Conservation Plan
for the
Hughes Creek Landscape Zone

Biodiversity Action Planning
in the Upper Goulburn Broken Catchment

Victoria
The Place To Be

Department of Sustainability and Environment

Department of Primary Industries

GOULBURN BROKEN
CATCHMENT MANAGEMENT AUTHORITY

Australian Government

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 methodology used to develop the Landscape Zone plans is according to the 'Developer's Manual for Biodiversity Action Planning in the Goulburn Broken Catchment (GBCMA 2004a)'. The Central Victorian Uplands and Highlands Northern Fall Bioregional Plans and the Hughes Creek Landscape Zone plan outline biodiversity priorities at the bioregional level. This Hughes Creek Landscape Zone Conservation Plan 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 to other planning processes, landholders and agencies.

The **Hughes Creek Landscape Zone** is located within the Goulburn Broken Catchment of Victoria. The Zone, 124,100 hectares in extent, is part of the Highlands Northern Fall and Central Victorian Uplands Bioregions. It is within the Local Government areas of Strathbogie, Mitchell and Murrindindi. Since European settlement much of the vegetation in the zone has been cleared, leaving a fragmented landscape, with many of the remnants that remain, being highly modified.

Over 1,780 **priority environmental sites** have been identified within the Hughes Creek Landscape Zone. The priority sites have been determined and ranked (low, medium, high or very high) based on factors such as, size, vegetation quality, Ecological Vegetation Class (EVC) conservation status, threatened species, landscape context and field survey results. These sites contain remnant vegetation and vary greatly in size from a stand of paddock trees, to areas of greater than one thousand hectares.

Two important components in the Biodiversity Action Planning 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. Six focal species have been identified in the zone: Brush-tailed Phascogale (*Phascogale tapoatafa tapoatafa*), Long-nosed Bandicoot (*Perameles nasuta*), White-eared Honeyeater (*Lichenostomus leucotis*), Eastern Yellow Robin (*Eopsaltria australis*), Crested Shrike-tit (*Falcunculus frontatus*) and Diamond Firetail (*Stagonopleura guttata*).

The **Key Biodiversity** Assets approach is a method of grouping biodiversity assets (ie. birds, animals and plants) that use the same type of habitat. Eight Key Biodiversity Assets were identified for the Hughes Creek Landscape Zone: Grassy Woodlands, Grassy Forests, Herb-rich Foothill Forests, Granitic Hills, Box Ironbark, Riparian Systems, Spring Soaks/Perched Bogs and Riverine Fish communities. The grouping of these assets will assist in targeting actions towards the very high value sites first.

Management actions have been developed for the Hughes Creek Landscape Zone, based on the results of desktop analysis and field surveying. It is intended that government agencies (primarily extension staff) and the community will work together to implement these actions, for the benefit of biodiversity conservation in the Hughes Creek Landscape Zone and the wider area of the Goulburn Broken Catchment.

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1.0 BACKGROUND

1.1 INTRODUCTION

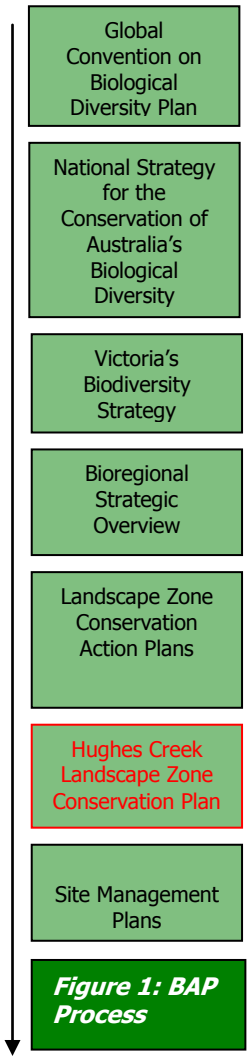


Figure 1: BAP Process

Biodiversity Action Planning[1] (BAP) is an initiative by the Victorian Government to identify priorities for the conservation of native biodiversity, as part of the implementation of the State's Biodiversity Strategy (Crown 1997). In particular according to Platt & Lowe 2002, it aims to:

- Conserve native biodiversity 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 landscape planning for biodiversity and the conservation of strategic assets, particularly in rural landscapes.

In order to achieve these aims, effective planning of actions 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). Figure 1 illustrates the Biodiversity Action Planning process and where the Hughes Creek Landscape Zone Conservation Plan (highlighted in red) fits within a policy context.

At the regional scale the 'Landscape Plan for the Goulburn Broken CMA – Hughes Creek Broken Zones identify the broad priorities for biodiversity conservation in the region. They also provide the foundation for producing detailed plans, such as the 'Hughes Creek Landscape Zone Conservation Plan (Ahern et al 2003). At the landscape level, this Hughes Creek Landscape Conservation Plan is intended to provide biodiversity conservation actions for the community to implement at a local level.

1.2 OBJECTIVES

The Hughes Creek Landscape Zone Conservation Plan aims to translate regional and catchment plans and targets for biodiversity, to a local landscape level. This plan aims to ensure that private and public resources expended for conservation are targeted to priority sites, for priority actions. In this way, available resources can be used for the greatest possible outcomes, based on the 'best' science. This plan identifies 1787 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 local area. This plan is intended primarily for use by extension officers, as well as the community, to guide the strategic and coordinated management of conservation.

Broadly, this plan details:

- The landscape, vegetation and significant flora and fauna of the area,
- Conservation objectives for the Hughes Creek Landscape Zone,
- Priority assets to be conserved, and the threats to these biodiversity values,
- Priority actions required to protect and restore the assets, and
- Further monitoring requirements for the zone (Robinson et al 2003).

[1] For further information on Biodiversity Action Planning visit Department of Sustainability and Environments website at www.dse.vic.gov.au

1.3 CONTEXT FOR THE DEVELOPMENT OF THE HUGHES CREEK CONSERVATION PLAN

The Goulburn Broken Regional Catchment Strategy (GBRCS) 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). This Hughes Creek Landscape Conservation Plan is to assist in achieving this vision, through providing a strategic coordinated approach, for conservation of priority assets.

The GBRCS also identifies targets and priorities for the catchment (refer to Appendix 3 for further detail). The following points are 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.

The Goulburn Broken Catchment Management 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 are driven by the conservation significance of the biodiversity asset. Regional investments in biodiversity conservation in the Goulburn Broken Catchment are driven by the following goals (in order of priority):

1. **Protecting** existing viable remnant habitats and the flora and fauna populations they contain (ie through reservation, covenants, management agreements, fencing and statutory planning),
2. **Enhancing** the existing viable habitats that are degraded (management by controlling threats such as pest plants and animals, grazing, salinity, promotion of natural regeneration and/or revegetation with understorey), and

Restoring under-represented biodiversity assets to their former extent by revegetation (to create corridors, buffers, patches of habitat) (GBCMA 2003a).

It is intended that the actions outlined in this plan will complement the targets of the GBRCS and other policy/strategies pertinent to the state, catchment and region (eg. 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 (eg. targets and legislative requirements) in to the one document, for use by local communities. For example, this plan incorporates aspects of legislation (eg. Action Statements prepared under the *Flora and Fauna Guarantee Act 1988*), in to recommended on-ground actions, for the conservation of threatened species and communities.

The Biodiversity Action Planning (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 ecosystems (Platt & Lowe 2002). It is therefore intended that this South West Landscape Zone Conservation Plan 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. The plan has therefore been developed as an adaptive plan, to enable management actions and information to be modified, in response to further information (eg monitoring).

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 DSE/DPI staff, to fully identify and understand the BAP process and to provide further information to the community. Consultation 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. 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

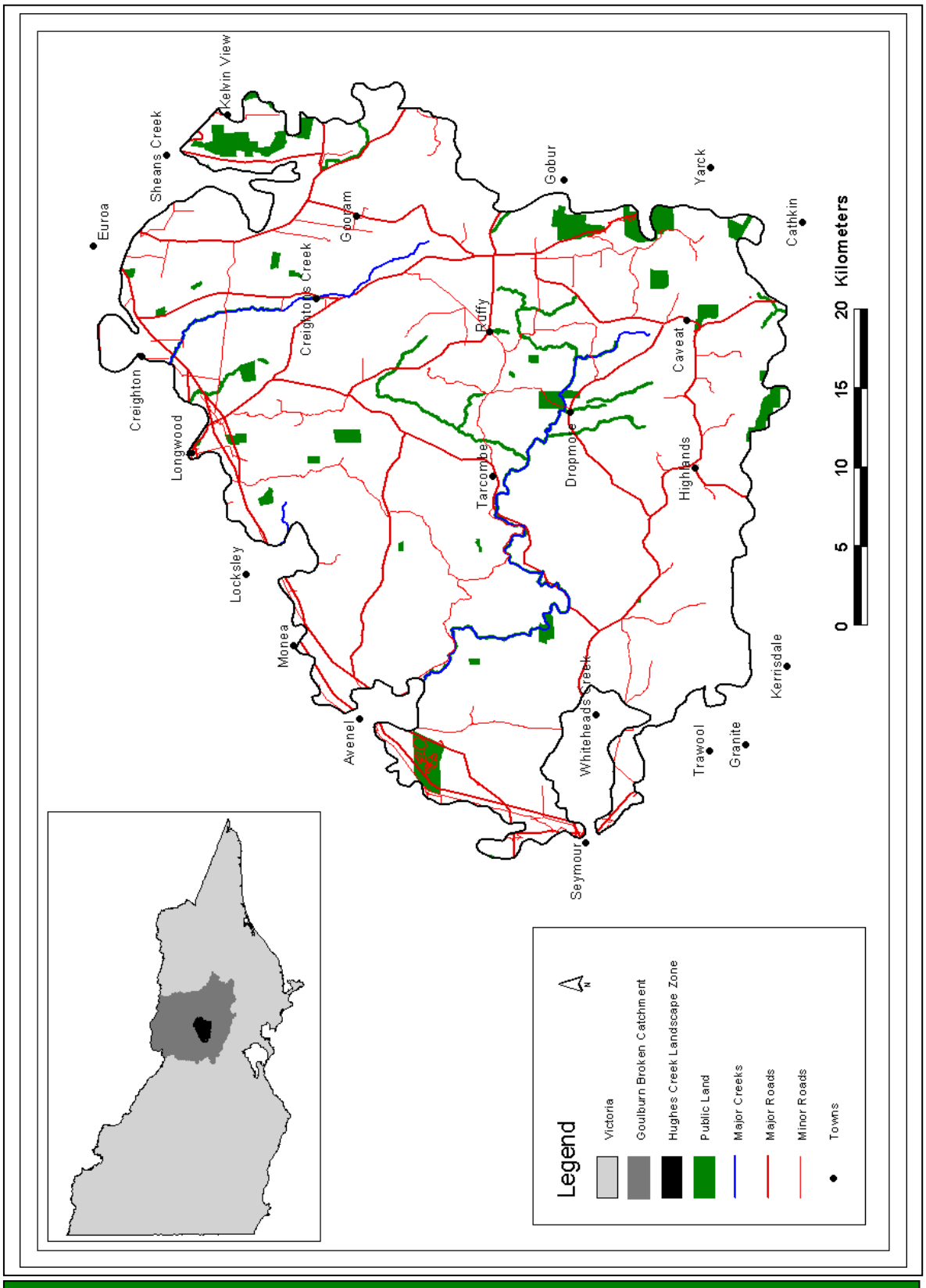


Figure 2: The Hughes Creek Landscape Zone

2.1 LANDSCAPE

The Hughes Creek Landscape Zone (figure 2a) covers an area of 124,100ha within the Goulburn Broken Catchment and contains both the Central Victorian Uplands and Highland Northern Fall Bioregions. Hughes Creek Landscape Zone falls within the Local Government areas of Strathbogie, Mitchell and Murrindindi. The majority of the Hughes Creek Landscape zone is on an undulating plateau. At the southern and south-eastern edge of the zone the plateaus undulating surface changes into escarpment sloping towards the Goulburn River floodplain. In the north and west of the zone the plateau slopes down to plains. Hughes and Creighton's Creek are the main streams draining the plateau.

