ecological Vegetation Classes. Less than one percent of EVCs remaining, so requiring the largest increases in extent (endangered).	Small Scurf-pea (*Cullen parvum*), Chocolate lily (*Arthropodium fimbriatum*), Grey-crowned Babbler *(Pomatostomus temporalis*), Tree Goanna, Bush-stone-Curlew and Woodland bird community
5) Riverine Woodlands Includes Riverine Grassy Woodlands and Riverine Chenopod Woodland Mosaic Ecological Vegetation Classes. Prominent in the Zone, especially the northern areas, generally associated with waterways. Provide crucial habitat (e.g. hollows) and other requirements for a range of species.	Sedges *(Carex spp*), Small Scurf-pea, Grey-crowned Babbler, Tree Goanna, Barking Owl, Superb Parrot, Bush-stone-Curlew, Rainbow Bee-eater (*Merops ornatus*), Diamond Firetail (*Stagonopleura guttata*) and River Swamp Wallaby-grass (*Amphibromus fluitans*)
6) Open Woodlands/Grasslands Although there is no specific grassland EVCs within the Zone, there are open patches of grassland areas, within woodland EVCs that are critical habitats. Generally associated with agricultural paddocks and roadsides.	Small-Scurf Pea, Chocolate Lily, Wallaby Grass (*Austrodanthonia spp*), Spear-grass (*Austrostipa spp*) and Bluebush (*Maireana spp*)
7) Sand Woodlands Includes Significant (Endangered) EVCs including Shallow Sand Woodland and Sand Ridge Woodlands/Mosaics. Usually associated with higher landforms (e.g. Sandhills). A number of notable species associated with this asset.	Buloke Mistletoe (*Amyema linophyllum*), Buloke (*Allocasuarina luehmanii*), Murray Pine (*Callitrus glaucophylla),* Yellow Box (*Eucalyptus melliodora*), Tree Goanna, Grey-crowned Babbler and Bush Stone-curlew

* The numbering of the Key Biodiversity Assets (1-7) is only intended to assist with the identification of the assets throughout the remainder of the report. Scientific names listed only once.

Whilst public land (e.g. roadsides) is not a biodiversity asset per se, it has been included as an asset category primarily due to their function in the landscape and for practical application in the field.

7.0 PRIORITY ACTIONS – KEY BIODIVERSITY ASSETS

Priority actions for the Zone have been developed and grouped based on each 'Key Biodiversity Asset'. There are two columns (Asset 1 and Asset 2) included in the data (Appendix 12). All sites have been categorised based this consistent approach. For sites that have two asset types (e.g. roadsides may also be open woodland), both assets have been listed in the data to allow further querying of actions for land managers. The actions listed below include actions for the consistent Asset Type (Asset 1).

Priority actions for the assets were developed based on the following factors, (1) size/extent (2) condition and (3) landscape processes (e.g. habitat connectivity and hydrological regimes). The condition (2) section was also further split in relation to, education/extension; on-ground works; threatened species; and pest plants and animals. For example; an action relating to the condition of a remnant, due to rabbits, can be found under; 'condition' – 'pest plants and animals'.

For each of the seven key biodiversity assets (1-7), the following pages identify;
A) An introduction to the asset in the Yarrawonga Landscape Zone,
B) Photographic example of the asset in 'good condition' for the Zone, and
C) Proposed actions for the asset in the Zone (broader actions in Ahern *et al* 2003).

It is proposed that the community and agencies in the Zone investigate options for implementing the actions into existing projects. The actions are designed to work with existing documents (e.g. Local Area Plans) and provide further guidance on priority sites. For example, BAP sites in each asset type should be targeted in order of priority (Very High, High, Medium to Low). This forms the basis of BAP, where the very high value sites that require less cost for long-term protection, can provide the highest prospect for conservation (GBCMA *in prep*.).

Note: Actions based on a rigorous legislative process (Acts of Parliament) and are of high priority. The actions originate from the Flora and Fauna Guarantee Act 1988 that provides for the listing of Victoria's threatened plant and animal species, ecological communities and potentially threatening processes. Under the Act an Action Statement must be prepared which outline what is required. For further information refer to the 'Actions for Biodiversity Conservation Database' (ABC) (DSE 2005a).

Acts of Parliament must be adhered to when planning and implementing actions. E.g. the Archaeological and Aboriginal Relics Preservation Act 1972 protects all Aboriginal places and relics in Victoria. For further information visit: www.dms.dpc.vic.gov.au/

Plate: Brolga are an example of a threatened species that are associated with a Key Biodiversity Asset (wetlands) in the Yarrawonga Landscape Zone. (Left) Brolga (Grus rubicundus) on wetland nest (Ian McCann) (Right Top and Bottom) Brolga Pair and Young (Tony Kubeil 2006).

7.1 WATERWAYS

A) Introduction - Waterways:

Waterways, such as rivers, streams, creeks and lagoons, are the lifeblood upon which most of the other assets depend. There are a number of waterways in the Zone, including the Murray River (and associated forest), Ulupna, Sheepwash and Cobrawonga Creeks, Torgannah, Cobrawonga, Sharps and Chinaman's Lagoons, Lake Mulwala and parts of Wild Dog Creek. A number of these areas are of high conservation value, as they provide essential corridors for species movement and provide habitat, food and shelter for a range of species (Ahern *et al* 2003).

Waterways such as the Murray River, Ulupna Creek, Sheepwash Creek and Torgannah Lagoon are classified as public land. However a number of other waterway frontages (e.g. Wild Dog Creek) are leased by private landholders. Lake Mulwala is a waterway in the northeastern extremity of the Zone. It is under threat from foreshore development, leading to the loss of riparian vegetation.

A number of other threats to waterways include vegetation/land clearing, adjacent land use practices (e.g. nutrient run-off), hydrological cycle changes and pest plants and animals. The actions identified below are intended to assist with the conservation of waterways within the Yarrawonga Landscape Zone. However, these actions are specific to the Zone and are by no means comprehensive for the region. Other strategies, such as the Victorian River Health Strategy (NRE 2002b) and the Draft GB River Health Strategy (GBCMA 2004b) provide a framework for managing and restoring rivers, streams and floodplains in Victoria and are overarching strategies for all areas. Whilst these strategies include other mechanisms for prioritising waterways (e.g. Index of Stream Condition), a Vegetation Quality Assessment (VQA) can also be a useful tool for site management.

B) Photographic Example - Waterways:

Example of a Waterways BAP Site of 'Good Condition'* for the Yarrawonga Landscape Zone

* Based on the Vegetation Quality Assessment (VQA) scores for sites surveyed in the Zone

The site (802544_180) pictured below, is a Very High value site and is part of the Wild Dog Creek. The EVC is Plains Woodland. As per the Vegetation Quality Assessment the site scored 15.5 due to good scores in size, understorey, large trees, regeneration and organic litter. Other high value sites (e.g. Ulupna Creek and Murray River) which are of good condition were not surveyed, as they were automatically given a very high value prior to surveying.

Plate: An example of a Waterways site of 'Good Condition' for the Yarrawonga Landscape Zone

C) Actions Proposed – Waterways:

Size/Extent Related Actions:

- **Increase the extent (buffering)** of the Ulupna Creek, by encouraging adjacent landholders to revegetate, using existing incentive programs.
- **Increase the extent** of remnants around Ulupna Creek, through the revegetation and linkage of remnants (792621_34 and 792621_35) with remnant 792621_36 and the Ulupna Creek.
- **Encourage** the buffering of all identified waterways in the Zone.

Condition Related Actions:

Education/Extension:

- **Promote** the benefits of protecting and enhancing native vegetation in the in-stream and riparian environments, through extension and voluntary programs (e.g. incentives).
- **Promote** the protection of sites from threatening processes, to improve overall condition, through extension principles and/or incentives.
- **Promote** the use of direct seeding in the Bearii, Mywee, Koonoomoo areas (where appropriate) to increase efficiency of revegetation.
- **Encourage** retention of fallen timber on all waterways and adjoining remnants.
- **Undertake** a targeted community education program, to promote conservation of waterways and the threats posed to waterways.
- **Consult** with licensees of waterways, to fence the creeklines (waterway incentives) and encourage the removal of stock, especially during set times to allow regeneration.
- **Consult** with adjacent landholders of Torgannah Lagoon, to provide a vegetation buffer between houses, orchards and the lagoon.
- **Liaise** with landholders adjacent to Lake Mulwala, to protect water frontages from the impacts of development and recreational pursuits and revegetate (buffer) edges.

On-ground Works:

- **Protect** high priority sites, through covenants or incentives.
- **Give priority** to protection and management of Public Land Water Frontage on Ulupna and Sheepwash Creeks (Ahern *et al* 2003).
- **Establish off stream watering points** for all affected sites on waterways, with priority to Ulupna and Sheepwash Creeks.
- **Fence** all waterways in the Zone, including Wild Dog Creek.
- **Encourage** the planting of alternative timber supplies, especially in the Strathmerton area, to reduce the impact of firewood collection on roadsides, remnants and waterways.
- **Monitor the condition** of stream frontages, especially with respect to fencing and grazing, giving priority to well-connected water frontage corridors (e.g. Ulupna/Sheepwash Creeks).

Threatened Species:

- **Modify stocking levels and grazing times**, as necessary, to benefit threatened species (e.g. River Swamp Wallaby-grass (*Amphibromus fluitans)*) (e.g. Ulupna/Sheepwash Creeks).
- **Provide shallow feeding sites** for the Freckled Duck (*Stictonetta naevosa*) at Lake Mulwala (Ahern *et al* 2003).

Pest Plant and Animals:

- **Implement integrated control of foxes and feral cats** for the protection of threatened species, especially in the Bearii/Mywee sections of Ulupna Creek (Ahern *et al* 2003).
- **Target pest plants** (e.g. Bridal Creeper (*Asparagus asparagoides*) (Declared Weed of National Significance), along waterways (e.g. Torgannah Lagoon).

Landscape Process Related Actions (e.g. regimes, connectivity):

- **Increase connectivity** between the Ulupna Creek, Sheepwash Creek and Torgannah Lagoon; (near the Goulburn Valley Highway) (e.g. **promote regeneration** of Public Land Water Frontages to improve connectivity with one another and with the adjacent riverine forests along the Murray River (Ahern *et al* 2003).
- **Enhance linkages** between revegetation sites and the Ulupna/Sheepwash Creeks. Focus on high value remnants in close proximity to one another to link to the creek (e.g. near Ulupna).
- **Reintroduce ecological flooding regimes** for waterways (and associated habitats) so as to equate as far as possible, with pre-European frequencies (Ahern *et al* 2003).

7.2 WETLANDS

A) Introduction – Wetlands:

Wetlands are amongst the most important, productive and valuable ecosystems within the Yarrawonga Landscape Zone. They perform vital functions including water purification, nutrient processing, flood management and maintenance of the watertable. They provide habitat, refuge, and breeding (nursery areas) for many common and threatened species (e.g. *Brolga (Grus rubicunda*)) (Howell 2002).

High value wetlands in the Zone include part of Barmah Forest (listed under the international Ramsar Convention) and associated wetlands (e.g. Big Reedy Lagoon), and wetlands along the Muckatah Depression. Big Reedy Lagoon is one of the largest wetlands within the Zone. It is associated with Barmah State Forest and is of vital importance to fauna in the Zone. The Muckatah Depression is primarily owned by private landholders. It is identified as an extended 'dip' rather than a distinct drainage line (Ahern *et al* 2003). It occurs largely on freehold land within the Zone, running southeast of Yarrawonga to Numurkah. This long shallow wetland is 2909 hectares and is listed (Site VIC053) in 'A Directory of Important Wetlands in Australia' (EA 2001). The Muckatah Depression has had a primary Surface Water Management System (SWMS) built along the lower reaches, to mitigate the impact of water logging (e.g. remove irrigation induced run-off) and to enhance environmental values of the area.

There are a number of threats affecting wetlands in the Zone, such as vegetation/land clearing, changed hydrological regimes, adjacent land use practices and pest plants and animals. The actions identified below are intended to assist in the protection of the remaining wetlands within the Yarrawonga Landscape Zone. However, these actions are specific to the Zone and are by no means comprehensive for the region. Other documents (e.g. Wetlands Directions Paper for the GB) (Howell, 2002), provide direction for protecting wetlands in the Catchment.

B) Photographic Example – Wetlands:

Example of a Wetland BAP Site of 'Good Condition'* for the Yarrawonga Landscape Zone

* Based on the Vegetation Quality Assessment (VQA) scores for sites surveyed in the Zone

The site (802514_55) pictured below is located on the Muckatah Depression, which is listed on the Directory of Important Wetlands in Australia (EA 2001). The EVC is Red Gum Wetland. The site scored 9 on the Vegetation Quality Assessment and is therefore a Very High value site for the area.

Plate: An example of a Wetlands site of 'Good Condition' for the Yarrawonga Landscape Zone

C) Actions – Wetlands:

Size/Extent Related:

- **Implement a buffer zone** around all identified wetlands (as far out beyond the rim of the basin as possible) to increase the size of wetlands and provide for their protection.

Condition Related:

Education/Extension:

- **Provide extension** to all landholders with wetlands in the Zone to assist with recognition of the benefits of wetlands and associated plants and animals on their properties.
- **Provide opportunities for education** of landholders and school children regarding the benefits of wetlands on farms (e.g. Katamatite East School Road site) (e.g. a campaign on the productive value of intact wetlands, in coordination with agriculture).
- **Investigate the development of a site management plan** for all identified wetlands in the Zone, particularly Burramine, Katamatite East School, Kokoda, Lorenz and Cassidy Roads.
- **Encourage landholders** with wetlands (e.g. Muckatah Depression) to protect (fence/manage stock) them. Work with the Muckatah Katamatite Naringaningalook (MKN) Local Area Planning (LAP) Group and associated community groups (e.g. Landcare) to do so.
- **Encourage the grazing** of wetlands under management, only when dry, to prevent seed set of weeds.
- **Encourage the appropriate use of chemicals** and other water contaminants on farms and within local communities, especially along the Muckatah Depression.
- **Encourage** the MKN LAP group, Landcare Groups and schools to promote World Wetlands Day as a focus for increasing community awareness of wetlands (e.g. Muckatah Depression).
- **Encourage** monitoring of wetlands and the adoption of new wetland monitoring sites, in consultation with the 'Waterwatch' Program and the Goulburn Murray Landcare Network.
- **Encourage** a local school to monitor biodiversity at the Katamatite East School Road Wetland.
- **Prevent** further removal of wetlands through education (and legislation where required).
- **Investigate** the use of 'Index of Wetland Condition Assessments' (DSE 2006) in conjunction with Vegetation Quality Assessments (still required to allow priority comparisons).

On-ground Works:

- **Protect** all identified wetlands in the Zone, commencing with very high value sites (e.g. Big Reedy Lagoon, Katamatite East School Road, Kokoda Road, Burramine Wetlands).
- **Protect existing or implement vegetative cover** on built systems (e.g. revegetate Surface Water Schemes, reuse systems) to increase water quality and create wetland environments.
- **Encourage the fencing** of sites to exclude grazing, particularly when wet or prior to being wet, to allow flowering and seed-set of native plants.
- **Identify a demonstration site** (show casing very high value site) for educational purposes.
- **Seek approval** from SIR IC for the Environmental Incentives program to provide off-stream-watering points for private wetlands.

Threatened Species:

- **Monitor growth** of cane grass and other nesting habitat in wetlands to ensure that grazing does not remove habitat for Brolga (*Grus rubicunda*) (e.g. allow time for growth of vegetation prior to Brolga and other birds searching for breeding sites).

Pest Plants and Animals:

- **Implement integrated fox control programs** within the Muckatah Depression and Burramine areas for the benefit of all species, especially Brolga.
- **Investigate** predator-control fences for known Brolga breeding sites (e.g. O'Kane's example).

Landscape Processes (e.g. regimes, habitat connectivity):

- **Form clusters of wetlands** by giving priority to protecting wetlands that are in close proximity to one another, or in close proximity to a high value site.
- **Restore and deliver natural hydrological regimes** to wetlands for the benefit of flora and fauna (e.g. Cassidy Rd), through liaison with landholders, DSE and Goulburn-Murray Water.
- **Monitor hydrological regimes** (e.g. water quality, quantity and hydrology) along the Muckatah Depression (e.g. Cassidy Rd) and re-evaluate/negotiate any alterations (DSE 2004).
- **Continue to seek** environmental water allocations for priority wetlands.

7.3 PUBLIC LAND

A) Introduction – Public Land:

Public land comprises approximately10% of the Zone and contains the highest proportion of very high value sites (e.g. Barmah Forest/Regional Parks). State Forest and Regional Parks extend intermittently along the Murray River Floodplains from Bearii to Burramine. All parcels are Special Management Zones (SMZ) 117/01 under the Mid-Murray Forest Management Plan (NRE 2002d). These areas are priority for protection due to their extent, connectivity and the high priority vegetation types and threatened flora and fauna that they contain.

Public land in the Zone include Barmah Forest (and associated Natural Features Reserves), Yarrawonga Regional Park, Cobram Regional Park, Bushland Reserves, Railways Reserves and Roadsides (Ahern *et al* 2003). There are four Bushland Reserves in the Zone, which total approximately 54 hectares. Railway Reserves of high priority include the Strathmerton-Tocumwal Railway Line and the Yarrawonga Railway Lines. Both are identified as very high value within this plan, due to their size, connectivity and threatened species. Old Coach Road, Bearii-Mywee Road and the Murray Valley Highway are among the most extensive roadsides in the Zone and support significant species (e.g. Grey-crowned Babbler (*Pomatostomus temporalis*)). Roadside vegetation is recognised as being a very valuable biodiversity asset. Moira Shire (minor roads) and Vic Roads (major highways) manage roadsides in the Yarrawonga Zone.

The actions identified below are intended to assist in the protection of bushland reserves, railway reserves and roadsides, within the Yarrawonga Landscape Zone. This plan does not provide management actions for other public land areas (e.g. Barmah Forest), as such sites are being investigated and managed through other processes (e.g. VEAC Riverine Red Gum Forests Investigation, the Living Murray Initiative (MDBC 2002), Mid-Murray Forest Management Plan (NRE 2002d), Asset Environmental Management Plan, Barmah Significant Ecological Asset (DSE & GBCMA 2005b) and the Barmah Forest Ramsar Site: Strategic Management Plan (DSE 2003). Therefore, for actions relating to Barmah Forest/Regional Parks refer to the documents identified above or Ahern *et al* 2003 for broader recommendations.

B) Photographic Example – Public Land:

Example of a Public Land BAP Site of 'Good Condition'* for the Yarrawonga Landscape Zone

* Based on the Vegetation Quality Assessment (VQA) scores for sites surveyed in the Zone

The site (802544_181) pictured below is part of Tobruk Road, near Katamatite. The site scored 12.5 on the survey and is therefore a Very High value site. The EVC is Plains Woodland.

Plate: An example of a Public Land (Roadside) site of 'Good Condition' for the Yarrawonga Landscape Zone

C) Actions – Public Land:

Size/Extent Related:

- **Buffer** Bushland Reserves H28, 29 and 31, through consultation with landholders.
- **Buffer** native vegetation communities at Strathmerton-Tocumwal Railway Reserve, the Tocumwal Railway Reserve and high value roadsides (e.g. Murray Valley Highway), through consultation with adjacent landholders (e.g. fencing and promoting natural regeneration).

Condition Related:

Education/Extension:

- **Liaise** with stakeholders regarding current management of the four-bushland reserves.
- **Investigate** the level of priority of the four Bushland Reserves on the DPI Terrestrial Plan Management List and the development of Terrestrial Management plans for H31 and H42 and local site plans for H28 and H29 (e.g. to abate threatening processes).
- **Encourage** local school group involvement and stewardship of the reserves (e.g. H28 - Katunga or Numurkah schools and H42 - Cobram schools).
- **Liaise** with licensees of H29 & H31 (east side) Bushland Reserves to manage grazing.
- **Promote** Tocumwal Railway Line and the Strathmerton-Tocumwal Railway Reserve flora values.
- **Encourage** the retention of logs, leaf litter and dead trees, as habitat for reptiles and bats.

On-ground Works:

- **Protect** all high value sites from threats (e.g. Old Coach Road, Murray Valley Highway).
- **Protect** good quality remnant vegetation directly adjacent to Bushland Reserve H29 and H31.
- **Investigate** with stakeholders, options for signage for high value roadsides, as per Significant Babbler Roadsides or 'Enviromark' (Greening Australia) method.
- **Develop** a community education campaign, regarding the conservation of roadsides.
- **Ensure** maintenance of roads in the Zone has minimal impact on biodiversity values (e.g. roadside management plans) (Moira Shire Council 1998).
- **Protect** all unused roadsides (e.g. wet weather/leased roads) (e.g. Ryan's Road).
- **Manage grazing** pressure in forests from macropods and introduced herbivores to benefit River Swamp Wallaby-grass (*Amphibromus fluitans*) (Ahern *et al* 2003).

Threatened Species:

- **Provide** Moira Shire with the location of threatened species along roadsides, for inclusion in the permit process (e.g. stock droving).
- **Encourage management of roadside grazing** and stock movement for the protection of threatened species (e.g. Grey-crowned babbler *(Pomatostomus temporalis*)).
- **Protect** threatened flora in H31 Bushland Reserve and investigate the presence of threatened Bush Stone-curlew *(Burhinus grallarius*) in the area.
- **Protect** roadsides in the Koonoomoo area for Diamond Firetail *(Stagonopleura guttata*) (e.g. provision of Saltbush (*Atriplex spp*) for feeding and retention of timber for protection from cats).
- **Maintain and enhance** populations of Lambs Tails (*Ptilotus exaltatus var semilantus)* along Boothroyd's Road.
- **Ensure that VicRoads implement** the actions outlined in the Environmental Effects Statement (EES) in relation to any Strathmerton deviation. Vic Roads are to "avoid where possible and minimise the impacts on flora, fauna and the aquatic environment" (Panel Report 2001, p95-99).

Pest Plants and Animals:

- **Undertake coordinated pest plant management** at all high priority sites (e.g. encourage group control programs/community working bees).
- **Undertake integrated pest animal management** (e.g. foxes) in areas adjoining reserves (e.g. H42) to benefit threatened fauna (e.g. Bush Stone-curlew, Tree Goannas *(Varanus varius*)).
- **Educate** the community about the spread of 'escaped' agricultural plants on to roadsides.

Landscape Processes (e.g. hydrological regime, habitat connectivity):

- **Increase** connectivity of Bushland Reserves H28, 29 and 31, with nearby vegetation.
- **Develop further linkages** between high value sites (e.g. roadsides, railway reserves, forests and creeks) using the Landscape Context Model (Ferwerda 2003) to identify sites.
- **Extend linkages** along Murray Valley Highway, in accordance with EVC requirements and existing vegetation (e.g. native grasses).

7.4 PLAINS WOODLANDS

A) Introduction – Plains Woodlands:

The key biodiversity asset 'Plains Woodland' is comprised of Plains Woodland, Plains Grassy Woodland/Gilgai Wetland Mosaic Ecological Vegetation Classes (EVC). These EVCs (e.g. Plains Woodland EVC) were historically the dominant vegetation types in the riverine plain part of the Yarrawonga landscape, but are now endangered. The majority of Plains Woodland communities (generally attributed to an overstorey of Grey Box (*Eucalyptus microcarpa*)) in the Zone, occur on private land, roadsides and edges of larger public land. These remnant types serve many important functions, including aesthetic values, habitat values, sources of native seed and sources of food, shelter and nesting sites for a range of woodland birds (Lunt 1998).

The majority of this asset type is located in the southern and eastern parts of the Zone (Figure 8). Many of the areas in the Zone that once contained these vegetation types have been cleared for agriculture, leaving fragmented landscapes. Other threats to this asset include adjacent land use practices, grazing management and pest plants and animals. The actions identified below are intended to assist in the protection of the remaining remnants within the Zone. However, these actions are specific to the Yarrawonga Zone and are by no means comprehensive for the region.

There are other BAP sites within the Zone that contain Plains Woodland or Mosaic EVCs (e.g. roadsides and fringes of public land). Whilst these could be classified as part of this Plains Woodland asset type, they have been categorised primarily based on the dominant factor (e.g. roadsides all public land, waterways all waterways) to ensure consistency of actions. Note: Both sets of actions for each listed Asset can be used (e.g. Public Land and Plains Woodland).

B) Photographic Example – Plains Woodlands:

Example of a Plains Woodland BAP Site of 'Good Condition'* for the Yarrawonga Landscape Zone

* Based on the Vegetation Quality Assessment (VQA) scores for sites surveyed in the Zone

The site (802544_180) pictured below is located near Wild Dog Creek (refer to waterway section). The EVC is Plains Woodland Mosaic. The site scored 15.5 on the Vegetation Quality Assessment and therefore is a Very High value site for the Zone. The site has a mixture of overstorey and grasses. Natural regeneration is also evident.

Plate: An example of a Plains Woodland site of 'Good Condition' for the Yarrawonga Landscape Zone

C) Actions – Plains Woodlands:

Size/Extent Related:

- **Encourage the implementation of buffer strips** around Plains Woodland sites.
- **Encourage landholders to increase the size** of priority remnants (e.g. fence to promote natural regeneration), to establish new areas of indigenous species of trees and shrubs, and to retain or establish buffer zones of unimproved, uncultivated pasture around woodland (DSE 2005a).

Condition Related:

Education/Extension:

- **Encourage** landholders to leave fallen branches and debris on the ground, especially at known Bush Stone-curlew *(Burhinus grallarius*) sites (DSE 2005a).
- **Encourage** the retention of dead trees as habitat for Birds, Reptiles, Insects and Mammals (e.g. Bats).
- **Implement community education activities** relating to the importance of Plains Woodlands and associated flora and fauna species, specifically targeting high priority remnants in paddock environments.
- **Develop a demonstration site** (show casing a very high value site) for educational purposes.

On-ground Works:

- **Encourage the protection (fencing)** of all Plains Woodland remnants and grazing management (e.g. encourage the exclusion of domestic grazing in remnants to allow plants to set seed and regenerate. Manage stock grazing for the benefit of native vegetation once plants set seed).
- **Maintain the health**, diversity and cover of native species in the long-term, by reviewing with stakeholders the location of stock holding areas and relocating these activities away from native vegetation remnants (DSE 2004).
- **Enhance** high value sites with shrubs if regeneration has not occurred following fencing (e.g. no existing viable seed source).