The plateau is bounded to the north and west by the interface between the Central Victorian Uplands and the Victorian Riverina Bioregions. The southern and eastern boundary follows the edge of a portion of the Highlands - Northern Fall bioregion in the Switzerland Ranges. The Hume Highway is the only major regional artery and runs along the north-western edge of the zone (Ahern et al 2003).

Private land covers 96% of the zone and of this over 83% has been cleared. This has resulted in not only a loss of habitat but also an inability for the landscape to sustain populations of flora and fauna. For example, many species may not be able to move across open farmland; this prevents breeding between populations, which makes them vulnerable to random events such as disease that can wipe out sub-populations without replacement. Eventually, this results in decline and then extinction of species. Private land use is varied within the Hughes Creek Landscape Zone with the majority used for stock grazing.

Public land covers 4% of the zone and mainly occurs along stream frontages, roadsides and 21 reserves. Hughes Creek and its associated reserves are an obvious focus for protection and rehabilitation works in the zone as they contain remnants of several threatened Ecological Vegetation Classes (EVCs) including Valley Grassy Forest and Grassy Dry Forest. Numerous roadsides in this zone contain high conservation value habitat.

Herb-rich Foothill Forest at the Caveat Bushland Reserve
Photo: Bronwyn Merritt

2.2 VEGETATION

Ecological Vegetation Class (EVCs) 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, undated).

Prior to European settlement, thirty-two EVCs[2] were known to have been present within the Hughes Creek Landscape Zone (figure 3). The vegetation of Hughes Creek Landscape Zone was a mixture of herb-rich Foothill Forest, Grassy Forests, Grassy Woodlands, Box Ironbark, Granitic Hills, Riparian Forests and Perched Bogs. Herb-rich Foothill Forest is the dominant EVC in the Hughes Creek zone. The majority of the zone was covered with Herb-rich Foothill Forest, most of which has now been cleared but some large remnants occur at Caveat and west of Terip Terip.

The grassy forests were dominated by Red Box *Eucalyptus polyanthemos*, Yellow Box *E. melliodora*, Red Stringybark *E. macrohyncha*, Long-leaf Box *E. goniocalyx* and Broad-leaf Peppermint *E. dives* with a range of understorey plants. Herb-rich Foothill Forests were dominated with Eurabbie Blue Gum *E. globulua* subsp. *Bicostata,* Messmate *E. obliqua*, Narrow-leaf Peppermint *E. radiata,* Candlebark *E. rubida* and Silver Wattle *Acacia dealbata* and Blackwood *Acacia mearnsii*. Box Ironbark Forests occurs along the western boundary of the zone and would have been dominated by Broad-leaf Peppermint, Long-leaf Box, Yellow Box, Red box and Red Ironbark *E. tricarpa*.

Grassy Woodlands were abundant in the Central Victorian Uplands component of the zone, interspersed with Granitic Hills Woodland, Grassy Dry Forest and Valley Grassy Forest. However, Grassy Woodlands are now only represented in patches, the majority of which occur along the Hume Highway roadside reserve. All of the Grassy Woodland and Box Ironbark EVCs are considered endangered within the Goulburn Broken Catchment. The Grassy Forests Group (EVC Group 6, Tables 1 & 2) are mostly considered vulnerable or depleted in the Central Victorian Highland Bioregion and least concern in the Highlands Northern Fall bioregion. Grassy Woodland communities were dominated by Grey Box *Eucalyptus microcarpa*, Yellow Box, Red Stringybark and White Box *E. albens.* Ground cover in these woodlands is comprised of grasses, sedges, lillies, orchids and herbs. Wattles provided an understorey. The stream-sides supported an overstorey of River Red Gum *E. camaldulensis*.

The current extent of native vegetation in the Hughes Creek Zone has dramatically reduced since European settlement, largely due to clearing (Figure 3). Table 1, identifies the Pre 1750 EVCs in the Hughes Creek Landscape Zone, including their Bioregional Conservation Status and their current extent (as of 2003) (in hectares and % cover). The table also identifies the area of 'Private Land No Tree Cover' and Unknown/Unclassified EVCs (Ahern et al 2003).

The Goulburn Broken Regional Catchment Strategy identifies goals and targets that have been set for the vegetation communities within the catchment. This includes "increasing the cover of all 'Endangered' and 'Vulnerable' EVCs to at least 15% of their pre-European vegetation cover by 2030" (GBCMA 2003a). The majority of EVCs within the Hughes Creek Landscape Zone are below the 15% target (Table 1) and are therefore considered 'Endangered' (12 EVC's) or 'Vulnerable' (11 EVC's) 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

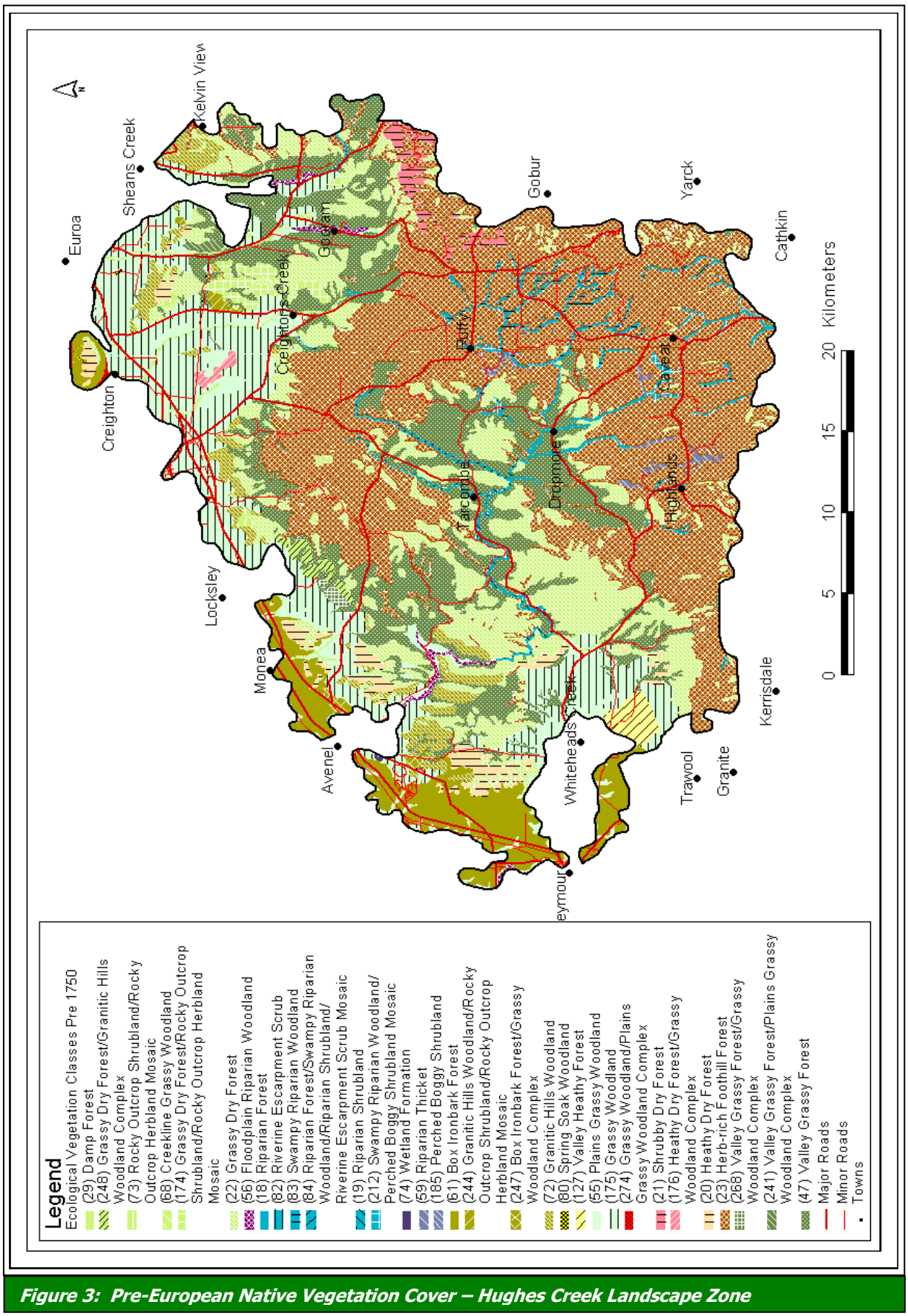


Figure 3: Pre-European Native Vegetation Cover – Hughes Creek Landscape Zone

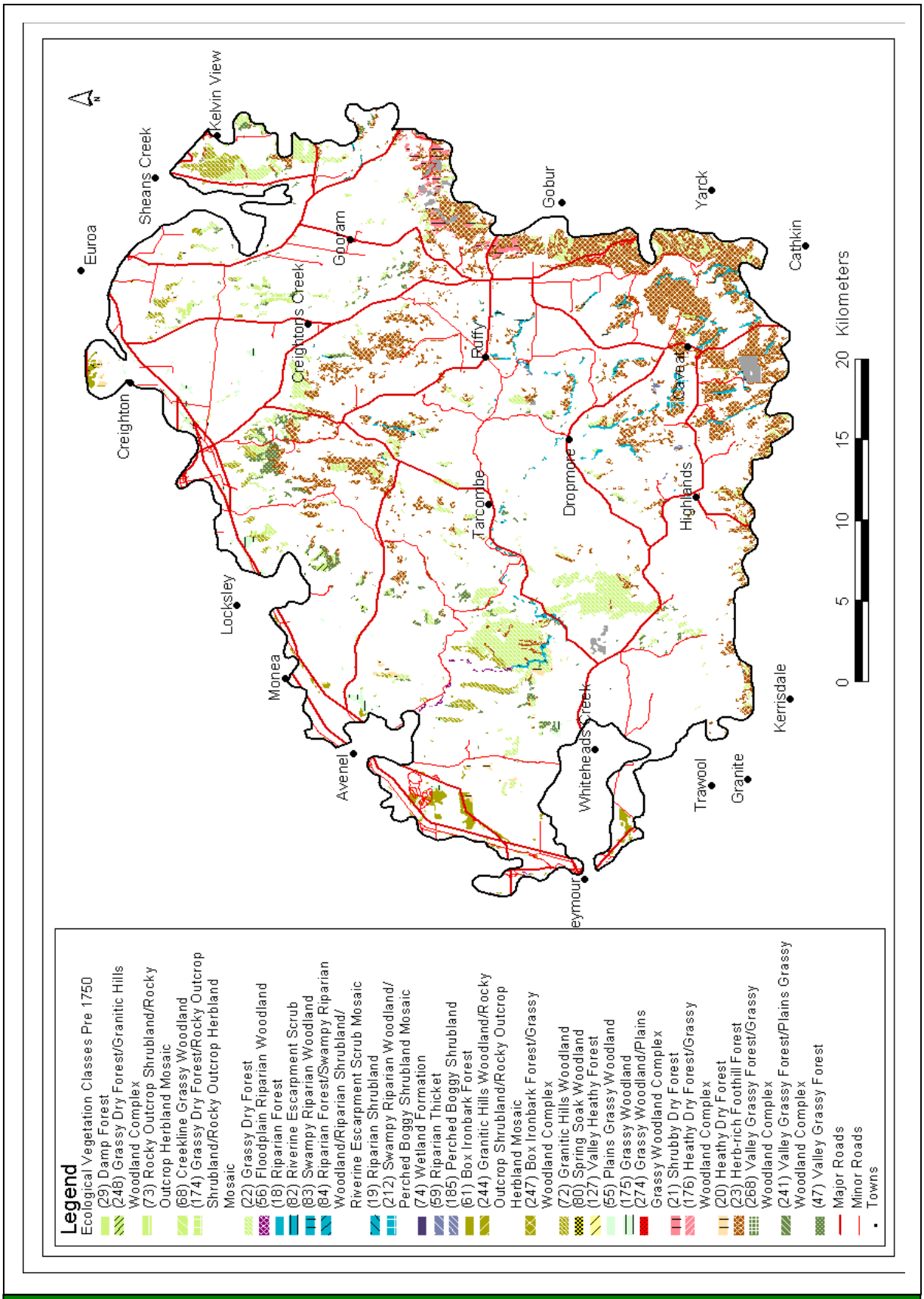


Figure 4: Current extent of Native Vegetation Cover– Hughes Creek Landscape Zone

Table 1: Hughes Creek Zone Ecological Vegetation Classes (pre-1750 and current)

EVC Group	EVC Number	EVC Bioregional Cons. Status*	EVC Zone Cons. Status	EVC Name	Pre 1750 Area (ha)	Current Area (ha)	% Current Cover	15% pre-1750 Target
4	61	V	E	Box Ironbark Forest	6468	577	8.9	970.2
4	72	V	V	Granitic Hills Woodland	3348	994	29	502.2
4	244	V	E	Granitic Hills Woodland/Rocky Outcrop Shrubland/Herbland Mosaic	172	22	12	25.8
4	245	V	V	Granitic Hills Woodland/Heathy Dry Forest Mosaic	12	0	0	1.8
4	247	V	E	Box Ironbark Forest/Shrubby Granitic-outwash Grassy Woodland Mosaic	210	7	3	31.5
5	80	E	E	Spring Soak Woodland	33	10	30	4.95
5	175	E	E	Grassy Woodland	16529	556	3.5	2479.4
5	254	E	E	Scrubby Granitic-outwash Grassy Woodland/Valley Grassy Forest Complex	152	7	4	22.8
5	274	E	E	Shrubby Granitic outwash Grassy Woodland/Plains Grassy Woodland Complex	51	<1	2	7.65
6	20	LC	E	Heathy Dry Forest	2130	210	9.8	319.5
6	21	LC	D	Shrubby Dry Forest	915	44	4.8	136.65
6	22	LC	D	Grassy Dry Forest	21031	5186	24.6	3154.65
6	23	LC	V	Herb Rich Foothill Forest	43118	10412	24.1	6467.7
6	47	V	E	Valley Grassy Forest	20647	1233	5.9	3097
6	127	E	E	Valley Heathy Forest	700	0	0	105
6	174	D	V	Grassy Dry Forest/ Rocky Outcrop Shrubland/ Herbland Mosaic	949	185	19	142.35
6	241	V	E	Valley Grassy Forest/ Plains Grassy Woodland Complex	126	1	0.9	18.9
6	248	D	LC	Grassy Dry Forest/Granitic Hills Woodland Complex	392	64	16	58.8
7	29	LC	LC	Damp Forest	127	98	77	19.05
8	19	E	D	Riparian Shrubland	414	164	39	62.1
8	59	V	V	Riparian Thicket	336	37	11	50.4
8	83	V	V	Swampy Riparian Woodland	1270	213	16.8	190.5
8	185	E	V	Perched Boggy Shrubland Complex	128	16	12.5	19.2
8	212	V	LC	Swampy Riparian Woodland/Perched Boggy Shrubland Mosaic	225	102	45	33.75
9	18	V	V	Riparian Forest	713	311	43.6	107.0
9	84	D	LC	Riparian Forest/Swampy Riparian Woodland/Riparian Shrubland/Riverine Escarpment Scrub/Disturbed Mosaic	441	135	30.6	66.15
14	55	E	E	Plains Grassy Woodland	2894	95	3.2	434.1
15	56	E	V	Floodplain Riparian Woodland	487	83	17	73.05
15	68	E	E	Creekline Grassy Woodland	732	76	10	109.8
19	74	E	E	Wetland Formation	14	0	0	2.1
21	73	R	D	Rocky Outcrop Shrubland/Herbland Mosaic	314	138	43.9	47.1
21	82	E	E	Riverine Escarpment Scrub	23	8	34	3.45
				Total	**126,851**	**18,812**	**14.8**	**19,027**
99	58	NA	NA	Cleared Severely Disturbed	0	163		
99	987	NA	NA	Plantation (undefined)	0	458		
99	987	NA	NA	Private Land no native vegetation	0	102096		
Table Information including column A & B from Ahern et al 2003					*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 unit ten)

EVC names have altered since Ahern et al 2003, however area and extent remain the same

* EVC Bioregional Conservation Status refers to the threatened status of the EVC in the bioregion (eg. Murray Fans). Endangered (E) means that 'less than 10% of the pre-European extent remains, whilst Vulnerable (V) is defined as 'less than 10-30% pre-European extent remaining (Platt 2002). The EVC Number refers to the unique number attributed to that EVC. Highlighted rows indicate those EVC's with less than 15% of their original EVC remaining in the Hughes Creek Landscape Zone

2.3 SIGNIFICANT FLORA AND FAUNA

2.3.1 Flora:

Photo: Common Fringe Lily (Thysanotus tuberosus). Photo Bronwyn Merritt

A range of native flora is found within the Hughes Creek Landscape Zone. Some of the most common overstorey species include—Red Stringybark (*Eucalyptus macrorhyncha*), Yellow Box (*Eucalyptus melliodora*), Red Box (*Eucalyptus polyanthemos*), Blue Gum (*Eucalyptus globulus*), Messmate (*Eucalyptus obliqua*) and Narrow-leaf Peppermint (*Eucalyptus radiata*). The range of small trees and shrubs includes species such as, Mountain Beard-heath (*Leucopogon hookeri*), Sweet Busaria (*Bursaria spinosa*), Prickly Parrot-pea (*Dillwynia juniperina*) and Slender Rice-flower (*Pimelea linifolia*). The zone also contains a range of groundcover plants including Wallaby-grass (*Austrodanthonia spp*), Black anther Flax-lilly (*Dianella revouta*), Kangaroo Grass (*Themeda triandra*), Common Wheat-grass (*Elymus scaber*) and Weeping Grass (*Microlaena stipoides*).

There are 21 threatened plant species recorded within the Hughes Creek Landscape Zone (Ahern et al 2003). These species are noted in Appendix 4, along with their threatened status, as per the Flora Information System, the State *level (Flora and Fauna Guarantee Act (FFG Act) 1998)* and the National level (*Environment Protection and Biodiversity Act (EPBC) 1999*) (Ahern et al 2003).

Threatened plant species recorded in the Hughes Creek Landscape Zone include:

- Deane's Wattle (*Acacia deanei*) (Rare in Victoria)
- Hickory Wattle (*Acacia penninervis var. penninervis*) (Rare in Victoria)
- Rough Twig-sedge (*Baumea planifolia*) (Status is poorly known in Victoria)
- Tall Club-sedge (*Bolboschoenus fluviatilis*) (Status is poorly known in Victoria)
- Weak Daisy (*Brachyscome debilis s.s.*) (Vulnerable in Victoria
- Tiny Daisy (*Brachyscome ptychocarpa*) (Rare in Victoria)
- Crimson Spider-orchid (*Caladenia concolor*) (Vulnerable across Australia, Endangered in Victoria)

Examples of some locally significant species known to occur in the Hughes Creek Landscape Zone are:

- Silver Banksia (*Banksia marginata*)
- Drooping She-oak (*Allocasuarina verticillata*)
- Black Sheoak (*Allocasuarina littoralis*)
- Grass Trees (*Xanthorrhoea australis*)
- Snow Gum (*Eucalyptus pauciflora*)
- Ploughshears Wattle (*Acacia gunni*)
- Woolly Wattle (*Acacia lanigera*)
- Red Stemmed Wattle (*Acacia rubida*)
- Heath Myrtle (*micromyrtus ciliata*)
- Austral Ladies Tress Orchid (*Spiranthes asutralia*)
- Mitchell's Wattle (*Acacia mitchelli*)
- Peach Heath (*Lissanthe strigosa*)
- Common Fringe-Myrtle (*Calytrix tetragona*)

2.3.2 Fauna:

There are 20 threatened fauna species recorded in the Hughes Creek Zone (refer to Appendix 5 for species, their threatened status and relevant acts) (Ahern et al 2003).