Threatened Species:

- **Plant corridors** to supplement habitat for all focal species, using current projects as examples (e.g. Superb Parrot (*Polystelis swainsonii*) and Grey-crowned Babbler (*Pomatostomus temporalis*).
- **Liaise** with stakeholders regarding current Bush Stone-curlew programs in the Nathalia area and options to expand or use as a demonstration project for other areas.

Pest Plants and Animals:

- **Manage** pest plants for the benefit of Plains Woodland flora and liaise with stakeholders (e.g. DPI Pest Management Officers) regarding their management.
- **Undertake integrated fox control programs** in areas with known records of Bush Stone-curlews and Tree Goannas (*Varanus varius*) (e.g. Ryan's Road, Bearii), in liaison with DPI Pest Management Officers.
- **Undertake integrated rabbit management** in all priority remnants and investigate re-initiating a program like the 'rabbit busters' program (in consultation with DPI Pest Management Officers).
- **Investigate** including pest plant and animal incentive as part of the environmental incentives.

Landscape Processes (e.g. hydrological regime, habitat connectivity):

- **Increase** connectivity of Plains Woodland sites with nearby sites, regardless of asset type.
- **Develop further linkages** between high value sites, using the Landscape Context Model (Ferwerda 2003) to identify potential sites.

7.5 RIVERINE WOODLANDS

A) Introduction – Riverine Woodlands:

The key biodiversity asset 'Riverine Woodlands' is comprised of Riverine Grassy Woodland (and mosaics), Riverine Chenopod Woodland and Riverine Sedgy Forests Ecological Vegetation Classes (EVCs). These EVCs occur on the riverine floodplain (e.g. north of Murray Valley Highway) at elevations of 100-200m and an annual general rainfall of 400-700mm. The dominant overstorey are River Red Gum *(Eucalyptus camaldulensis*), occasionally with Black Box (*Eucalyptus largiflorens*) on the margins (e.g. on the Murray Valley Highway). The understorey is typically grassy, with herbs (e.g. Bluebells), Sedges (*Carex spp*) and Daisies (e.g. *Brachyscome spp*) (DPI 2003).

This asset type primarily occurs along the northern perimetre of the Zone, along the Murray River and associated creek systems (e.g. north of the Murray Valley Highway). These remnants are relatively intact, compared to Plains Woodland remnants. The largest remnants are located on public land (e.g. Barmah Forest, Regional Parks and Ulupna/Sheepwash Creek flanks) and the smallest remnants are scattered throughout the Zone.

Pest plants and animals, vegetation/land clearance (e.g. for new developments), grazing management and changed hydrological cycles, are examples of threats to this asset. The actions identified below are intended to assist in the protection of the remaining remnants within the Yarrawonga Landscape Zone. However, these actions are specific to the Zone and are by no means comprehensive for the region.

As per the Plains Woodland asset, there may be BAP sites within the Zone that contain Riverine Grassy Woodland or Mosaic EVCs (e.g. public land sites – Barmah Forest). Whilst these could be classified as part of this Riverine Woodland asset type, they have been categorised primarily based on the dominant factor (e.g. Barmah Forest all public land) to ensure consistency of actions.

B) Photographic Example – Riverine Woodlands:

Example of a Riverine Woodland BAP Site of 'Good Condition'* for the Yarrawonga Landscape Zone

* Based on the Vegetation Quality Assessment (VQA) scores for sites surveyed in the Zone

The site (792621_12) pictured below is located near Ulupna Bridge Road, Mywee. The site scored 14.5 on the Vegetation Quality Assessment, due to good scores in neighbourhood and large trees. The site is therefore of Very High value for the Yarrawonga Landscape Zone.

Plate: An example of a Riverine Woodland site of 'Good Condition' for the Yarrawonga Landscape Zone

C) Actions – Riverine Woodlands:

Size/Extent Related:

- **Encourage the implementation of buffer strips** around Riverine Woodland sites.
- **Encourage landholders to increase the size** of priority remnants (e.g. fence to promote natural regeneration), to establish new areas of indigenous species and to retain or establish buffer zones of unimproved, uncultivated pasture around woodland (DSE 2005a).
- **Encourage expansion** of Riverine Woodland sites adjacent to 'Significant Roadsides' (as sign-posted – e.g. Old Coach Rd) for Grey-crowned Babblers (*Pomatostomus temporalis*).

Condition Related:

Education/Extension:

- **Encourage** landholders to leave fallen branches and debris on the ground, especially at known Bush Stone-curlew *(Burhinus grallarius*) sites (DSE 2005a).
- **Encourage** the retention of dead trees as habitat for Birds, Reptiles, Insects and Mammals.
- **Implement community education activities** relating to the importance of Riverine Woodlands and associated species, targeting high priority remnants in paddock environments.
- **Develop a demonstration site** (show casing a very high value site) for educational purposes.
- **Promote** the benefits of native grasses in remnants, through education (e.g. values and management techniques).
- **Implement extension activities** to encourage landholders with high value remnants to enhance the long-term viability of the sites.

On-ground Works:

- **Encourage the protection (fencing)** of all Riverine Woodland remnants to allow flowering and seed set of native plants. Retain access for controlled grazing to manage weeds, where necessary. Manage stock grazing for the benefit of native vegetation once plants set seed.
- **Maintain the health**, diversity and cover of native species in the long-term, by reviewing with landholders the location of stock holding areas and relocating these activities away from native vegetation remnants (DSE 2004).
- **Enhance** high value sites with shrubs if regeneration has not occurred following fencing (e.g. no existing viable seed source).

Threatened Species:

- **Plant corridors** to supplement focal species habitat, using current projects as examples (e.g. Superb Parrot (*Polystelis swainsonii*) and Grey-crowned Babbler (*Pomatostomus temporalis*).
- **Actively discourage** the removal of firewood from all priority sites in the Strathmerton/Mywee area, for the benefit of threatened fauna.
- **Support and encourage further research** that directly relates to the management of the Superb Parrot (Webster & Ahern 1992).
- **Protect clusters** of old growth or individual large trees (e.g. north of Old Coach Road) that provide potential habitat for significant species (e.g. Owls, Bats and Tree Goannas).

Pest Plants and Animals:

- **Manage** pest plants for the benefit of Riverine Woodland flora and liaise with DPI Pest Management Officers and the land manager, regarding their management.
- **Undertake integrated fox control programs** in areas with known records of Bush Stone-curlews (e.g. remnants near Bearii and Ulupna Creek).
- **Undertake integrated rabbit management** in all high priority remnants and investigate re-initiating a program like the 'rabbit busters' program (consult with Pest Management Officers).
- **Investigate the management** of Noisy Miners (*Manorina melanocephala*) in areas of significant corridors and known sites inhabited by Grey-crowned Babblers (e.g. Old Coach Rd).

Landscape Processes (e.g. hydrological regime, habitat connectivity):

- **Link** high value Riverine Woodland remnants using the Landscape Context Model (Ferwerda 2003) as a guide (e.g. to link with and complement native vegetation on public land, particularly areas adjacent to forests/reserves (e.g. adjacent to Barmah Forest)).
- **Identify further opportunities to link high value sites** by mapping all sites planted as part of the Grey-crowned Babbler and Superb Parrot projects in Riverine Woodland areas.

7.6 OPEN WOODLANDS/GRASSLANDS

A) Introduction – Open Woodlands/Grasslands:

Open woodlands are areas of woodland (e.g. Plains Woodland or Riverine Woodland EVCs) that have a scarce number of trees, but contain valuable grassland characteristics (the open spaces within woodlands). **Native grasslands** are areas dominated by native grasses, with few, if any, widely spaced trees. Native grasslands were typically treeless prior to European settlement however others have been created since settlement, due to clearing or heavy grazing (DSE 2004).

Five sites within the Yarrawonga Landscape Zone have been identified as predominantly 'open woodland/grassland' areas, which contain significant grassland characteristics. The EVC of the sites are Plains Woodland and Riverine Woodland related EVCs, rather than Grassland related EVCs (e.g. Northern Plains Grassland EVC), however they have significant grassland characteristics. This includes annual grasses, herbs, perennial herbs, saltbushes, perennial grasses and small patches of bare ground, with no tree cover (Ahern *et al* 2003). They have been identified as their own asset type in order to ensure appropriate recognition of the value of groundcovers in our environment.

The majority of the open woodland/grassland BAP sites in the Zone are located on private land. Primarily they are, or previously were, agricultural paddocks that have not been intensely (if ever) cultivated and therefore retain native pasture management/grassland qualities. Most of the sites were identified through the 'Native Pasture Management Layer' (CGDL 2005). The sites occur predominantly north of the Murray Valley Highway, between Bearii and Strathmerton and Katamatite.

These remaining sites are highly fragmented. They are potentially also under threat from further vegetation/land clearance, adjacent land use practices, pest plants, and species diversity decline. The actions identified below are intended to assist in the protection of the remaining sites and any other pockets of open areas within woodlands, which contain native grasses (in the Zone). Therefore, general actions relating to groundcover species have also been included on the following page, to assist in grassland species protection throughout the Zone.

B) Photographic Example – Open Woodlands/Grasslands:

Example of an Open Woodland/Grassland BAP Site of 'Good Condition'* for the Yarrawonga Landscape Zone

* Based on the Vegetation Quality Assessment (VQA) scores for sites surveyed in the Zone

The site (792622_51) pictured below is located near Bearii and is a Very High value site. The site scored 7 on the Vegetation Quality Assessment (completed as per grasslands). The adjacent roadside contains the regionally significant Lambs-tail (*Ptilotus exaltatus var. semilanatus)*.

Open Woodlands/Grasslands are a Key Biodiversity Asset in the Zone.
Plate: Open Woodlands/Grasslands site of 'Good Condition'
Inset: (Top Left) Lambs-tail (Ptilotus spp) (Bottom Left) Bluebush (Maireana spp) are examples of plant species recorded at the above site

C) Actions – Open Woodlands/Grasslands:

Size/Extent Related:

- **Encourage landholders to increase the size** of sites through buffering (e.g. fence to allow natural regeneration).

Condition Related:

Education/Extension:

- **Liaise with landholders** of all identified sites, regarding their past and future management.
- **Promote the benefits/uniqueness** and management requirements of diverse native grasslands/open woodlands (e.g. field day at one of the identified sites, possibly south of Bearii).
- **Discourage the planting of trees and shrubs** in identified sites.
- **Liaise** with Native Grass officer (DSE) regarding inclusions of grassland sites on the Native Pasture Management layer and ongoing management of sites.
- **Encourage** extension officers, Landcare Groups and landholders to report significant grassland communities, for the possible inclusion on the Native Pasture Mapping layer (DSE).
- **Provide stakeholders** (and especially those with identified sites) with SIR Flora Booklet to assist with the identification of grassland species.

On-ground Works:

- **Develop a site management plan** for identified sites and implement recommended actions.
- **Survey all roadsides** adjacent to identified sites during Spring, and where appropriate, encourage Moira Shire to protect all roadsides adjoining grassland sites (e.g. Enviromark method).
- **Encourage all landholders** to protect sites for the long-term (e.g. covenants).
- **Support landholders** and community groups in the protection of all sites (e.g. Environmental incentives, extension).
- **Trial implement on-ground works** (e.g. fire management, stock management, replanting) in consultation with all relevant stakeholders and experts.
- **Investigate funding options** for successfully trialled management options (as listed above).
- **Create conditions** for recruitment (where required, appropriate and agreed) through management techniques (e.g. reduced competition and grazing pressure, scarifying soil).
- **Liaise** with Trust for Nature (Vic) regarding trials at Naringaningalook Grasslands (e.g. fire, stock management).
- **Review current pasture management** of sites (e.g. reduced grazing, slashing) to enable recruitment of existing species to occur (DSE 2004).
- **Control the spread** of pasture grasses from adjacent cropping land (Ahern *et al* 2003).

Threatened Species:

- **Protect known records** of Small-scurf Pea (*Cullen parvum*), by providing stakeholders with extension regarding its protection and enhancement.
- **Develop a flier** promoting the existence of the Small-scurf Pea to increase known sites (e.g. encourage landholders to report rare plants).

Pest Plants and Animals:

- **Protect sites** through the management of pest plants, grazing and reduced vehicle movement.
- **Manage** pest plants for the benefit of grassland flora and liaise with DPI Pest Management Officers and the land manager, regarding their on-going management.

Landscape Processes (e.g. hydrological regime, habitat connectivity):

- **Link** high value sites with roadsides (where possible – e.g. Bearii area). Investigate linking sites by the creation of corridors between sites.
- **Identify further opportunities to link high value sites,** by mapping all sites planted as part of the Grey-crowned Babbler and Superb Parrot projects.

* The actions identified in this section could be implemented for other areas that contain ground-cover species in the Yarrawonga Landscape Zone.