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

- Brown Toadlet (*Pseudophryne bibronii*) (Endangered in Victoria)
- Brush-tailed Phascogale (Phascogale tapoatafa) (Vulnerable in Victoria)
- Hooded Robin (*Melanodryas cucullata*) (Near threatened in Victoria)
- Squirrel Glider (*Petaurus norfolcensis*) (Endangered in Victoria)

Examples of threatened species recorded within the Hughes Creek Landscape Zone, predominantly associated with wetlands and waterways include:

- Australasian Bittern (*Botaurus poiciloptilus*) (endangered in Victoria)
- Australasian Shoveller (*Anas rhynchotis*) (vulnerable in Victoria),
- Growling Grass Frog (*Litoria raniformis*) (Vulnerable across Australia, Endangered in Victoria)
- Macquarie Perch (*Macquaria australasica*) (Endangered across Australia endangered in Victoria),
- Nankeen Night Heron (*Nycticorax caledonicus*) (Near threatened in Victoria)
- Trout Cod (*Maccullochella macquariensis*) (Endangered across Australia. critically endangered in Victoria)
- River Blackfish (*Gadopsis marmoratus*) (Endangered in Victoria)

Photo: River Blackfish (Gadopsis marmoratus). Photo: DNRE

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 (eg. threatened under State or Commonwealth legislation). This involved desktop analysis of data (eg. literature review; spatial data (eg EVC, trees cover, wetlands, flora and fauna records, aerials); corporate databases (eg. 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
Involved surveying of the zone from the roadside, to compare desktop analysis data with the on-ground sites in regards to presence, type of vegetation and condition.

Step 3. Field Survey 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 were undertaken in accordance with the Birds of Australia – Atlas Search Methods (2-hectares, twenty minutes) (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 (ie. box ironbark, herb-rich foothill forest, grassy woodlands) (Refer to Appendix 7).
3.3) Threat Identification – Whilst undertaking the Vegetation Quality Assessment, a list of threatening processes (ie. pest plants and animals) on the priority sites, were recorded.

Step 4. Prioritise BAP Sites
The 1787 sites were given a 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, VQA score). Sites not surveyed, were automatically given a ranked value (as per Appendix 6) to the lesser of the available options (until surveying occurs).

Step 5. Generate 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. For example, if a species that requires the largest remnant size is selected, then fulfilling the needs of that species may result in the conservation of all species, with smaller remnant size requirements. The factors used in this plan to select focal species were, remnant size and isolation distance (GBCMA *in prep.*).

Step 6. Generate Key Biodiversity Asset List

The identified environmental 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; creek-lines or ecological vegetation classes.

Step 7. Develop 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 determine in Step 6). Available information (eg. Actions for Biodiversity Conservation (ABC) database) (DSE 2005a) and the Hughes Creek Landscape Plan (Ahern et al 2003) were also used to compile the 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) (Ferwerder 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 the 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 Hughes Creek Landscape Zone priority sites and Landscape Context overlay are shown in Appendix 8.

4.0 IDENTIFYING PRIORITY SITES

In the Hughes Creek Landscape Zone 1,787 sites have been identified as Biodiversity Action Planning 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 Gobur Flora Reserve. 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 (eg. 1-1767). An example of the site identification numbering system (eg. 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). The location of all of the 1767 BAP sites (in map form) is available, by contacting DSE, Alexandra.

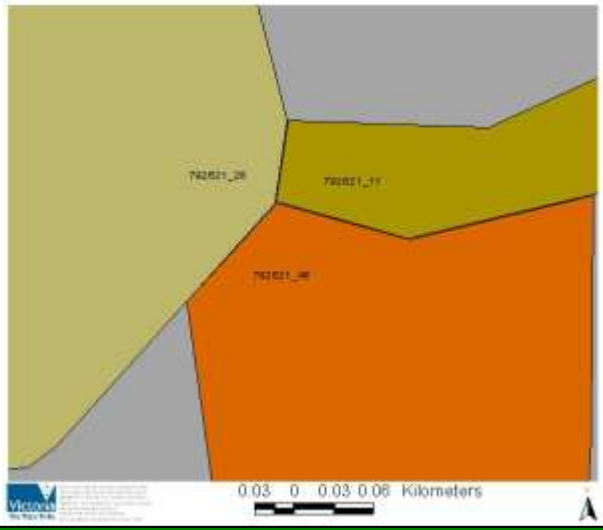


Figure 5– An example of the site identified numbering system

Site Number:	792623_1
Biodiversity Asset	Box Ironbark (Section 6.0)
Conservation Status	Very High
Management Action	Protect
EVC	61 (Section 2.2)
EVC status	E (Endangered)
Focal Species	Diamond Firetail (Section 6.1)
Threatened Spp Record?	Yes (Y) (and name included)
Buffered for Focal Species?	No (N)
Vegetation Quality Score	16/20 (Section 5.1)
Management	Private
Threats	Pest plants, land clearance

Figure 6– An example of the data contained in the database (attribute table)

5.0. SUMMARY OF PRIORITY SITE SURVEYING

5.1. VEGETATION QUALITY ASSESSMENTS

One hundred of the 1787 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 of, 8) Size, 9) Neighbourhood and 10) Core Area. They were scored out of a maximum score of 20 (intact habitat). An example of the assessment sheet is provided in Appendix 7. Graphical illustration of the results is also provided in Appendix 9.

The sites in the Hughes Creek Landscape Zone scored between 4 and 17 (Appendix 10). The graphical results (Appendix 9) highlight some of the challenges for biodiversity conservation in the Hughes Creek Zone. In summary, the assessments identified that:

- Only 10% of sites scored the highest for large trees (more than 7 large trees/ha)
- 52% of the sites scored the highest for canopy cover (more than 50% cover)
- Only 5% of sites scored adequate understorey (more than 75% understorey cover and more than two forms)
- Only 14% of sites scored less than 25% weed cover
- Only 35% sites have adequate regeneration
- 64% of sites have adequate organic litter covering the ground (more than 5% cover)
- Only 23% of sites have adequate number of logs (25m/ha)
- 81% of sites surveyed were larger than 10 hectares and 20% between 2-10 hectares
- 80% of sites had more than 50% vegetation cover in the surrounding landscape (to 1km radius)
- 48% of sites were less than 1km from a block of native vegetation greater than 50-hectares.

(Note: Sites were scored in relation to the Ecological Vegetation Class Benchmark. Refer to Appendix 7 for further information on surveying).

Over the entire zone, the surveys show that there is very little understorey or regeneration, a high percentage of pest plants, not enough fallen timber and a limited number of large trees. These habitat elements should be targeted within the zone.

The VQA scores for each of the sites provide a valuable monitoring system that can be repeated over time. It is also intended that the remaining priority sites will also be assessed over time.

5.2 BIRD SURVEYS

One hundred of the 1,787 priority BAP sites had bird surveys completed. Fifty-five birds were recorded in the zone (Appendix 10). Information on birds located at each of the 100 sites is provided in Appendix 10. Note that surveys were restricted in season, timing and duration and the list is not intended to represent the entire population of birds in the Hughes Creek Zone.

The two threatened birds recorded during the survey were the Diamond Firetail (*Stagonopleura guttata*) and Lathams Snipe (Gallinago hardwichii). A list of threatened fauna (including birds) recorded in the zone during these surveys, is shown in Appendix 5. Further information on threatened birds in the Hughes Creek Landscape Zone can also be obtained from the BAP site attribute table.

5.3 CONSERVATION THREATS

Whilst some of the identified threats (eg. land clearance, habitat fragmentation, changes in hydrology and salinity) are primarily a result of historical activities (eg. wide spread clearing), they continue to have impacts on the biodiversity in the zone.

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.

Habitat fragmentation described as a potentially threatening process for fauna in Victoria under the *FFG Act* 1988 (Wierzbowski et al 2002), is usually the result of land clearance. A range of species such as the Brush-tailed Phascogale and Diamond Firetail are detrimentally affected by habitat fragmentation, as it affects their ability to source food and suitable habitat required for their survival. Habitat fragmentation also favours species such as Noisy Miners (*Manorina melanocephala*) (Simpson et al 1993). **Elevated competition** from these aggressive species threatens biodiversity in the area, by the exclusion of less aggressive species, such as the Diamond Firetail, from remnants.

Changes in hydrology (eg. wetting/dry/flow regimes) are a threat for native vegetation, particularly for wetlands and perched bogs, which have evolved to function with the natural cycles of flood and drought. Alteration in 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 can dramatically alter wetland and waterway appearance and functioning, disrupt natural productivity cycles and cause changes in vegetation and habitat. This in turn affects fauna that rely on wetlands (ie. for resources and breeding) (Howell 2002).

Damming and draining of perched bogs and spring soaks. Perched Bog and spring soak areas play a vital role in the hydrological cycle, having an important filtering effect, while also acting as sponges in the landscape, absorbing and holding water. These areas are at risk by cattle grazing, deliberate clearing, and dam creation, and are becoming increasingly rare.

Inappropriate grazing by introduced and native animals affects biodiversity conservation, through soil compaction, removal of vegetation (ie. regeneration), changed nutrient levels in and around native vegetation, contributes to tree dieback, and results in competition for fodder by native animals and small mammals that require tussocky grass for shelter (Wilson et al 2004). A large number of isolated paddocks trees are stressed and showing signs of dieback (ie. dead limbs, loss of trunk bark and compacted soils around bases).

The removal of fallen timber (or 'cleaning up') was evident along roadsides and within private remnants (see photograph below). Removal of fallen timber results in a loss of habitat, soil and fauna on which animals rely. Fallen timber provides shelter for regenerating seedlings. It also provides protection from fire and hollows for ground mammals, such as the Long-nosed Bandicoot and striped Legless Lizard, and a wide variety of smaller organisms that provide food for mammals and birds.

Photo: Firewood Collection in remnant vegetation
Photo: Rebecca Heard

Pest Plants (Weeds) are a major threat to biodiversity as they compete for space, light and

nutrients with native species. Invasion of native vegetation by environmental weeds is listed as a potentially threatening process under the *FFG Act* 1988 (Wierzbowski et al 2002). Some of the environmental weeds evident in the zone include Gorse (*Ulex europaeus*), Sweet Briar Rose (*Rosa rubiginosa*), Broom (*Bromus spp.*), Blackberry (*Rubus spp.*), Phalaris (*Phalaris spp.*), Paterson's Curse (*Echium plantagineum*), Horehound (*Marrubium vulgare*), Peppercorns *(Schinus molle*), Boxthorn (*Lycium ferocissimum*), Bridal Creeper (*Myrsiphyllum asparagoides*), African Love-grass (*Eragrostis curvula*), Willows (*Salix spp*), Poplars (*Poplar spp*) and many more. Weeds are especially evident on roadsides, disturbance by machinery and vehicles spread weed seed and agricultural weeds invade remnants. Pest plants invading remnants also results from adjacent land practices (eg. agricultural weeds).

Pest Animals are a major threat to the conservation values of the area. Predation of native wildlife by the cat (*Felis catus*) and Red Fox (*Vulpes vulpes*) are listed as potentially threatening processes under the *FFG Act* 1988 (Wierzbowski et al 2002). Species such as the Bush-stone Curlew are preyed upon by these introduced species. Whereas the European rabbit *(Oryctolagus cuniculus*) and European Hares (*Lepus europaeus*) compete for habitat, remove native vegetation and disturb soil structure.

Salinity is a potential threat to the area as a result of high watertables (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). Remnant vegetation on the lower-lying parts of the landscape is especially at risk from a rising watertable. 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). If not managed appropriately, the uptake of irrigation in new areas, such as north of the Murray Valley Highway, is also a potential threat to biodiversity, as the majority of the remnant vegetation in the zone is contained in this area.

Adjacent land use practices. Pasture improvement (such as sowing with Phalaris or application of fertilisers) and herbicide use, cropping, irrigation and plantations, are a threat to remnant vegetation. They can lead to the colonisation of areas by weeds, waterlogging of vegetation, high watertable depths, nutrient run-off and an increase in sediment input to rivers and streams (DPI 2005).

Land Development and subdivision. As land becomes subdivided for development, property sizes become smaller leaving less space for native regeneration and increasing the risk of clearing areas of trees and grassland for housing. Increasing the population density can also affect hydrology by increasing the area of hard surfaces and water runoff. However, it should also be noted that small properties can also attract "lifestyle" property owners who may be interested in restoring native vegetation rather than engaging in primary production

6.0 CONSERVATION ASSETS

6.1 FOCAL SPECIES

Research shows that different species have different types of responses to landscape change. The focal species approach therefore 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 focal species are 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. Therefore, focal species are a way of defining and guiding targets (eg. patch size and connectivity) for our landscape restoration strategies (Lambeck 1997).

Additional benefits of a focal species approach are that it allows for the monitoring of actions (eg. can undertake regular surveys to establish if focal species are becoming more common and using new sites). It also provides the community and organisations implementing on-ground works, with an 'iconic/focal' species (if they don't already have one), which in turn, is envisaged to enhance enthusiasm for implementing works.

The seven focal species identified in the Hughes Creek Zone, and their ecological requirements (thresholds[9]) are identified below (Table 2). A definition 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 (eg. for breeding, 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.

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. The focal species are only a suggestion of species to focus on-ground works. Other species may also be the focus for on-ground works, given new information and community desire to implement works for another species. Keeping in mind that if we aim to cater for these species, we are also assisting a suite of species and working towards overall vegetation cover targets for the catchment.

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

Table 2: Focal Species and their Habitat Requirements – Hughes Creek Zone		
	**Brush-tailed Phascogale (*Phascogale tapoatafa*)**	
	Minimum patch size (threshold)	>100 ha
	Critical distance between patches	10 km
	Dispersal threshold	1.4 km
	Ecological Vegetation Class	Grassy woodlands, Grassy forest BVT, Box Ironbark
	Some other requirements (general)	Mature rough barked Trees; good ground layer; fallen timber and litter
	**Long-nosed Bandicoot (*Perameles nasuta*)**	
	Minimum patch size (threshold)	3 ha
	Critical distance between patches	400m
	Dispersal threshold	Unknown
	Ecological Vegetation Class	Grassy Forests, Herb-rich Foothill Forest, Riparian Forests
	Some other requirements (general)	Dense ground or shrub cover
	**White-eared Honeyeater (*Lichenostomus leucotis*)**	
	Minimum patch size (threshold)	> 10 ha
	Critical distance between patches	< 1 km
	Dispersal threshold	2 km
	Ecological Vegetation Class	Riparian forests or woodlands, Grassy woodlands, Grassy forests, Herb-rich Foothill forest
	Some other requirements (general)	Fallen timber, dense understorey with Eucalypt species that have peeling bark, eg Manna Gum
	**Diamond Firetail *(Stagonopleura guttata)***	
	Minimum patch size	>10ha, not roadsides
	Critical distance between patches	<1km
	Dispersal threshold	>10km
	Ecological Vegetation Class	Plains Grassy Woodland/Creekline Grassy Woodlands
	Some other requirements (general)	Mobile seasonally, fox/cat control
	**Eastern Yellow Robin (*Eopsaltria australis*)**	
	Minimum patch size	>5 ha
	Critical distance between patches	< 1 km
	Dispersal threshold	Unknown
	Ecological Vegetation Class	Grassy Forests, Herb-rich Foothill Forest, Riparian Systems
	Some other requirements (general)	Patches of shrubs or regeneration, good ground litter layer, fallen timber.
	**Crested Shrike-tit (*Falcunculus frontatus*)**	
	Minimum patch size	> 5 ha
	Critical distance between patches	<1 km
	Dispersal threshold	Unknown
	Ecological Vegetation Class	Riparian Systems
	Some other requirements (general)	Sites containing mature trees with patches of dense understorey

Photo Credits Brush-tailed Phascogale (Peter Robertson), Long-nosed Bandicoot (Ian McCann), White-eared Honeyeater (Ian McCann), Diamond Firetail (Ian McCann), Eastern Yellow Robin (Bronwyn Merritt), Crested Shrike-tit (Ian McCann).

6.2 KEY BIODIVERSITY ASSETS

Biodiversity Action Planning (BAP) attempts to take a 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 the most critical part of the BAP process. The approach of using 'Key Biodiversity Assets' has been used, to group together the birds, animals and plants that utilise the same type of habitat. As per the focal species approach, by protecting these assets, we are conserving habitat for a suite of threatened species associated with that habitat. For example, by choosing 'Grassy Woodlands' as a key biodiversity asset, it incorporates all of the species that live in, and use Grassy Woodlands, as well as the individual threatened species. Another benefit of this approach is that specific actions can be developed. (Section 7.0) based on the requirements of each asset (eg. to counter threats and improve the status of the asset) Planning and implementation of on-ground works and actions that specifically target each of these assets, can then be undertaken (GBCMA *in prep*.)

Eight key biodiversity assets have been identified for the Hughes Creek Landscape Zone. The 1787 BAP sites have been categorised according to the dominant asset type. For further information on each asset, along with threatened species examples, refer to Table 3.

Photo: Long-nosed Bandicoot (Perameles nasuta). Photo Ian McCann

Table 3: Key Biodiversity Assets - Hughes Creek Zone	
Key biodiversity Assets	**Locally significant species**
(1) Grassy Woodlands Historically one of the dominant vegetation types in the landscape particularly on the west and north west slopes of the Highlands plateau to the Hume Highway. It is now the vegetation requiring the largest increase in extent with only 3.5% remaining.	***Fauna:*** Brush-tailed Phascogale, Swift Parrot, Hooded Robin, Regents Honeyeater, Squirrel Glider, Tree Goanna, Striped Legless Lizard. ***Flora:*** Narrow Goodenia, Flat Leaf Bush Pea, Rising Star Guinea Flower, Euroa Guinea Flower, ***EVCs***: EVC Group 14 including Grassy Woodland (175), Plains Grassy Woodland (55) and various mosaics.
(2) Grassy Forests Although some of the Grassy Forests Vegetation group remain relatively well represented such as Herb-rich Foothill Forest, in which 24% remains, other such as Valley Grassy Forest have been substantially cleared with 5.9% remaining.	***Fauna:*** Brush-tailed Phascogale, Powerful Owl, Hooded Robin, Diamond Firetail, Square-tailed kite. ***Flora:*** Ausfields Wattle, Hickory Wattle, Narrow Goodenia, Cupped Bush Pea, Rough Twig Sedge, Crimson Spider Orchid, Slender Tick Trefoil, ***EVCs*** : Valley Grassy Forest (127), Grassy Dry Forest (22) and mosaics of these with grassy forest EVC's
(3) Herb-rich Foothill Forests Herb-rich Foothill Forest was the dominant EVC in Hughes Creek Zone, with Damp Forest occurring in the moist gullies. For this reason it has been separated from Grassy Dry Forests to form an independent Key Biodiversity Group. The majority of this has been cleared although there are some large remnants near Caveat and Terip Terip.	***Fauna:*** Brush-tailed Phascogale, Powerful Owl, Long-nosed Bandicoot, Painted Honeyeater, Hooded Robin, Speckled Warbler, Eastern Horseshoe Bat, Common Bent-wing Bat. ***Flora:*** Ausfields Wattle, Hairy Hop Bush, Yarra Gum, Silky Brown Top, Cupped Bush Pea, Crimson Spider Orchid ***EVCs*** Include Herb Rich Foothill Forest (23) and Damp Forest (29)
(4) Granitic Hills Granitic Hills only cover a small area of the Hughes Creek Landscape Zone. They are unique areas that provide important habitat.	***Fauna:*** Speckled Warbler, Tree Goanna, Diamond Firetail, Hooded Robin, Cunninghams Skink. ***Flora:*** Deans Wattle, Hickory Wattle, Narrow Goodenia, Rye Beetle Grass ***EVCs*** include all Granitic Hills (72) EVCs and Mosaics.
(5) Box Ironbark Box Ironbark Vegetation occurs near the Western boundary of the zone, north of Seymour. It has been substantially cleared and is now in need of a large increase in its extent.	***Fauna:*** Bush-stone Curlew, Hooded Robin, Speckled Warbler, Diamond Firetail, Brush-tailed Phascogale, Squirrel Glider, Tree Goanna. ***Flora:*** Buloke, Summer Fringe Sedge, Narrow Goodenia, Rising Star Guinea Flower, Large Fruit Fireweed, Yellow Star, Euroa Guinea Flower ***EVCs*** Box Ironbark (62) EVCs and Mosaics
(6) Riparian Systems Riparian systems especially Creekline Grassy Woodland has been drastically cleared with only 1.3% of Creekline Grassy Woodland remaining, most of which is in a fragmented or degraded state. Riparian systems are highly significant habitat links. They provide habitat for a wide variety of species.	***Fauna:*** Waterbirds, Long-nosed Bandicoot, Mountain Galaxias, Bluenose Cod, Macquarie Perch, River Blackfish, Growling Grass Frog. ***Flora:*** Green Top Sedge, Green Leek Orchid, White Lipped Spider Orchid. ***EVCs*** listed in Table 1, Group 9 and 15.

(7) Spring soaks/ Perched Bogs Bogs and soaks play a vital role in the hydrological cycle, having an important filtering effect. They support a wide range of plant and animal species, including several threatened species.	***Fauna:*** Lewin's Snipe, Waterbirds. ***Flora:*** Green Leek Orchid, Sharp Midge Orchid, Golden Dodder, Small Spider Orchid, ***EVCs*** listed in table 1 and 2, Group 8.
(8) Riverine Fish Community Fish species listed under the Flora & Fauna Guarantee 1988 and other significant fish species.	***Fauna:*** Mountain Galaxias, Bluenose Cod, Macquarie Perch, River Blackfish.