7.7 SAND WOODLANDS

A) Introduction – Sand Woodlands:

The key biodiversity asset 'Sand Woodlands' is comprised of Shallow Sand Woodland Ecological Vegetation Class (EVC) and Sand Ridge Woodland EVC. These EVCs typically occur on natural high sand ridges or dunes, typically formed by large rivers, depositing the deep sandy soils at elevations of 100-125m. They are generally a grassy ecosystem with an overstorey of Yellow Box *(Eucalyptus melliodora*), White Cypress-pine (Murray Pine) (*Callitrus glaucophylla*) and Buloke (*Allocasuarina leuhmanii*), and sometimes Grey Box (*E. microcarpa*). The shrub layer generally consists of wattles (e.g. Lightwood (*Acacia implexa*), Grey Mulga (*Acacia brachybotrya*), Golden Wattle (*Acacia pycnantha*), Mallee Wattle (*Acacia montana*), Gold-dust Wattle (*Acacia acinacea*), Weeping Pittosporum *(Pittosporum phylliraeoides*) and Emubush (*Eremophila longifolia*)) (Ahern *et al* 2003).

This asset type primarily occurs on sandier rises in conjunction with Plains Woodland EVC. The largest remnants of this asset are located near Naringaningalook/Katamatite area. They are subject to threats including, grazing management, adjacent land use practices, pest plants, pest animals (rabbits) and lack of species diversity (e.g. no understorey). The actions identified below are intended to assist in the protection of the remaining remnants within the Zone. However, these actions are specific to the Zone and are by no means comprehensive for the region.

As per the Plains Woodland and Riverine Woodland assets, there may be BAP sites within the Zone that contain Sand Woodland Mosaic EVCs (e.g. public land sites - roadsides). Whilst these could be classified as part of this Sand Woodland asset type, they have been categorised primarily based on the dominant factor (e.g. roadsides - all public land) to ensure consistency of actions. However the actions listed below may still be applied to sites where 'Sand Woodland' is listed as secondary.

B) Photographic Example – Sand Woodlands:

Example of a Sand Woodland BAP Site of 'Good Condition'* for the Yarrawonga Landscape Zone

* Based on the Vegetation Quality Assessment (VQA) scores for sites surveyed in the Zone

The site (802544_184) pictured below is located near Naringaningalook. Although the site only scored 5 on the Vegetation Quality Assessment, it is an endangered EVC and over 15 hectares in size and therefore scored as 'High value'.

Plate: An example of a Sand Woodland site of 'Good Condition' for the Yarrawonga Landscape Zone

C) Actions – Sand Woodlands:

Size/Extent Related:

- **Encourage landholders to increase the size** of existing remnants, to establish new areas of indigenous species of trees and shrubs, and to retain or establish buffer zones of unimproved, uncultivated pasture around woodland (DSE 2005a).
- **Extend remnants** and create corridors to combat the affect of isolation of remnants (e.g. loss of a healthy gene pool such as Buloke - *Allocasuarina luehmanii*).

Condition Related:

Education/Extension:

- **Encourage** landholders to leave fallen branches and debris on the ground, especially at known Bush Stone-curlew *(Burhinus grallarius*) sites (DSE 2005a).
- **Encourage** the retention of dead trees as habitat for Birds, Reptiles, Insects and Mammals.
- **Implement community education activities** relating to the importance of Sand Woodlands and associated threatened species, targeting high priority remnants in paddock environments.
- **Develop a demonstration site** (show casing a high value site) for educational purposes.
- **Promote** the benefits and value of native grasses in remnants, through education/extension.

On-ground Works:

- **Encourage the protection (fencing)** of all Sand Woodland remnants and manage grazing practices (e.g. encourage the exclusion of domestic grazing in remnants to allow plants to seed and regenerate (especially during Summer/Autumn). Manage stock grazing for the benefit of native vegetation once plants set seed) (NRE 2002c).
- **Enhance** high value sites with shrubs if regeneration has not occurred following fencing (e.g. no existing viable seed source).
- **Collect seed** from sites over Summer and direct seed by hand in early Autumn (or have propagated by nursery) if not having success with natural regeneration
- **Keep irrigation run-off** at least 20-metres away from base of trees, ideally further.
- **Encourage the development of site management plans** for all sand woodland sites (for example, discourage use of remnant near Katamatite as laneway and stock holding area. If unavoidable, fence off affected area rather than using a large area. Remove excess manure following removal of cattle and revegetate site. Encourage catch drains around edge of remnant to reduce impacts from irrigation. Investigate groundwater management for the environment).
- **Create conditions** for recruitment (where required, appropriate and agreed) through management techniques (e.g. reduced competition and grazing pressure, scarifying soil).

Threatened Species:

- **Investigate** all identified sites for the presence of both male and female (or combined) Buloke trees to determine ability to regenerate (other than from root disturbance).

Pest Plants and Animals:

- **Manage pest plants** for the benefit of Sand Woodland flora and liaise with DPI Pest Management Officers and the land manager, regarding their management.
- **Undertake integrated fox programs** in areas with known records of Bush Stone-curlews.
- **Encourage integrated rabbit management** in all high priority remnants and investigate re-initiating a program like the 'rabbit busters' program (in consultation with DPI Officers).
- **Evaluate** current extension processes for managing rabbits and investigate options within the Environmental Incentives, to provide assistance with rabbit management prior to enhancement.
- **Develop rabbit management brochure**, for all extension officers to provide to landholders wishing to uptake environmental incentives, particularly for Sand Woodlands.
- **Undertake weed control** (particularly during Summer/Autumn) to encourage regeneration of seed (e.g. White Cypress-pine (Murray Pine) (*Callitrus glaucophylla*) and Buloke) (NRE 2002c).

Landscape Processes (e.g. hydrological regime, habitat connectivity)

- **Link** high value Sand Woodland remnants using the Landscape Context Model (Ferwerda 2003) as a guide.
- **Extend linkages** along roadsides that contain Sand Woodland type EVCs, (e.g. near Cobram Tip) in accordance with EVC requirements (and native grass management).

8.0 MONITORING

Monitoring is a fundamental component of all management activities and an important tool, which can be used to enhance the knowledge of biodiversity assets and manage for their on-going protection (Robinson *in prep.*).

The following table (Table 4) provides a basis for monitoring in the Yarrawonga Landscape Zone. Where possible, this information will feed into the various Goulburn Broken Catchment monitoring programs. It identifies a general monitoring outline, including actions that may be conducted to determine progress towards achieving Catchment biodiversity targets. It identifies the key biodiversity asset, key indicators for monitoring and the suggested frequency/intensity of monitoring.

It is important to note that many of the monitoring activities listed below are already taking place, through a variety of mechanisms (e.g. collection of data via local, Catchment and Statewide databases and processes). Where existing mechanisms are already in place, they will continue to be used. However, there are other monitoring activities that are needed to provide useful information and allow for accurate assessment of the Catchments progress, towards meeting the Biodiversity Resource Condition Targets (RCTs).

A wide variety of monitoring actions are listed below. However this does not result in a binding commitment of those organisations (e.g. time or funding) to undertake all of the monitoring. Rather, this table is intended to be a source of ideas for agency staff and community groups (e.g. community groups may be interested in conducting future surveys). Interested persons can contact the Goulburn Broken Catchment Management Authority, Shepparton, or the Department of Primary Industries and Department of Sustainability and Environment Offices, Tatura, to discuss ideas and to ensure a coordinated approach (refer to Section 10.0 for contact information).

Whilst Table 4 outlines monitoring actions, evaluation of the BAP process also needs to occur to evaluate the effectiveness of the BAP process (e.g. in engaging people and prioritising works). An evaluation plan is therefore being developed to provide an overarching evaluation process for BAP in the Goulburn Broken Catchment.

Table 4: Monitoring - Yarrawonga Landscape Zone

Key Biodiversity Asset	Key Indicators for Monitoring	Frequency/Intensity
1) Waterways	• Trends in environmental flows and in-stream habitat condition (as measured by ISC).	Five yearly* ISC assessments.
	• Trends in water quality.	Once yearly; as part of EPA monitoring; five yearly as part of ISC; at least 30 sites (GBCMA 2004b).
	• Monitor the trends in condition and functionality of riparian vegetation/stream frontages condition (resurveying of sites using VQA assessments; area/number fenced; area/number with restored flows).	Every 5 year; 30 sites, part of ISC; CAMS inputs.
	• Surveying of mean habitat width of waterways in Zone.	Every 5 years; all sites (or in accordance with existing waterways monitoring), aerial photography.
2) Wetlands	• Monitoring of wetlands using index of wetland condition guidelines, as well as Vegetation Quality Assessments (to allow priority comparison).	Every 5 years.
	• Number of significant wetlands with improved hydrological regimes.	Every 5 years.
	• Percentage (%) of sites with barriers to natural flow.	Every 5 years.
3) Public Land	• Refer to "All Key Biodiversity Sites" below.	See below.
4) Plains Woodland	• Refer to "All Key Biodiversity Sites" below.	See below.
5) Riverine Woodland	• Refer to "All Key Biodiversity Sites" below.	See below.
6) Open Woodlands/ Grasslands	• Refer to "All Key Biodiversity Sites" below.	See below.
7) Sand Woodlands	• Refer to "All Key Biodiversity Sites" below.	See below.

* Five yearly refers to five times per year

All Key Biodiversity Assets	• Trends in vegetation condition (resurvey the 100 sites using VQA assessments) (this includes threats data).	Every 5 years; wetlands – 20 sites; woodlands/grasslands – 30 sites.
	• Trends in bird survey data (resurvey sites using bird survey method).	Every 5 years; wetlands – 20 sites; woodlands/grasslands – 30 sites.
	• Photographic point surveys (re-photograph sites).	Every 5 years; when complete VQA and bird surveys.
	• Vegetation Quality Assessments, bird surveys and photographic point surveys at the remaining unsurveyed BAP sites.	Within next 5 years; to allow monitoring of these sites (as outlined above).
	• Inclusion and surveying of up-to-date data and information (if any changes), or addition of sites (e.g. if not already an identified site).	Once yearly; all new information; all sites.
	• Trends in Focal Species reporting/sightings (e.g. population size, age distribution, frequency of records, number of birds/pairs recorded, habitat (e.g. number of sites/EVC), breeding success, recruitment).	Initial survey throughout Zone to establish baseline data on population size and structure, subsequent two-yearly as part of bioregional program; across the Zone.
	• Monitoring of threatened species against current records.	Every 2 years; across the Zone.
	• Undertake surveys for all of listed (threatened) species to establish baseline data on abundance and distribution in accordance with Victorian Rare or Threatened Species procedures.	Within next 5 years; across the Zone.
	• Subsequent assessments of selected populations (as per above threatened populations) to determine population trends.	Within next 5 years (subsequent to above action); across the Zone.
	• Trends in connectivity and characteristics of sites within landscape (e.g. size of remnants).	Every 5 years; aerial photography.
	• Overlay of on-ground works areas against this Plan mapping data.	Once yearly; (end financial year), all applicable sites.
	• Number of incentives processed and implemented for priority sites for all Key Biodiversity Assets (private land only).	Once yearly; in accordance with incentive mapping and overlaying of on-ground works areas (as per above action).
	• Trends in plants of special concern (e.g. undertake monitoring of River Swamp Wallaby-grass in the Zone to further determine management requirements).	Once; then as required.

* Five yearly refers to five times per year

9.0 FURTHER INFORMATION – PRIORITY SITES

Priority Site Data:
Appendix 12 provides information on how to obtain data for the 266 priority BAP sites within the Yarrawonga Landscape Zone. It is intended that the priority site information and other information detailed in this plan, will allow groups and staff (e.g. extension staff and community groups) to;

- Be pro-active in targeting sites,
- Act as a basis for informed management of the site,
- Provide a further rationale for applying incentives,
- Provide a tool for landholders and the wider community,
- Provide a tool to show how a site fits into the wider landscape, and
- Provide a benchmark against which future improvements in management can be monitored.

How to Use the Data Provided:
The data provided is intended for use by a range of agencies and community groups to assist with biodiversity conservation in the Zone. It is particularly targeted towards agency extension officers. For example, it is anticipated that prior to, or following a site visit, an extension officer will investigate the data associated with a site, such as;

- What is the Ecological Vegetation Class of the site?
- How does the site fit in to the wider landscape?
- Are there any management agreements or incentives for the site (e.g. covenant, bush tender)?
- Are there threatened or notable species recorded at the site or nearby?
- What is the rating of the site and those near it (e.g. Very High, High, Medium or Low)?
- What are the actions recommended for the site (e.g. pest plant management)?
- What are the options available to the landholders to fulfil these actions (e.g. fencing incentive)?
- What are the options for joining the site to public land (e.g. widening roadsides to provide a corridor/link)?
- Use the Landscape Context Map (Appendix 9) to determine where possible linkages (revegetation) may be of the most benefit – think about the landscape, what we could do to help the area.
- It is also important to remember that sites with scattered trees are still a vital link in the landscape and especially in an area where much of the original vegetation has given way to agriculture. Officers need to determine on-site where the best possible linkages could occur, and often this should include scattered vegetation, as although scattered vegetation have not always been identified as a site in this Plan, they form an important element for providing links between the identified sites.

Keeping the Data Current:
The data contained in this report is by no means 'comprehensive', as this process relies on the regular updating of information, to keep it accurate and timely. Therefore this Plan is adaptive to enable management actions and information to be modified in response to further information, including monitoring. This Plan will also be reviewed when necessary to ensure that it remains a 'living' document. In order for the data and associated maps to remain as up-to-date and relevant as possible, it is important that site data continue to be added to the database. For example, the Department is not always aware of sightings of flora and fauna by individual landholders or community groups and there are a number of sites that require Vegetation Quality Assessments and Bird Surveys.