* The numbering of the Key Biodiversity Assets (1-8) is only intended to assist with the identification of the assets throughout the remainder of the report, not their priority ranking for conservation. Scientific names listed only once.

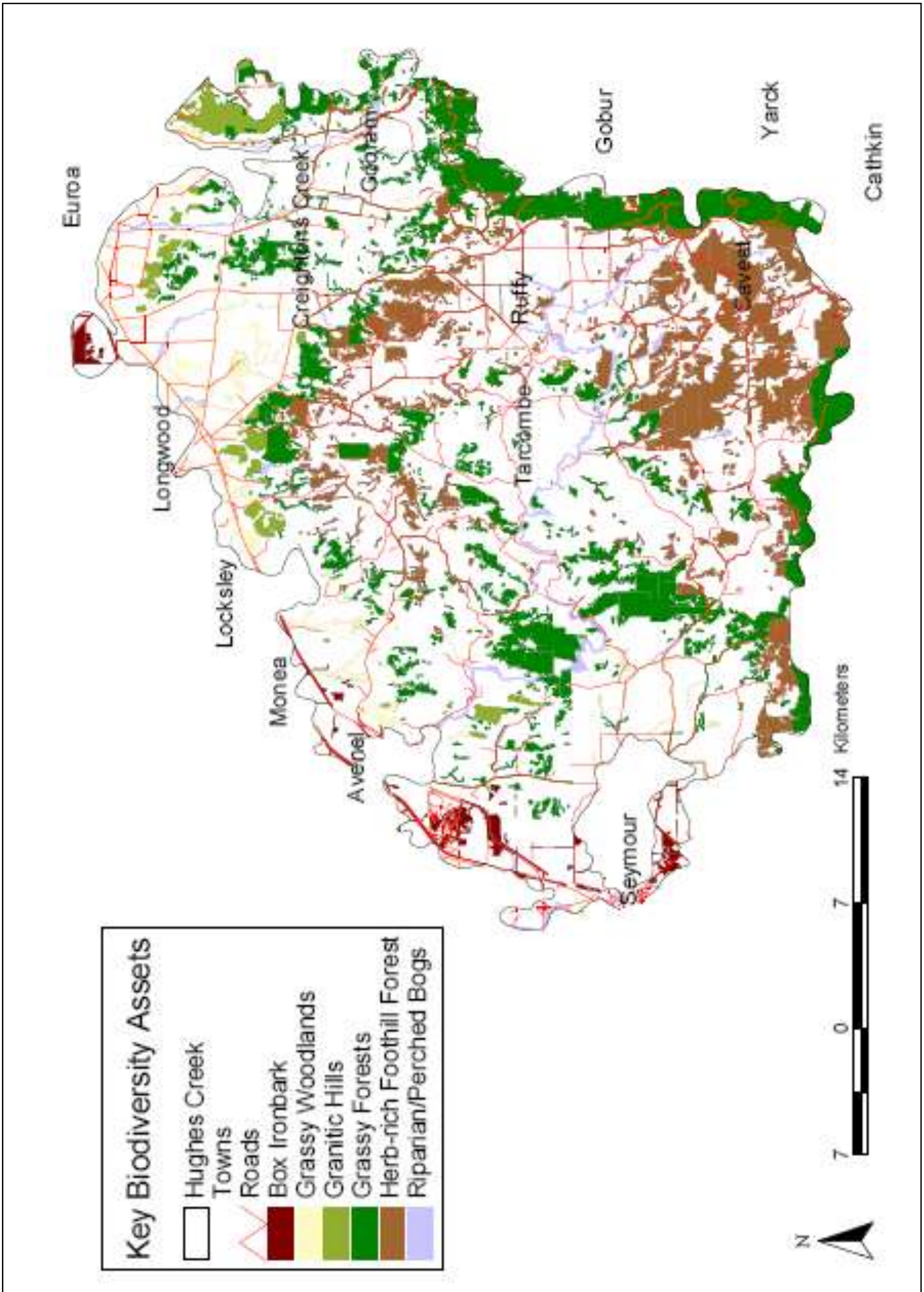


Figure 7 – Location of Key Biodiversity Assets – Hughes Creek Landscape Zone

7.0 PRIORITY ACTIONS FOR KEY BIODIVERSITY ASSESTS

Priority actions for the Hughes Creek Landscape Zone have been developed and grouped based on each 'Key Biodiversity Asset' (eg. Grassy Woodlands) (refer to Section 6.2). Priority actions for the key biodiversity assets were developed based on the following factors, (1) size/extent (2) condition and (3) landscape processes (eg. habitat connectivity, 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 Hughes Creek Landscape Zone,
B) Photographic example of the asset in 'good condition' for the zone, and
C) Proposed actions for each of the assets in the Zone (broader actions in Ahern et al 2003).

It is proposed that the community and agencies in the Hughes Creek Zone investigate options for implementing these actions in to existing projects/policies. For example, BAP in each asset type, should be targeted in order of priority (Very High, High, Medium to Low) in relation to these actions (where applicable). This forms the basis of BAP, where the very high value sites, that require less cost for long-term protection, will provide the highest prospect for conservation (GBCMA *in prep.*).

Note: The Flora and Fauna Guarantee Act 1988 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. Action Statements outline what is required for the species conservation. They are developed based on a rigorous legislative process (Acts of Parliament) and are therefore of high priority. For further information refer to the 'Actions for Biodiversity Conservation Database' (ABC) (DSE 2005a).

Hughes Creek and its associated riparian vegetation
Photo: Bronwyn Merritt

1) KEY BIODIVERSITY ASSET – Grassy Woodlands

1A) Introduction – Grassy Woodlands:

Grassy woodlands were one of the dominant vegetation type in the zone once covering 17.5% of the zone. It has since been substantially cleared, with only 3% remaining, and requires large increases in extent in order to sustain healthy populations of the fauna that rely on it (see Table 3). Grassy Woodlands occur on lower slopes of foothills and low rounded hills above plains and floodplains, at elevations of 150-500m, and 500-750mm annual rainfall. They are predominantly open grassy Box woodlands with a variety of grasses, including Kangaroo Grass, Red-leg Grass, Wallaby Grasses and Spear Grasses plus sedges, lilies, orchids and herbs. The overstorey usually consists of Box species (mainly Grey Box, or White Box with Yellow Box) and some River Red Gum, and Black Wattle in the rockier areas. The medium to low scattered shrub layer has characteristic species of local wattles (Golden Wattle, Hedge Wattle, Gold-dust Wattle), Drooping Cassinia and Sweet Bursaria.

More than 97% of Grassy Woodlands in the Goulburn Broken Catchment have disappeared since European invasion. Over 81% of what remains is on private land. Many of the plants and animals that rely on this habitat are now also threatened, and some are extinct. Therefore, the support of private landholders is essential for the ongoing conservation of Grassy Woodlands. High value Grassy Woodlands in the zone include Kobyboyn Rd, Hume Highway Road reserve, Mansfield-Euroa Road, Creightons Creek Road, Longwood-Mansfield Road, Oak Valley Road and Upton Road

The main threats affecting Grassy Woodlands in the zone, are land clearing, inappropriate grazing regimes, cleaning up and pest plants and animals. The actions identified below are intended to assist in the protection of the remaining Grassy Woodlands within the Hughes Creek Landscape Zone. However, these actions are specific to the zone and are by no means comprehensive for the region. Other strategies (eg. Victoria's Native Vegetation Management framework (DNRE 2002)), provide a framework for net gain and are overarching strategies for the State and Goulburn Broken Catchment (DSE 2005d).

Photo: Grassy Woodlands – A Key Biodiversity Asset - Hughes Creek Landscape Zone. Photo Bronwyn Merritt

1B) Photographic Example – Grassy Woodlands:

The Site (792421-12) pictured below is grassy woodland site is along the Longwood-Mansfield Road. This is a good example of grassy woodland as it has a diverse and largely intact structure. The site has large trees with hollows and good recruitment; however, this site lacks fallen timber and given it's long narrow shape is under threat from weed invasion either from the road (hay carting trucks dropping seeds etc) or from adjoining farm land.

1C) Actions – Grassy Woodlands:

Size/Extent:

- **Create buffers**, through revegetation, on freehold land abutting roadside remnants or reserves to widen the habitat.
- **Increase connectivity** to remnants and reserves such as Tallarook State Forest, Mt Piper, Tyaak, Monument Hill, High Camp and Broadford-Kerrisdale Reserves.
- **Protect** significant roadsides such as the Kobyboyn Rd, Hume Highway Road reserve, Mansfield-Euroa Road, Creightons Creek Road, Longwood-Mansfield Road, Oak Valley Road and Upton Road.
- **Expand** patch size and improve connectivity of isolated or partly disconnected patches

Condition:

Education/Extension

- **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 revegetation or unimproved, uncultivated pasture around woodland.
- **Liase** with Parks Victoria, DSE, committees of management and adjacent landholders, regarding the current management of the reserves.
- **Encourage protection** (fencing) of all remnants and manage grazing practices to benefit the grassy woodland (such as exclude all domestic grazing stock in remnants to allow plants to set seed and regenerate. Manage stock grazing to benefit the native vegetation once plants have set seed).
- Organise **community education** activities relating to the importance of Grassy Woodlands and associated flora and fauna species, specifically targeting high priority remnants in paddock environments.
- Further **promote** the benefits of protecting and enhancing remnant patches through extension and voluntary programs, such as Environmental Management Incentives.
- **Encourage** retention of fallen timber in privately owned sites and making sure that fallen timber is not removed illegally from public land.

On-ground Works

- **Minimise disturbance** at high value sites at high value sites to prevent erosion and minimise weed invasion.
- **Ensure** clusters or individual specimens of large, hollow-bearing trees and dead standing trees are retained and protected throughout the zone.
- **Enhance** high value sites with shrubs and other species if regeneration has not occurred following fencing (eg. no existing seed source).
- **Identify** additional native grassland paddocks for protection and restoration, where artifact grasslands were once grassy forests.

Threatened Species

- **Install nest boxes** where hollows are deficient to increase the number of nesting hollows for animals, such as the Brush-tailed Phascogale and Sugar Gliders.

Pest Plant and Animals

- Continue ongoing **control of foxes and feral cats**.
- Control regionally listed weeds and environmental weeds from sites
- Through the use of exclusion plots and monitoring, identify a healthy macropod population density and work to maintain this through culling

Landscape Processes (ie. hydrological regime, habitat connectivity):

- **Encourage** adjacent landholders to revegetate adjacent to significant road reserves such as Kobyboyn Rd, Hume Highway Road reserve, Mansfield-Euroa Road, Creightons Creek Road, Longwood-Mansfield Road, Oak Valley Road and Upton Road. In order to widen and buffer them against weed invasion
- **Identify and prioritise potential** sites for habitat expansion and improved connectivity as identified by the landscape context model and maps provided in this document.

2) KEY BIODIVERSITY ASSETS – GRASSY FORESTS

2A) Introduction – Grassy Forests:

Grassy Forests occur on hills, generally with very shallow soil, at elevations at 230-900m. Grassy Forests occur in protected aspects at low rainfall, and on steeper, north facing aspects at higher rainfall and altitude. These are typically open forests of Red Stringybark and Long-leaf Box at lower altitudes. Occasionally Blakleys Red Gum occurs. Broad-leaf Peppermint and Brittle Gum occur at higher altitudes. The shrub layer consists of few medium and low shrubs such as guinea-flowers, wattles and peas. The diverse grassy understorey occurs on more protected south-east slopes with species such as Silver-top Wallaby-grass, Grey Tussock-grass, Plume Grass, Common Wheat-grass and wallaby-grasses. There is often sparse but diverse range of herbs, lilies and orchids.

High value Grassy Forests in the zone include the Yarck, Gobur, Molesworth and Switzerland Reserves.

Many plant and animal species rely on these forests and the ecological services they provide. More than 48% of Grassy Forests in the Goulburn Broken Catchment have disappeared since European invasion. It is important to protect the remaining area for the continued survival of the species that rely on it and for the ecological services these forests provide. Of the remaining area of Grassy Forest in the catchment, 38% occurs on private land. The support of private landholders is essential for the ongoing conservation of Grassy Forests (DSE 2005d).

2B) Photographic Example – Grassy Forests:

Example of a Grassy Forest BAP Site of Good Condition – Hughes Creek Zone

The site (802432-7) is a good example of a Grassy Dry Forest remnant with a diverse and largely intact structure. This site runs along the Euroa-Mansfield Road. It has a diverse understorey with good recruitment. There are also large hollow trees and some fallen timber. This site is under threat from the invasion of environmental weeds such as Watsonia and Blackberry.

Photo: Grassy Forest – A Key Biodiversity Asset – Hughes Creek Landscape Zone. Photo Bronwyn Merritt

2C) Actions – Grassy Forests:

Size/Extent:

- **Increase the extent of existing remnants**, by establishing new areas of indigenous species of trees and shrubs, and revegetate to establish buffer zones or unimproved, uncultivated pasture around grassy woodland.
- **Protect and manage** significant roadsides, such as Kobyboyn Rd, Longwood-Mansfield Road, Euroa-Mansfield Road, Forlonge Memorial Road, Highlands Road, Homewood Road, Coulsons Land and Lambing Gully Road.
- **Encourage** adjacent landholders to revegetate adjacent to these significant road reserves as a way of increasing the area of remnants and providing a buffer to weed invasion

Condition:

Education/Extension

- **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 revegetation or unimproved, uncultivated pasture around woodland.
- **Liase** with Parks Victoria, DSE, committees of management and adjacent landholders, regarding the current management of the reserves.
- **Encourage protection** (fencing) of all remnants and manage grazing practices to benefit Grassy Forests (such as exclude all domestic grazing stock in remnants to allow plants to set seed and regenerate. Manage stock grazing to benefit the native vegetation once plants have set seed).
- Organise **community education** activities relating to the importance of Grassy Forests and associated flora and fauna species, specifically targeting high priority remnants in paddock environments.
- Further **promote** the benefits of protecting and enhancing remnant patches through extension and voluntary programs, such as Environmental Management Incentives.
- **Encourage** retention of fallen timber in privately owned Grassy Dry forest Sites and making sure that fallen timber is not removed illegally from public land.

On-ground Works

- **Minimise disturbance** at high value sites at high value sites to prevent erosion and minimise weed invasion.
- **Ensure** clusters or individual specimens of large, hollow-bearing trees and dead standing trees are retained and protected throughout the zone.
- **Enhance** high value sites with shrubs and other species if regeneration has not occurred following fencing (eg. no existing seed source).
- **Identify** additional native grassland paddocks for protection and restoration, where artifact grasslands were once grassy forests.

Threatened Species

- **Install nest boxes** where hollows are deficient to increase the number of nesting hollows for animals, such as the Brush-tailed Phascogale and Sugar Gliders

Pest Plant and Animals

- Continue ongoing **control of foxes and feral cats** for the protection of threatened species and focal species such as brush-tailed Phascogales, Sugar Gliders Golden Whistlers and Hooded Robins.
- Control regionally listed weeds and environmental weeds form sites.
- Through the use of exclusion plots and monitoring, identify a healthy macropod population density and work to maintain this through culling

Landscape Processes (ie. hydrological regime, habitat connectivity):

- **Increase connectivity**, by linking to other remnants, important reserves such as Hughes Creek Flora Reserve, Mt Wombat Flora and Fauna Reserve, Euroa Bushland Reserve and Gooram Gooram Bushland Reserve
- **Enhance linkages** between remnant vegetation such as degraded roadsides, rail reserves and waterways.

3) KEY BIODIVERSITY ASSET – HERB-RICH FOOTHILL FOREST

3A) Introduction – Herb-Rich Foothill Forest:

Herb-rich Foothill forest, is a medium to tall type of open forest which is usually found on easterly and southerly aspects of lower slopes and gullies. It occurs on relatively fertile, moderately well-drained soils and covers a wide range of geological types and in areas of moderate to high rainfall. The overstorey commonly consists of Narrow-leaf Peppermint and Candlebark and Blue Gum 'Eurabbie'. The small tree layer of Silver Wattle occurs over a sparse to dense shrub layer including Prickly Currant-bush, Handsome Flat-pea, Hop Bitter-pea and Pink Bells. The understorey contains a high cover and diversity of herbs and grasses in the ground layer, such as Kidney-weed, Pennywort, Mat-rush, Austral Bear's-ears, Mountain Clematis, Weeping Grass, Common Tussock-grass, Common Hedgehog-grass and Common Wheat-grass. Austral Bracken may tend to dominate following frequent disturbance, particularly by fire and grazing (DSE 2005d).

High value Herb-rich Foothill Forests in the zone include: Gobur, Yarck, Switzerland Ranges, Dropmore, Caveat, Molesworth and Ruffy Reserves.

Many species rely on these forests and the ecological services that they provide. More than 36% of Herb-rich Foothill Forests in the Goulburn Broken Catchment have disappeared since European settlement. Of the remnant area, 21% occurs on private land. The support of private landholders is important for the ongoing conservation of Herb-rich Foothill Forests. Current threats include, inappropriate fire regimes, soil disturbance, weed invasion, pest animals, loss of tree and ground habitat, poor timing of stock grazing and overgrazing and a lack of native understorey and ground layer (DSE 2005d).

3B) Photographic Example – Herb-Rich Foothill Forest:

Example of a Public Land BAP Site of Good Condition - Hughes Creek Zone

The site (802344-90) pictured below is part of the Caveat Nature Reserve and is a good example of Herb-rich Foothill Forest in the Hughes Creek Landscape zone. It has a diverse and relatively intact structure. There is some fallen timber and large hollow bearing trees. Weeds, such as Spear Thistle and Blackberry, are present but only in small areas.

Photo: Herb-Rich Foothill Forest - a Key Biodiversity Asset - Hughes Creek Landscape Zone. Photo Bronwyn Merritt

3C) Actions – Herb-Rich Foothill Forest:

Size/Extent:

- **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.
- **Work with** VicRoads, local government and Landcare groups to protect significant roadsides, such as Wales, Homewoods, Magalore, Hughes Creek, Highlands Roads, Ruffy, Killeans Hill, Angle, Ruffy-Euroa, Longwood-Ruffy, Gum, Caveat-Dropmore, Dropmore-Molesworth Roads, Ghin Ghin Lane, Sinclairs Lane and Weibye Track.

Condition:

Education/Extension

- **Encourage** (eg. community education activities) landholders to leave fallen branches and large woody debris on the ground.
- **Liase** with Parks Victoria, DSE, committees of management and adjacent landholders, regarding the current management of the reserves and state forests.

On-ground Works

- **Maintain and improve condition** of all identified high value sites by encouraging the retention of fallen timber and hollow bearing trees, and manage regionally listed weeds.
- **Install nest boxes** to provide hollows, where hollow bearing trees are deficient.
- **Retain both live and dead hollow bearing trees**, stags for Powerful.
- **Ensure** clusters or individual specimens of large, hollow-bearing trees and dead standing trees are retained and protected throughout the zone.

Pest Plant and Animals

- Continue **active weed management** throughout forest remnants, particularly around the perimeter to control encroachment from private land. Encourage adjacent landowners to participate in Weed Action Groups and Rabbit Action Groups.
- Active **weed management** to control and prevent weed infestation. Control small isolated infestations first. Burning weedy, open areas in autumn, could be an option (perhaps too risky at other times of the year for landholders). Soon after fire spot spray weedy grasses with species specific herbicide, avoiding native grasses.
- **Minimise disturbance** to reduce the risk of further weed invasion and revegetate or encourage regeneration of areas where weeds are removed.
- **Implement control of foxes and feral cats** for the protection of native animals with threatened and focal species sites (brush-tailed Phascogales, Sugar Gliders) being the highest priority.

Threatened Species

- **Install nest boxes** where hollows are deficient to increase the number of nesting hollows for animals, such as the Brush-tailed Phascogale and Sugar Gliders

Landscape Processes (ie. hydrological regime, habitat connectivity):

- **Target drainage lines**, freehold remnants and roadsides remnants for revegetation to enhance connectivity with forest blocks.
- **Identify and prioritise** potential sites for habitat expansion and improved connectivity, using the Landscape Context map as a guide.
- **Important reserves** to manage and restore include: Gobur, Yarck, Switzerland Ranges, Dropmore, Caveat, Molesworth and Ruffy Reserves. These reserves should be linked up to other vegetation and managed to protect and enhance their biodiversity value

4) KEY BIODIVERSITY ASSET – GRANITIC HILLS

4A) Introduction – Granitic Hills:

Not surprisingly Granite Hill Woodland occurs on granite country with outcropping rocks and sandy to sandy-clay soils which typically have low water holding capacity. They occur at elevations between 150-450m, with an annual rainfall of 400-750mm. Rocky Outcrop Shrubland / Herbland is often interspersed amongst this vegetation community. The low woodland overstorey is usually dominated by Blakely's Red Gum, with Red Stringybark, Red Box and Long-leaf Box. The dense shrub layer is often dominated by Common Fringe-myrtle and includes species such as Drooping Sheoak, Lightwood, Box-leaf Wattle and Varnish Wattle. White Cypress-pine can also be found in this vegetation community, usually in uncleared and fire sheltered rock areas. Ground layer species include Nodding Blue Lily, Austral Carrot, Raspwort, Cotton Fire-weed, Green Rock Fern and Austral Stonecrop.