Further Information or to Provide Data:
BAP data relies on regular updating to keep the information relevant for users. For clarification of information or to provide further data, please refer to Appendix 12 (CD) or contact bap@gbcma.vic.gov.au, or the Biodiversity Action Planning Officer, Department of Sustainability and Environment, Benalla PO BOX 124, Vic 3672.

10.0 LANDHOLDER ASSISTANCE

There is a range of assistance available for landholders in regards to planning for biodiversity conservation and implementing works on their properties. This section is designed to provide an overview of some of the property planning, management tools and incentives available to landholders and the community within the Shepparton Irrigation Region. Also included are some of the programs that could benefit from the information provided in this Plan.

LOCAL AREA PLANS	*WHOLE FARM PLANS*
This Conservation Plan can provide an extra resource for Local Area Planning groups, in relation to their Local Area Plans. It can assist groups with both implementation and in the provision of further information for conducting biodiversity planning in their area.	Protecting biodiversity on a farm is an important element when developing and implementing a Whole Farm Plan. Biodiversity Action Planning can inform the process and provide extra information for landholders and extension officers.

Advice and Information:
Please contact your local Department of Primary Industries (DPI)/Department of Sustainability and Environment (DSE) Office, the Goulburn Broken Catchment Management Authority (GBCMA), the Goulburn Murray Landcare Network (GMLN) or Trust for Nature (TFN) (Vic), for further information on biodiversity conservation. There are extension officers within these organisations who can provide advice on a range of aspects such as; whole farm planning, irrigation design, groundwater management, revegetation and protection of remnant vegetation, threatened species protection and best management practices.

Incentives for On-Ground Works:
There are a range of incentives available for landholders within the Shepparton Irrigation Region for Catchment works, including;

- Environmental incentives – (e.g. fencing, direct seeding and revegetation) to assist with the protection and/or enhancement of remnant vegetation, including wetlands and grasslands,
- Tree Growing incentives - to assist with the re-establishment of native vegetation, and
- Water Use Efficiency Incentives (including Whole Farm Planning, Reuse and Automatic Irrigation). *For the above three points, contact the Department of Primary Industries, Tatura* (03) 58 335 222.
- Waterways Incentives – for on-ground works along rivers and creeks.
  For the above point, contact the GBCMA office, Shepparton on (03) 58 201 100.

Management Arrangements:
Programs such as Carbon Tender, Bush Returns, EcoTender and Bush Broker, may provide incentives and advice for long-term conservation management on properties. *Contact the GBCMA, Shepparton on (03) 58 201 100 or Benalla DSE (03) 57 611 611 for further information or visit www.gbcma.vic.gov.au*

Permanent Protection:
A Conservation Covenant permanently protects sites for conservation. It may provide assistance for rate relief, tax concessions and incentives for the costs of on-ground works. *TFN (Vic) is the managing organisation in regard to Conservation Covenants; visit their website at www.tfn.org.au*

Other Assistance:

- Goulburn Murray Landcare Network Shepparton – Landcare related advice (www.gmln.org.au)
- Land for Wildlife – a voluntary scheme aiming to encourage and assist landholders to protect and enhance biodiversity values on their properties. *For further information visit* www.dse.vic.gov.au
- Local Government (Moira Shire, Cobram) – managing authority for native vegetation statutory planning requirements. For further information visit www.moira.vic.gov.au

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A special acknowledgment to all current and past representatives (to date) on the Goulburn Broken Biodiversity Action Planning (BAP) Steering Committee. This Committee was established to oversee the BAP process and is responsible for the coordination of BAP in the Goulburn Broken Catchment. The Committee is comprised of personnel from a range of departmental organisations, including the GBCMA, DPI, DSE and TfN (Vic). Committee members are detailed below, along with steering committee contributors. Thank you to those who have attended meetings as invited guests (names not listed) and provided valuable comment. Your assistance was very much appreciated.

Goulburn Broken Catchment Biodiversity Action Planning Steering Committee Members:

GBCMA - Barlow, Tim – Manager, Biodiversity Program, GBCMA (current)
Brunt, Kate – Biodiversity Projects Coordinator, GBCMA (current)
Bell, Kate – (as) Manager, Biodiversity Program, GBCMA (past)

DPI - Stothers, Kate – Nature Conservation Coordinator, DPI (Dryland) (current)
Heard, Rebecca – Native Biodiversity Coordinator, DPI (SIR) (current)
Sislov, Alex – Environmental Management Program Team Leader (SIR) (current)
Williams, Lance – Planning Officer, DPI (past)

DSE - Smith, Stephen – Senior Flora and Fauna Officer, DSE (Upper) (current)
Wilson, (Dr) Jenny – Biodiversity Projects Officer, DSE (Dryland) (current)
Edmonds, Tobi – Threatened Species Project Officer, DSE (current)
Merritt, Bronwyn – (as) Biodiversity Landscape Plan Project Officer, DSE (past)
Colbourne, Debbie – (as) Flora and Fauna Planner, DSE (Dryland) (past)
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TfN (Vic) - Robinson, (Dr) Doug – Regional Manager, Goulburn Broken – TfN (Vic) (current)

Goulburn Broken Catchment Biodiversity Action Planning Contributors:

Mentiplay-Smith, Janice – Links Officer, DPI (trial implementation, upper Goulburn) (current)
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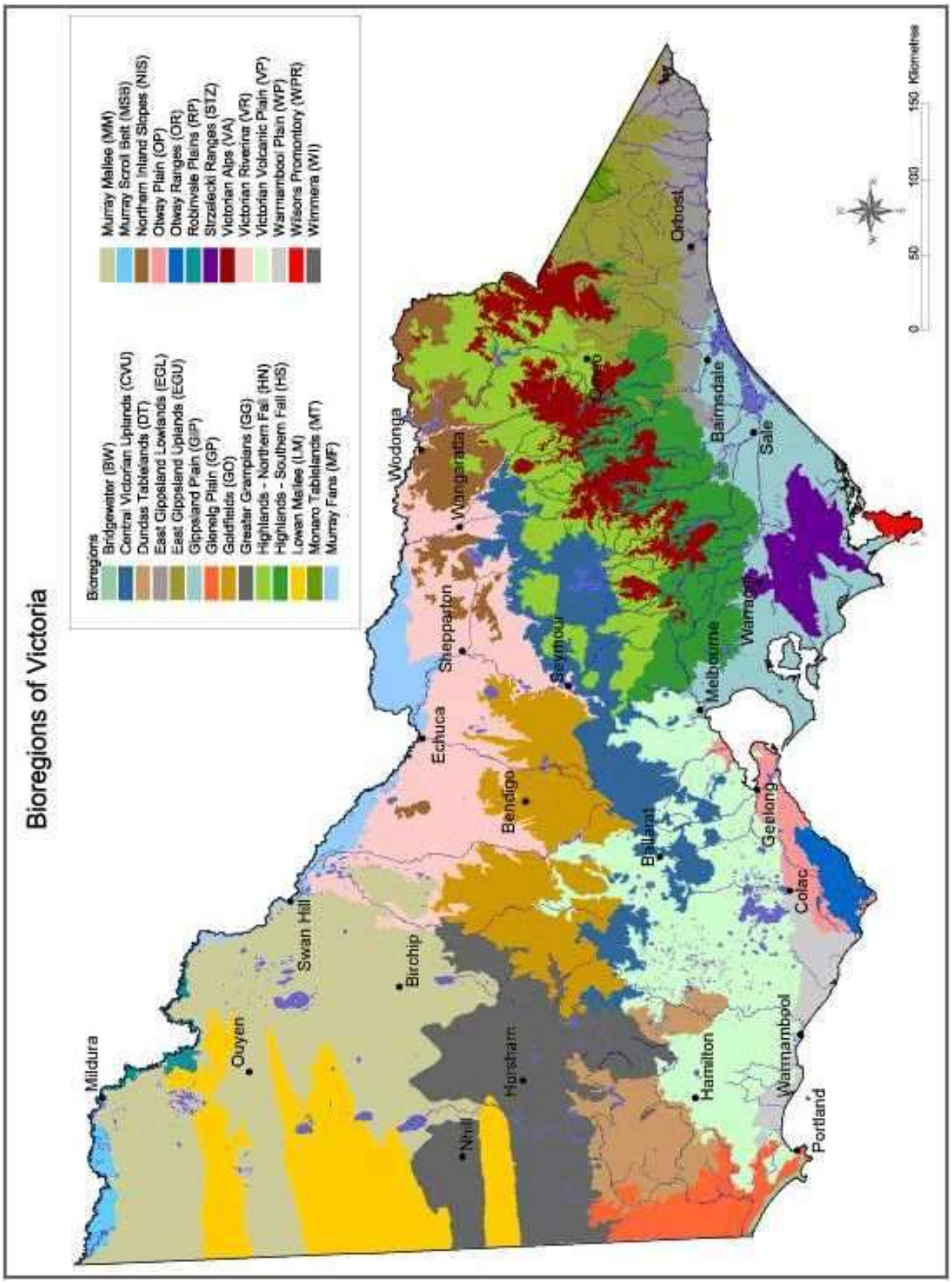
Weber, Rolf – (as) Acting Biodiversity Team Leader, DSE (current)
Berwick, Sue – (as) Flora and Fauna Planner, DSE (current)
Marion Howell – (as) Biodiversity Officer, GBCMA (past)

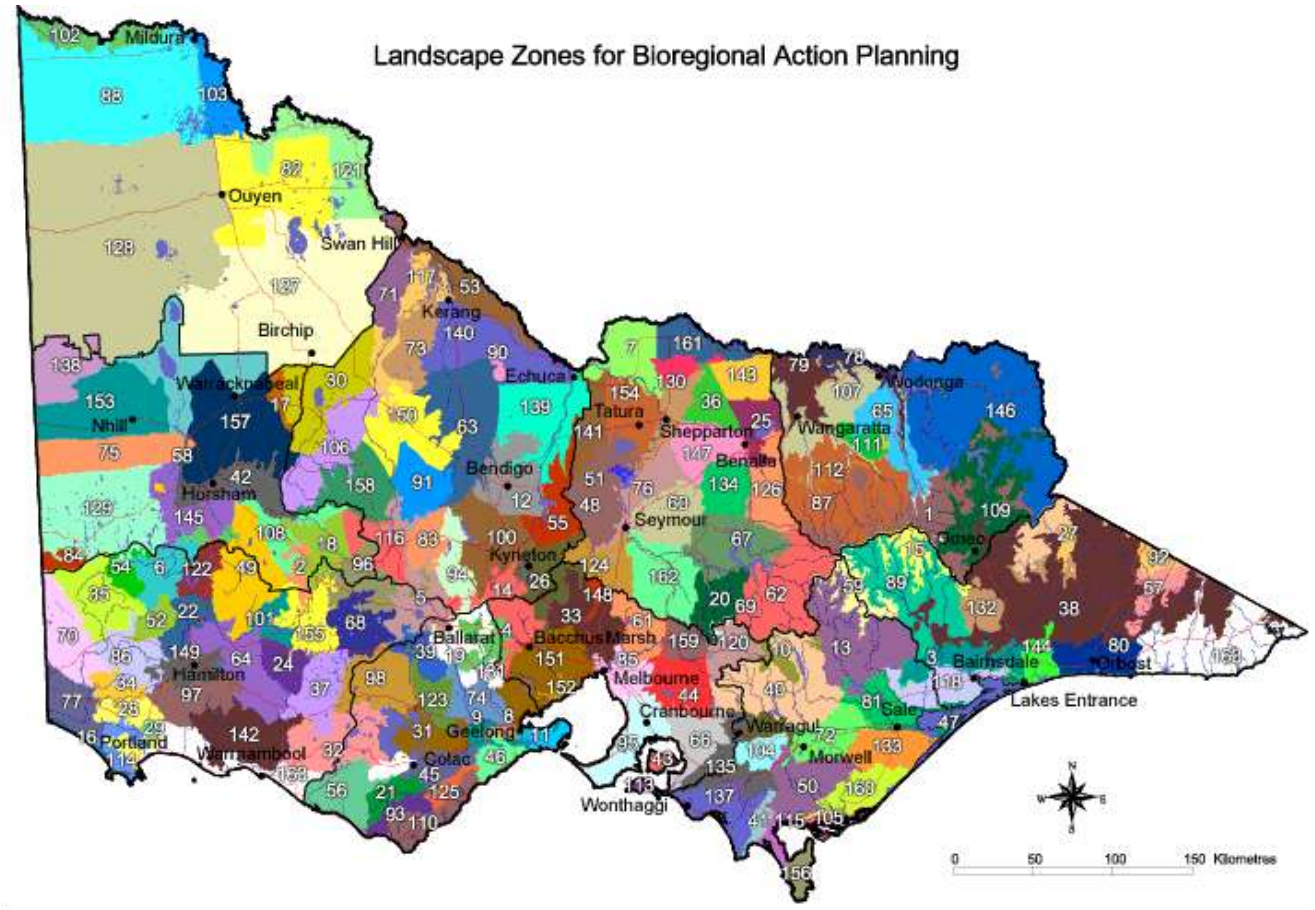
13.0 APPENDICES

APPENDIX 1 – VICTORIAN BIOREGIONS



Source: www.dse.vic.gov.au

APPENDIX 2 – VICTORIAN LANDSCAPE ZONES



1. Alpine
2. Ararat Hills
3. Bairnsdale foothills
4. Ballan
5. Ballarat
6. Balmoral
7. Barmah Murray Fan
8. Barrabool
9. Barwon
10. Baw Baw
11. Bellarine
12. Bendigo
13. Black Range
14. Blackwood
15. Bogong
16. Bridgewater
17. Brim Lawler
18. Bulgara
19. Buninyong
20. Buxton
21. Carlisle
22. Cavendish
23. Central Creek
24. Chatsworth
25. Chesney
26. Cobaw
27. Cobbera
28. Cobboboonee
29. Codrington
30. Corack
31. Corangamite East
32. Corangamite West
33. Craigieburn
34. Crawford River
35. Dergholm
36. Dookie
37. Dundonnel
38. East Gippsland Uplands
39. Enfield
40. Erica
41. Fish Creek
42. Flat Grey Plains
43. French Island
44. Gembrook
45. Gerangamete
46. Gherang
47. Gippsland Lakes
48. Goldfields
49. Grampians
50. Grand Ridge
51. Graytown
52. Gringegalgona
53. Gunbower
54. Harrow
55. Heathcote
56. Heytesbury
57. Highlands - Far East
58. Hindmarsh
59. Howitt
60. Hughes Creek
61. Hurstbridge
62. Jamieson/Bulla
63. Jarkilin
64. Karabeal
65. Kiewa
66. Koo Wee Rup
67. Lake Eildon
68. Lake Goldsmith
69. Lake Mountain
70. Lake Mundi
71. Lalbert
72. Latrobe
73. Leaghur
74. Leigh
75. Little Desert
76. Longwood
77. Lower Glenelg
78. Lower Kiewa
79. Lower Ovens
80. Lower Snowy
81. Macallister
82. Manangatang
83. Maryborough
84. Meerlieu
85. Melbourne
86. Merino
87. Mid King
88. Millewa - Carwarp
89. Mitchell
90. Mitiamo
91. Mollagul
92. Monaro Tableland
93. Moomowroong
94. Moorookyle
95. Mornington
96. Mount Cole
97. Mount Eccles
98. Mount Elephant
99. Mt Talbot
100. Muckelford
101. Muirhead
102. Murray Scroll Belt
103. Nangiloc - Colignan
104. Narracan
105. Nooramunga
106. North Central
107. North East
108. Northern Footslopes
109. Omeo
110. Otway
111. Ovens
112. Ovens & King
113. Phillip Island
114. Portland
115. Prom Plain
116. Pyrenees
117. Quambatook
118. Red Gum Plain
119. Reedy Lake
120. Reefton
121. Robinvale - Nyah
122. Rocklands
123. Rokewood
124. SW Goulburn
125. Sabine
126. Samaria/Lake Nillahcootie
127. South East Mallee
128. South West Mallee
129. South West Wimmera
130. Southern Goulburn
131. Steiglitz
132. Stirling
133. Stradbroke
134. Strathbogie
135. Strzelecki West
136. Tanjil
137. Tarwin/Powlett
138. Telopea Downs
139. Tennyson
140. Terrick
141. Timmering Dryland
142. Tower Hill
143. Tungamah
144. Tyres
145. Undulating Alluvial
146. Upper Murray Mitta
147. Violet Town
148. Wallan
149. Wannon
150. Wedderburn
151. Werribee
152. Werribee South
153. West Wimmera Plain
154. Western Goulburn
155. Willaura
156. Wilsons Promontory
157. Wimmera Plains
158. Wingallok
159. Yarra
160. Yarram
161. Yarrawonga Murray Fan
162. Yea
163. unnamed

Source: www.dse.vic.gov.au

APPENDIX 3 – GOULBURN BROKEN CATCHMENT TARGETS

This Appendix is intended to provide a summary of the Goulburn Broken Regional Catchment Strategy targets and priorities for biodiversity conservation. For further information please refer to GBCMA 2003a or visit www.gbcma.vic.gov.au.

The Goulburn Broken Regional Catchment Strategy identifies the following biodiversity resource condition targets for native vegetation in the Catchment;

1. Maintain the extent of all native vegetation types at 1999 levels in keeping with the goal of 'Net Gain' listed in Victoria's Biodiversity Strategy 1997,
2. Improve the quality of 90% of existing (2003) native vegetation by 10% by 2030,
3. Increase the cover of all endangered and applicable vulnerable Ecological Vegetation Classes to at least 15% of their pre-European vegetation cover by 2030,
4. Increase 2002 conservation status of 80% threatened flora and 60% threatened fauna by 2030,
5. Maintain the extent of all wetland types at 2003 levels where the extent (area and number) has declined since European settlement, and
6. Improve the condition of 70% of wetlands by 2030, using 2003 as the benchmark for condition (GBCMA 2003a p11).

Priorities for action to conserve biodiversity in the Goulburn Broken Catchment (GBC) are driven by the conservation significance of the biodiversity asset. Regional investments in biodiversity conservation in the GBC are driven by the following goals (in order of priority);

1. **Protecting** existing viable remnant habitats and the flora and fauna populations they contain (e.g. through reservation, covenants, management agreements, fencing and statutory planning),
2. **Enhancing** the existing viable habitats that are degraded (e.g. management of threats such as pest plants and animals, grazing, salinity, promotion of natural regeneration and/or revegetation with understorey), and
3. **Restoring** under-represented biodiversity assets to their former extent by revegetation (to create corridors, buffers, patches of habitat) (GBCMA 2003a).

APPENDIX 4 – COMMUNITY ACTIVITIES

A Communication Plan was developed in the Shepparton Irrigation Region, to guide Biodiversity Action Planning community consultation activities. The following list identifies the range of community consultation activities that have occurred during the development of this Plan.

Note: Whilst a large number of activities have occurred in the Goulburn Broken Catchment that led to the development of these Plans (e.g. existing biodiversity management programs and strategies), only the most recent activities in relation to this Conservation Plan have been included.

- Steering Committee Meetings – (quarterly) Goulburn Broken Biodiversity Action Planning Steering Committee Meetings. Comprising representatives from; Department of Primary Industries (DPI), Department of Sustainability and Environment (DSE), Goulburn Broken Catchment Management Authority (GBCMA) and Trust for Nature (Victoria) (TfN) (Vic).

- Training – 1st & 9th February 2005, 28th April 2005 - Fieldwork with DSE regarding Plan development. Discussions with landholders.

- Working Group Memos/Presentations (throughout 2005) (papers, plan reviews, technical/ community advice from the Shepparton Irrigation Region Technical Committee (SIRTEC) and the Shepparton Irrigation Region Implementation Committee (SIR IC) respectively).

- Presentation – 2nd March 2005 – Farm and Environment Program Working Group.

- August 2005 to October 2005 – Field Surveying – Liaisons with Landholders regarding property access, background to BAP process, Field Surveys, Data Collection and Local Knowledge.

- Presentation/Meeting – 29th August 2005 - Muckatah Katamatite Naringaningalook Local Area Planning Group

- Presentation/Meeting – 6th September 2005 - Nathalia Local Area Planning (LAP) Group

- Presentation – 8th November 2005 - Sustainable Irrigated Landscapes, DPI

- Draft Plan Community Review - November 2005 - January 2006 - Community Consultation (letters, phone calls, e-mails and/or meetings) Draft Yarrawonga Landscape Zone Conservation Plan. Plan sent for comment to a number of representatives of the following agencies/community groups: SIR IC, SIRTEC, GBCMA (including board representatives), DPI, DSE, TfN (Vic), Goulburn-Murray Water, Parks Victoria, Goulburn Murray Landcare Network, Local Government (Moira Shire), Peechelba-Landcare Group, South Yarrawonga Landcare Group, Muckatah Landcare Group, Nathalia LAP Group, Naringaningalook Landcare Group, Broken Creek Field Naturalists and Nathalia Tree Group.

- Newspaper Article – January 2006 – SIR IC Land and Water Update Column, Country News.

- Newspaper Article – March 28th, 2006, 'Plans for Nature' Country News. Also listed in DPI News - Notes and e-mailed to DPI Staff.

- Meeting/Presentation - April 4th 2006 – Naringaningalook Landcare Group.

- Meeting/Presentation - April 12th 2006 – Muckatah Landcare Group.

- Final Plan Review/Approval – April 2006, Steering Committee, SIRTEC and SIRIC.

APPENDIX 5 – THREATENED FLORA

List of threatened flora and their conservation status in the Yarrawonga Landscape Zone (NRE 2002e). Table modified from Ahern *et al* 2003.

English Name	Latin Name	Australian Status*	Victorian Status*	FFG Listed*	FFG Action Statement Number	BNA Assessment*	Species Number*
Myall	*Acacia melvillei*		v			Un	58
Yarran Wattle	*Acacia omalophylla*		e	L			69
River Swamp Wallaby-grass	*Amphibromus fluitans*	V	k				3623
Dark Wire-grass	*Aristida calycina var. calycina*		r			Un	3630
Corkscrew Spear-grass	*Austrostipa setacea*		r			Un	3292
Yellow-tongue Daisy	*Brachyscome chrysoglossa*		v	L			3654
Mueller Daisy	*Brachyscome muelleroides*	V	e	L			465
Reader's Daisy	*Brachyscome readeri*		r			Un	474
Winged Water-starwort	*Callitriche umbonata*		v			Un	575
Riverina Bitter-cress	*Cardamine moirensis*		r			Un	5032
Swamp Billy-buttons	*Craspedia paludicola*		v			Un	4649
Small Scurf-pea	*Cullen parvum*	E	e	L	31		2773
Silky-heads	*Cymbopogon obtectus*		e			Un	904
Lax Flat-sedge	*Cyperus flaccidus*		v			Un	920
Glaucous Flax-lily	*Dianella longifolia var. grandis*		v			Un	4419
Late-flower Flax-lily	*Dianella tarda*		v			Un	5085
Umbrella Grass	*Digitaria divaricatissima*		v				1045
Silky Browntop	*Eulalia aurea*		r			Un	1328
Woolly Buttons	*Leiocarpa panaetioides*		r			Un	1945
Button Rush	*Lipocarpha microcephala*		v			Un	2020
Leafless Bluebush	*Maireana aphylla*		v			Un	2096
Small-leaf Bluebush	*Maireana microphylla*		e			Un	3865
Waterbush	*Myoporum montanum*		r			Un	2240
Ridged Water-milfoil	*Myriophyllum porcatum*	V	v	L			2257
Dwarf Bitter-cress	*Rorippa eustylis*		r			Un	2944
Narrow-leaf Sida	*Sida trichopoda*		r			Un	3147
Silky Swainson-pea	*Swainsona sericea*		v			Un	4946
Leafy Templetonia	*Templetonia stenophylla*		r			Un	3341
Rye Beetle-grass	*Tripogon loliiformis*		r			Un	3455

* Australian (denoted by capital letter) Status of Species: E = Endangered, V = Vulnerable (in order highest to lowest)
* Victorian (denoted by lower case) Status of Species: e = endangered, v = vulnerable, r = rare, k = poorly known
* FFG (Flora Fauna Guarantee Act 1988) taxon: L = listed (individual species only - not if part of listed communities)
* BNA (Bioregional Network Analysis) Assessment: Un = Unassessed. Ranking refers to the required response level for each taxon (determined through the occurrence of the species in the bioregion, in different land tenures, occurrence ranking, risk ranking and priority level).
* Species Number: State identification number/code attributed to individual species.

APPENDIX 6 – THREATENED FAUNA

List of threatened fauna and their conservation status in the Yarrawonga Landscape Zone (NRE 2002f). Table modified from Ahern *et al* 2003.

English Name	Latin Name	Australian Status*	Victorian Status*	FFG Listed*	FFG Action Statement Number	Recovery Plan	BNA Unassessed*	Species Number*
Australasian Bittern	*Botaurus poiciloptilus*		EN				Un	197
Australasian Shoveler	*Anas rhynchotis*		VU				Un	212
Baillon's Crake	*Porzana pusilla*		VU				Un	50
Barking Owl	*Ninox connivens*		EN	L	166		Un	246
Black Falcon	*Falco subniger*		VU				Un	238
Blue-billed Duck	*Oxyura australis*		EN	L	174		Un	216
Bluenose(Trout) Cod	*Maccullochella macquariensis*	End	CR	L	38	Yes	Un	4093
Broad-shelled Tortoise	*Chelodina expansa*		EN					2016
Brolga	*Grus rubicunda*		VU	L	119			177
Bush Stone-curlew	*Burhinus grallarius*		EN	L	78			174
Diamond Firetail	*Stagonopleura guttata*		VU	L			Un	652
Freckled Duck	*Stictonetta naevosa*		EN	L	105			214
Giant Bullfrog	*Limnodynastes interioris*		CR	L				3060
Golden Perch	*Macquaria ambigua*		VU					4095
Great Egret	*Ardea alba*		VU	L	120			187
Grey Falcon	*Falco hypoleucos*		EN	L	83		Un	236
Grey-crowned Babbler	*Pomatostomus temporalis*		EN	L	34			443
Ground Cuckoo-shrike	*Coracina maxima*		VU	L			Un	423
Hardhead	*Aythya australis*		VU				Un	215
Intermediate Egret	*Ardea intermedia*		CR	L	120			186
Little Egret	*Egretta garzetta*		EN		120			185
Murray Cod	*Maccullochella peelii peelii*		EN	L				4094
Musk Duck	*Biziura lobata*		VU				Un	217
Painted Snipe	*Rostratula benghalensis*		CR				Un	170
Powerful Owl	*Ninox strenua*		VU	L	92		Un	248
Red-chested Button-quail	*Turnix pyrrhothorax*		VU				Un	19
River Blackfish	*Gadopsis marmoratus*		CR				Un	4127
Royal Spoonbill	*Platalea regia*		VU					181
Silver Perch	*Bidyanus bidyanus*		CR	L				4099
Superb Parrot	*Polytelis swainsonii*	Vul	EN	L	33			277
Swift Parrot	*Lathamus discolor*	End	EN	L	169	Yes	Un	309
Tree Goanna	*Varanus varius*		VU				Un	2283
Warty Bell Frog	*Litoria raniformis*	Vul	EN				Un	3207
White-bellied Sea-Eagle	*Haliaeetus leucogaster*		VU	L	60			226

* Australian Status of Species: End= Endangered, Vul= Vulnerable (in order highest ranking to lowest ranking)
* Victorian Status of Species: CR= critically endangered, EN= endangered, VU= vulnerable
* FFG (Flora Fauna Guarantee Act) taxa: L= listed (individual species only - not if part of listed communities)
* BNA (Bioregional Network Analysis) Assessment: Un = Unassessed
* Species Number: State identification number/code attributed to individual species.

APPENDIX 7 – SITE PRIORITISATION METHOD

To determine the conservation significance and the need for ground-truthing (surveying), sites were prioritised according to the following table (GBCMA *in prep.*). If ground-truthing was required and no survey was completed (e.g. more than 100 sites required survey), the minimum priority status was applied. *LCM refers to the Landscape Context Model.

Status of EVC	Potential habitat within known dispersal range of threatened taxon or focal species, or within priority areas as identified by LCM*	EVC Patch Size	Ground-truthing required to confirm priority rank on basis of vegetation condition	Priority Status: Very High, High, Medium, Low
Endangered	Y	<5ha	Ground-truthing needed	VH or H
E	N	<5ha	Ground-truthing needed	VH or H
E	Y	5-10ha	Ground-truthing needed	VH or H
E	N	5-10ha	Ground-truthing needed	VH or H
E	Y	11-40ha		VH
E	N	11-40ha		VH
E	Y	>40ha		VH
E	N	>40ha		VH
Vulnerable	Y	<5ha	Ground-truthing needed	M, H or VH
V	N	<5ha	Ground-truthing needed	M or H or VH
V	Y	5-10ha	Ground-truthing needed	M, H or VH
V	N	5-10ha	Ground-truthing needed	M or H or VH
V	Y	11-40ha		VH
V	N	11-40ha	Ground-truthing needed	H or VH
V	Y	>40ha		VH
V	N	>40ha		VH
Rare	Y	<5ha	Ground-truthing needed	M, H or VH
R	N	<5ha	Ground-truthing needed	M or H or VH
R	Y	5-10ha	Ground-truthing needed	M, H or VH
R	N	5-10ha	Ground-truthing needed	M or H or VH
R	Y	11-40ha		VH
R	N	11-40ha	Ground-truthing needed	H or VH
R	Y	>40ha		VH
R	N	>40ha		VH
Depleted	Y	<5ha	Ground-truthing needed	M or H
D	N	<5ha	Ground-truthing needed	L or M
D	Y	5-10ha	Ground-truthing needed	M or H
D	N	5-10ha	Ground-truthing needed	L, M or H
D	Y	11-40ha		H
D	N	11-40ha	Ground-truthing needed	M or H
D	Y	>40ha		VH
D	N	>40ha		VH
Least Concern	Y	<5ha		M
LC	N	<5ha		L
LC	Y	5-10ha		M
LC	N	5-10ha	Ground-truthing needed	L or M
LC	Y	11-40ha	Ground-truthing needed	M or H
LC	N	11-40ha	Ground-truthing needed	L or M
LC	Y	>40ha	Ground-truthing needed	H or VH
LC	N	>40ha	Ground-truthing needed	H or VH

APPENDIX 8 – VEGETATION QUALITY ANALYSIS (VQA) ASSESSMENT FORM

There are four survey forms for vegetation types in the Yarrawonga Landscape Zone (e.g. grassland, wetland, plains grassy forests or woodlands and riverine forests or woodlands). The example below is the plains grassy forests or woodlands sheet (refer to DSE 2004 for further information). Recording of site information and other factors (e.g. threatening processes) was also recorded at each of the surveyed sites. Refer to Appendix 12 for further information on how to obtain data on site scores.

ASSESSMENT OF HABITAT QUALITY – Self-assessment method

Site score sheet 12. Plains Grassy FORESTS or WOODLANDS

Component & Benchmark	Observations	Quality Range			Score
LARGE TREES Defined as trunk diameter or circumference at breast height. Apply to both WOODLANDS and FORESTS: **Diameter** 80 cm **(Circumference)** (250 cm)	**Number of large trees /ha (100m x 100m)**	*no large trees*		0	
		up to	7 LARGE TREES /ha in WOODLANDS 12 LARGE TREES /ha in FORESTS	1	
		more than	7 LARGE TREES /ha in WOODLANDS 12 LARGE TREES /ha in FORESTS	2	
CANOPY COVER Defined as the tallest stratum of native trees greater than 5m tall. Apply as: Plains Grassy WOODLANDS 10% benchmark Plains Grassy FORESTS 30% benchmark	% canopy cover **% cover/benchmark x 100**	*less than*	25% CANOPY COVER	0	
		between	25 – 50% CANOPY COVER	0.5	
		more than	50% CANOPY COVER	1	
UNDERSTOREY **(B)** Tick appropriate boxes for PRESENCE of native vegetation (i.e. different life forms) Tree >5m; Large herb >1m; Grass or grasslike <1m; Other Shrub 1-5m; Small herb <1m; Fern Small shrub <1m; Grass or grasslike >1m; Moss or lichen	**(A) % cover of native species**	*minimal*	COVER *less than* 10%	0	
		low	COVER *between* 10% – 25%	2	
		reduced	COVER *between* 25% - 75% AND *less than* 4 boxes ticked for WOODLANDS *less than* 5 boxes ticked for FORESTS OR 4 or *more* boxes for ticked WOODLANDS 5 or *more* boxes ticked for FORESTS	3 4	
		adequate	COVER *more than* 75% AND *less than* 4 boxes for ticked WOODLANDS *less than* 5 boxes ticked for FORESTS OR 4 or *more* boxes for ticked WOODLANDS 5 or *more* boxes ticked for FORESTS	4 5	
WEEDINESS	**% weed cover**		50% *or more* WEED COVER	0	
		between	25% - 50% WEED COVER	1	
		between	5% - 25% WEED COVER	2	
		less than	5% WEED COVER	3	
RECRUITMENT A woody species is considered to be recruiting when the number of immature plants (i.e. not flowering or fruiting) of an individual woody species is at least 10% of the total population of that species	(A) Number of *woody species* present (B) Number of *woody species* recruiting **% recruitment = B/A x100**	*less than*	30% woody species RECRUITING	0	
		between	30% -70% woody species RECRUITING	1	
			70% *or more* woody species RECRUITING	2	
ORGANIC LITTER Defined as small branches (less than 10cm diameter), twigs, leaves and other fallen or dead organic matter	**% cover of organic litter**	*less than*	5% ORGANIC LITTER for WOODLANDS 10% ORGANIC LITTER for FORESTS	0	
		more than	5% ORGANIC LITTER for WOODLANDS 10% ORGANIC LITTER for FORESTS	1	
LOGS Defined by length of stumps, fallen trees or branches at least 10 cm diameter (30 cm circumference)	Length of logs greater than 10 cm dia in 50m x50m (i.e. 0.25 ha) **Logs (m) x 4 (i.e. m/ha)**	*no logs*		0	
		less than	25m LOGS/ha	0.5	
		more than	25m LOGS/ha	1	
SIZE Defined by the size of the area being assessed **AND** any adjoining native vegetation		*less than*	2 ha	0	
		between	2 – 10 ha	1	
		more than	10 ha	2	
NEIGHBOURHOOD Defined by the % area covered by native vegetation within 1 km of the site being assessed		*less than*	10% area covered	0	
		between	10% - 50% area covered	1	
		more than	50% area covered	2	
CORE AREA Defined by the distance of the site being assessed from a block of native vegetation greater than 50ha		*1 km or more*	from 50 ha block of native vegetation	0	
		less than 1 km	from 50 ha block of native vegetation	1	
Department of Sustainability and Environment ENVIRONMENTAL MANAGEMENT IN AGRICULTURE **Native Biodiversity Resource Kit** ©2004		**Assessment of Habitat Quality (total)**			

APPENDIX 9 – LANDSCAPE CONTEXT MODEL (LCM)

The LCM Mapping is also available on the BAP CD* (Version 1, January 2008) or on the GBCMA website (www.gbcma.vic.gov.au). This mapping can be used in conjunction with the BAP mapping and this Conservation Plan.

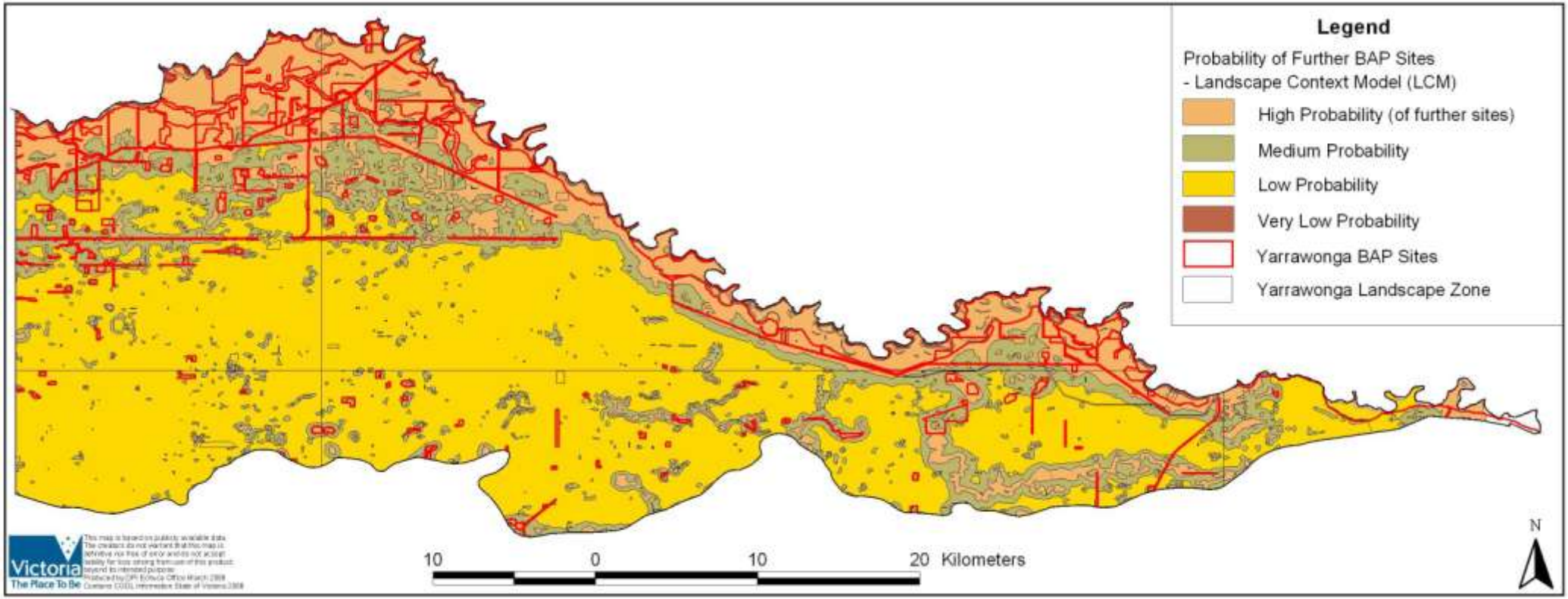
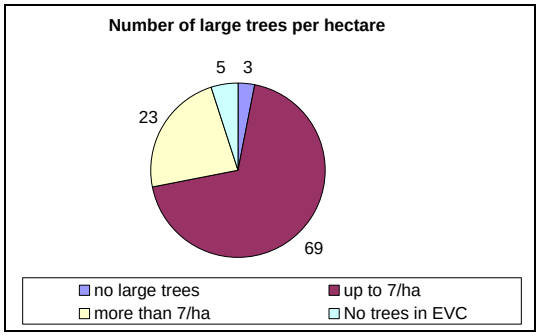
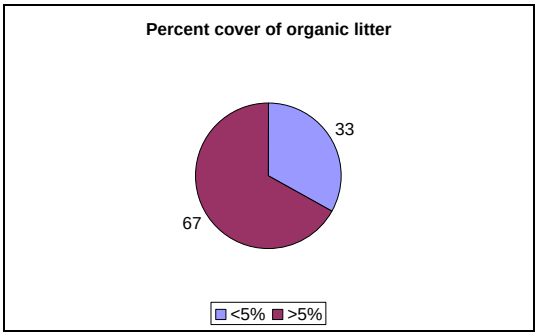


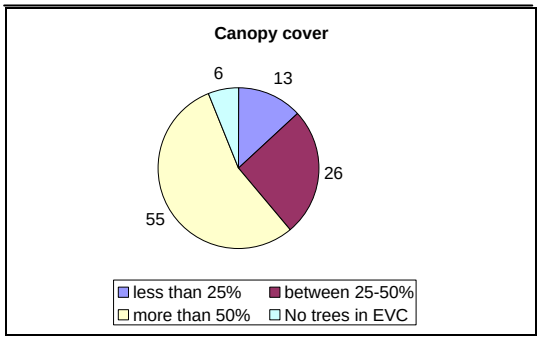
Figure 8: Landscape Context Model for the Yarrawonga Landscape Zone (with Yarrawonga BAP Site Overlay) depicts the probability of further BAP sites within the Zone (e.g. high probability towards the North and low probability towards the Southern extent of the Zone)

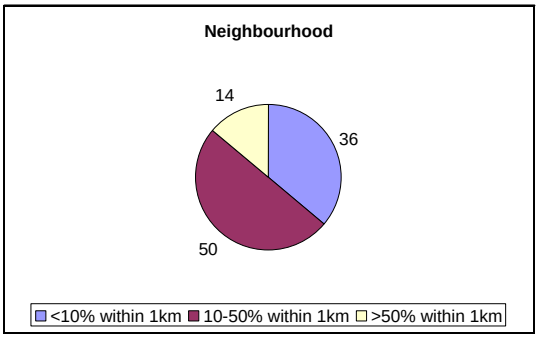
* To obtain copies of the BAP CD (Version 1, January 2008), or for further information on BAP, please contact bap@gbcma.vic.gov.au OR the Biodiversity Action Planning Officer, Department of Sustainability and Environment (DSE) Benalla at Ph: (03) 57 611 611

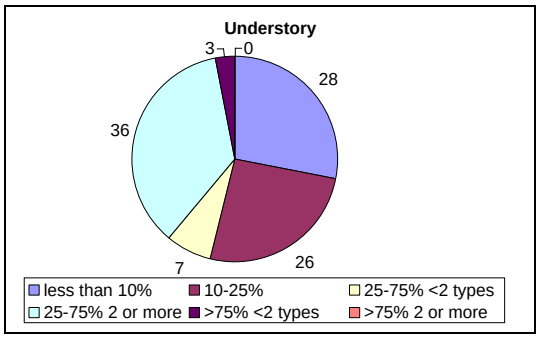
APPENDIX 10 –VEGETATION QUALITY ASSESSMENT (VQA) RESULTS

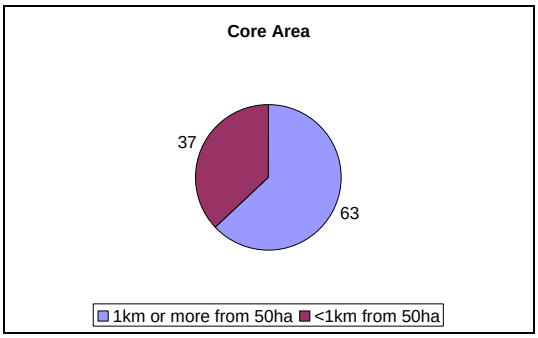


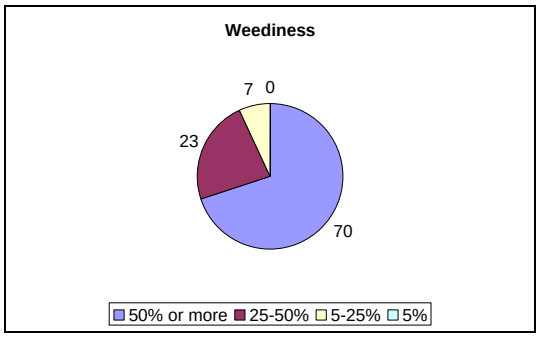


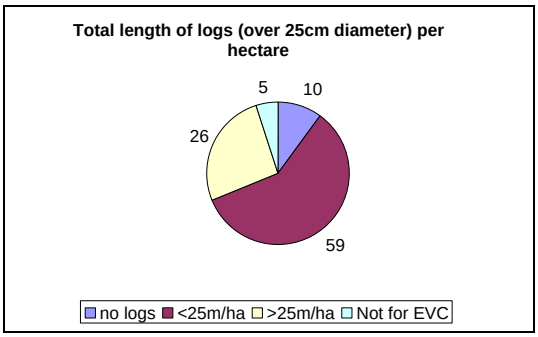


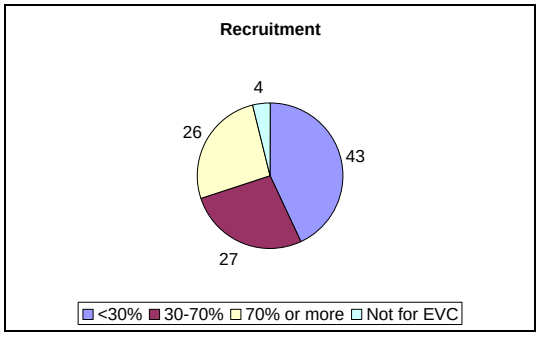


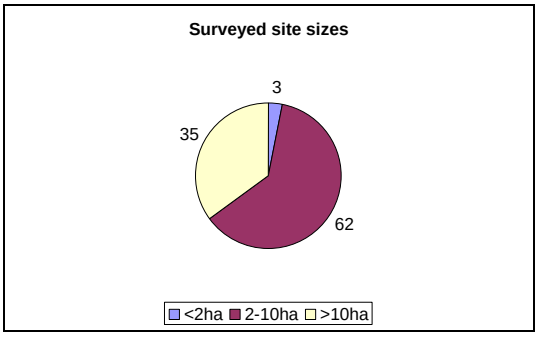












APPENDIX 11 –BIRD LIST

This list includes birds surveyed during the 100 site (20 minute) surveys. It is not intended to represent the entire bird population in the Yarrawonga Landscape Zone. For further information on birds surveyed at each site refer to Appendix 12.

* In Alphabetical Order of English Name

English Name*	Latin Name
Australian Hobby	*Falco longipennis*
Australian Raven	*Corvus coronoides*
Barn Owl	*Tyto alba*
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Black-shouldered Kite	*Elanus axillaris*
Black Swan	*Cygnus atratus*
Black-winged Stilt	*Himantopus himantopus*
Black-fronted Dotterel	*Elseyornis melanops*
Blue-faced Honeyeater	*Entomyzon cyanotis*
Brown Falcon	*Falco berigora*
Brown Thornbill	*Acanthiza pusilla*
Brown Treecreeper	*Climacteris picumnus*
Buff-rumped Thornbill	*Acanthiza reguloides*
Bush Stone-curlew	*Burhinus grallarius*
Chestnut Teal	*Anas castanea*
Clamorous Reed-warbler	*Acrocephalus stentoreus*
Common Blackbird	*Turdus merula*
Common Bronzewing	*Phaps chalcoptera*
Crested Pigeon	*Ocyphaps lophotes*
Crested Shrike-tit	*Falcanculus frontatus*
Domestic Peahen	*Pavo cristatus*
Dusky Moorhen	*Gallinula tenebrosa*
Dusky Woodswallow	*Artamus cyanopterus*
Eastern Rosella	*Platycercus eximius*
Fairy Martin	*Hirundo ariel*
Feral Pigeon	*Columba livia*
Flame Robin	*Petroica phoenicea*
Galah	*Cacatua roseicapilla*
Golden Whistler	*Pachycephala pectoralis*
Grey Falcon	*Falco hypoleucos*
Grey Fantail	*Rhipidura fuliginosa*
Grey Shrike-thrush	*Colluricincla harmonica*
Grey Teal	*Anas gracilis*
Grey-crowned Babbler	*Pomatostomus temporalis*
Hardhead	*Aythya australis*
Hooded Robin	*Melanodryas cucullata*
House Sparrow	*Passer domesticus*
Indian Mynah	*Acridotheres tristis*
Intermediate Egret	*Ardea intermedia*
Jacky Winter	*Microeca fascinans*
Laughing Kookaburra	*Dacelo novaeguineae*
Letter-winged Kite	*Elanus scriptus*
Little Corella	*Cacatua sanguinea*
Little Friarbird	*Philemon citreogularis*
Little Pied Cormorant	*Phalacrocorax melanoleucos*
Little Raven	*Corvus mellori*
Long-billed Corella	*Cacatua tenuirostris*
Magpie	*Gymnorhina tibicen*
Magpie Lark	*Grallina cyanoleuca*

English Name	Latin Name
Martin	*Hirundo spp.*
Masked Lapwing	*Vamellus miles*
Mistletoebird	*Dicaeum hirundinaceum*
Mountain Duck	*Tadorna tadornoides*
Nankeen Kestrel	*Falco cenchroides*
Noisy Friarbird	*Philemon corniculatus*
Noisy Miner	*Manorina melanocephala*
Olive-backed Oriole	*Oriolus saggittatus*
Oriole	*Oriolus spp.*
Pacific Black Duck	*Anas superciliosa*
Pelican	*Pelecanus conspicillatus*
Pied Butcherbird	*Cracticus nigrogularis*
Pied Currawong	*Strepera graculina*
Purple Swamphen	*Porphyrio porphyrio*
Raven	*Corvus spp.*
Red-kneed Dotterel	*Erythrogonys cinctus*
Red-rumped Parrot	*Psephotus haematonotus*
Restless Flycatcher	*Myiagra inquieta*
Rufous Songlark	*Cincloramphus mathewsi*
Rufous Whistler	*Pachycephala rufiventris*
Southern Whiteface	*Aphelocephala leucopsis*
Starling	*Sturnus vulgaris*
Straw-necked Ibis	*Threskiornis molucca*
Striated Pardalote	*Pardalotus striatus*
Striated Thornbill	*Acanthiza lineata*
Sulphur-crested Cockatoo	*Cacatua galerita*
Superb Fairy-wren	*Malurus cyaneus*
Superb Parrot	*Polytelis swainsonii*
Tawny Frogmouth	*Podargus strigoides*
Tree Sparrow	*Passer montanus*
Wedge-tailed eagle	*Aquila audax*
Welcome Swallow	*Hirundo neoxena*
Whistling Kite	*Haliastur sphenurus*
White-backed Swallow	*Cheramoeca leucosternus*
White-browed Babbler	*Pomostostomus superciliosus*
White-eared Honeyeater	*Lichenostomus leucotis*
White-faced Heron	*Egretta novaehollandiae*
White Ibis	*Threskiornis molucca*
White-plumed Honeyeater	*Lichenostomus penicilatus*
White-throated Treecreeper	*Cormobates leucophaeus*
White-winged Chough	*Cocorax melanorhamphos*
Willie Wagtail	*Rhipidura leucophrys*
Wood Duck	*Chenonetta jubata*
Wood Swallow	*Artamus sp.*
Yellow-billed Spoonbill	*Platelea flavipes*
Yellow Rosella	*Platycercus elegans flaveolus*
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
Yellow Thornbill	*Acanthiza nana*
Zebra Finch	*Taeniopygia guttata*

APPENDIX 12 – PRIORITY SITE INFORMATION (MAPPING):

Mapping and accompanying information for each of the priority BAP sites is contained on the BAP CD* (Version 1, January 2008) or on the GBCMA website (www.gbcma.vic.gov.au). This mapping data is designed to be used in conjunction with this Conservation Plan to assist users to obtain further information on priority sites.

HOW TO OBTAIN INFORMATION FROM THE BAP CD:

1. Locate the available mapping data by clicking on the 'BAP Mapping' hyperlink#.
2. Click on the hyperlink relating to the Zone of interest under 'BAP Mapping' and the 'Available Maps Subheading' (e.g. 'Barmah').
3. This will lead to a map identifying priority BAP sites within the chosen Zone.
4. On this map, locate the area/site of interest by clicking on the area.
5. Zoom in or out to the areas/sites of interest, using the North, South, East, West arrows.
6. Click on a BAP site to view the Attribute Table information for that site.
7. Refer to the list of birds surveyed at each site (where available).
8. An explanation of the data provided in the Attribute Table is provided in the 'Attribute Table Definition' document under the 'BAP Mapping' subheading.
9. For further information to assist with the identification of opportunities to link the BAP sites, refer to 'BAP Mapping', 'Landscape Context Model Maps' and choose the relevant Zone name hyperlink (e.g. 'Barmah').
10. To access the data via the Geographical Information System (GIS) (where available) select 'BAP Mapping', 'GIS data' then either 'BAP GIS layer' or 'LCM GIS layer'.

 # Note: Mapping data for each Landscape Zone can also be located by clicking on the 'BAP Zones' hyperlink and choosing the Landscape Zone of interest from the map of the Goulburn Broken Catchment.

* To obtain copies of the BAP CD (Version 1, January 2008), or for further information on BAP, please contact bap@gbcma.vic.gov.au OR the Biodiversity Action Planning Officer, Department of Sustainability and Environment (DSE) Benalla at Ph: (03) 57 611 611