High value Granitic Hills in the Hughes Creek zone include: Tenneriffe, Big Hill, Euroa and Mt Wombat Reserves

More than 56% of Granitic Hills Woodlands in the Goulburn Broken Catchment have disappeared since European invasion. Many of the plants and animals that rely on this habitat are now also threatened, and some are extinct. As 18% of the remaining Granite Hills Woodlands withing the Goulburn Broken Catchment is on private land, landowners should be encouraged to protect and revegetate remnants on their properties.

4B) Photographic Example – Granitic Hills:

Example of a Riverine Woodland BAP Site of Good Condition – Hughes Creek Zone

The site (802434-150) pictured below is in good condition with large areas of bare granitic rock and a diverse understorey of shrubs and grasses. There are some large trees and fallen timber. Grassy weeds are present but do not dominate the site.

Photo: Granitic Hills – A Key Biodiversity Asset – Hughes Creek Landscape Zone. Photo Bronwyn Merritt

4C) Actions – Granitic Hills:

Size/Extent:

- **Encourage** landholders to increase the size of existing remnants, to establish new areas of indigenous species of trees and shrubs, and to retain or revegetate to establish buffer zones or unimproved, uncultivated pasture around granite outcrops.
- **Increase connectivity** (through revegetation) by linking areas of remnant granitic hills vegetation.

Condition:

Education/Extension

- **Encourage** (eg. community education activities) landholders to leave all rocks, fallen branches and woody debris on the ground.
- **Promote** the benefits/uniqueness and management requirements of diverse granite country vegetation

On-ground Works

- **Maintain** all rocks as structural habitat.
- **Minimise disturbance** at high value sites to prevent erosion and minimise weed invasion.
- **Restore structural diversity** by revegetating patches trees with indigenous shrubs and ground cover.
- **Improve habitat quality** by leaving fallen timber, logs and branches on the ground and by leaving dead trees standing as they provide hollows used by many wildlife species.
- **Exclude grazing** to protect remaining patches of trees and native vegetation and encourage regeneration.
- **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).

Pest Plants and Animals

- Continue ongoing **control of foxes and feral cats** for the protection of threatened species and focal species such as Brush-tailed Phascogale, Sugar Gliders and Diamond Firetails.
- Undertake active **weed control** at all BAP sites.

Landscape Processes (ie. hydrological regime, habitat connectivity):

- **Link high value sites** with roadsides. Investigate the linking sites by the creation of corridors between sites.
- **Important reserves** to enhance and manage include: Tenneriffe, Big Hill, Euroa and Mt Wombat Reserves should be linked up to other vegetation and managed to protect and enhance their biodiversity values

5) KEY BIODIVERSITY ASSET – BOX IRONBARK FORESTS

5A) Introduction – Box Ironbark Forests:

Box Ironbark Forest are open forests that occur on low hills at altitudes between 150-230m, with an annual rainfall between 500-650mm. The skeletal sandy loam to clay loam soils are often gravelly, and are of low fertility with a poor moisture holding capacity. In the Hughes Creek Zone Box Ironbark forests occur in scattered sites to the west around Seymour. The overstorey is dominated by Red Box, Red Stringybark (*Eucalyptus macrorhyncha*), Long-leaf Box, and Yellow Box, Red Ironbark (*E. tricarpa*). The understorey is a scattered shrub layer which includes Golden Wattle, Spreading Wattle, Daphne Heath (*Brachyloma daphnoides*), Grey Everlasting (*Ozothamnus obcordatus*) and Sweet Bursaria (*Bursaria spinosa*). The sparse ground layer includes Wallaby Grasses, Spear Grasses, Red Anther Wallaby Grass (*Joycea pallida*), Black Anther Flax Lily (Dianella revoluta), Shiny Everlasting (*Bracteantha viscosa*) and Chocolate lily.

Significant sites include the Bushland Reserve and Lighthorse Park near Seymour

Over 60% of Box Ironbark Forests in the Goulburn Broken Catchment have disappeared since European invasion. Of the 40% that remain, most has been disturbed at some stage and is degraded. Many of the plants and animals that relied on this habitat are now also threatened, and some are extinct. Over 18% of the remaining Box Ironbark forests in the Goulburn Broken Catchment remain on private land. Therefore, the support of private landholders is essential for the ongoing conservation of Box Ironbark Forests (DSEd 2005). Many of the areas in the zone that once contained Box Ironbark forest have been cleared for agriculture. Other threats include Adjacent Land Use Practices, Grazing, Pest Plants and Pest 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 Hughes Creek Zone and are by no means comprehensive for the region.

5B) Photographic Example – Box Ironbark Forests:

Example of a Box Ironbark BAP Site in Good Condition – Hughes Creek Zone

The site (792421-1) pictured below is both a Trust for Nature and Land for Wildlife site and is a good example of Box Ironbark vegetation in the Hughes Creek Landscape zone. It has a diverse understorey with good recruitment. Nest boxes have been installed to increase the nesting sites available. There have been threatened flora and fauna species recorded in this site such as Euroa Guinea Flower, Narrow Goodenia, Hooded Robin, Diamond Firetail and Brush-tailed Phascogale.

Photo: Box Ironbark Forest – A Key Biodiversity Asset - Hughes Creek Landscape Zone. Photo Bronwyn Merritt

5C) Actions – Box Ironbark Forests:

Size/Extent:

- **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 with revegetation or fence out and allow regeneration around Box Ironbark forest.
- **Protect significant roadsides** such as the Hume Highway, Back Mountain Roads and the Melbourne – Albury Rail Reserve.

Condition:

Extension/Education

- **Organise community education activities** relating to the importance of Box Ironbark Forests and associated flora and fauna species, specifically targeting high priority remnants in paddock environments.
- Further **promote** the benefits of protecting and enhancing remnant patches through extension and voluntary programs, such as Environmental Management Incentives and Land for Wildlife.
- **Encourage** retention of fallen timber in privately owned Box Ironbark Forest sites.

On-ground Works

- **Maintain and improve condition** of all identified high value sites by encouraging the retention of fallen timber and hollow bearing trees, and manage regionally listed weeds.
- **Exclude all grazing** to allow trees, shrubs and native ground cover regenerate.
- **Restore structural diversity** by revegetating degraded remnants with indigenous shrubs and ground cover, if regeneration has not occurred following fencing (eg. no existing seed source).
- **Protect** clusters or individual specimens of large, hollow-bearing trees are retained and protected throughout the zone.
- **Leave any dead standing trees**. Install nest boxes where natural hollows are in short supply to increase the number of nesting hollows for animals such as Brush-tailed Phascogales.

Pest Plant and Animals

- **Minimise disturbance** at high value sites to prevent erosion and minimise weed invasion.
- **Continue ongoing contro**l of foxes and feral cats for the protection of threatened species and focal species including Brush-tailed Phascogale, Sugar Gliders and Diamond Firetails.

Landscape Processes (ie. hydrological regime, habitat connectivity):

- **Increase connectivity to important reserves and remnants** such as Seymour Bushland Reserve and Lighthorse Park.
- **Identify and prioritise potential sites** for habitat expansion and improved connectivity as identified by the landscape context model and maps provided in this document.

6) KEY BIODIVERSITY ASSET – RIPARIAN SYSTEMS

6A) Introduction – Riparian Systems:

Riparian Systems, such as rivers, streams and creeks are the lifeblood upon which most of the other assets depend. Significant waterways in this zone, include Hughes Creek, Creightons Creek, Boundary Creek, Woolshed Creek, Emu Ponds Creek, Castle Creek and Seven Creeks and their associated riparian vegetation. 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. Waterways such as Hughes Creek and Creightons Creek are classified as public land and are therefore managed by the Department of Sustainability and Environment (DSE) and/or the Goulburn Broken Catchment Management Authority (GBCMA).

The Creekline Grassy Woodland occurs along the banks of the smaller ephemeral (seasonal) streams on the plains and lower slopes of the foothills at elevations of 100-200mm with an annual rainfall of 400-700mm. These open woodlands are also dominated by River Red Gum. Manna Gums are also occasionally found on the lower slopes of the foothills. There is a medium open shrub layer of Silver Wattle and Blackwood. Seasonal innundation provides good moisture availability to fertile soils supporting ground layer of Common Tussock0-grass, Weeping Grass and Common Wheat Grass with rushes and sedges.

Riparian Forest grows along river banks, the larger creeks and associated alluvial terraces in areas higher in the catchment with an annual rainfall of 900-1800mm. The overstorey forms a tall forest typically of Manna Gums, with a mixture of species such as Narrow Leaf Peppermint. Blackwoods, Silver Wattles, Tree Violet, Hazel Pomaderris (*Pomaderris aspera*) and Tree Lomatia (*Lomatia fraseri*) typically occur as a well developed secondary tree layer. The understorey is dominated by dense patches of Prickly Currant-bush (*Comprosma quadrifida*) with a ground layer rich in grasses, ferns and herbs.

Significant sites include Hughes, Creightons, Boundary, Woolshed, Emu, Castle and Seven Creeks

A number of other threats to riparian systems include land clearing, adjacent land use practices (eg. 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 Hughes Creek 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.

6B) Photographic Example – Riparian Systems:

Example of a Riparian System BAP Site in Good Condition – Hughes Creek Zone

The site (792314-8) pictured below runs along the Hughes Creek. The site has a diverse and largely intact understorey. Some areas have weed infestations but they are generally located at picnic areas or locations that have been grazed. There are large hollow bearing trees and fallen timber. Hughes Creek also forms an important link to other large remnants.

Photo: Riparian Systems – A Key Biodiversity Asset – Hughes Creek Landscape Zone. Photo Bronwyn Merritt

6C) Actions – Riparian Systems:

Size/Extent:
• In consultation with GBCMA and adjacent landholders **buffer** creeks and rivers, revegetating or allowing regeneration, using waterway/environmental incentives or covenanting. • **Encourage** direct seeding to increase cost efficiency and time of creating linkages between private remnants and waterways.
Condition:
Education/Extension • **Consult** with licensees of waterways, to fence the creeklines, through waterway incentives and encourage the removal of stock, especially during set times to allow regeneration. • **Further promote** the benefits of protecting and enhancing native vegetation in the in-stream and riparian environments and linking to private remnants, in extension and voluntary programs, such as Environmental Incentives. • **Encourage** the planting of alternative timber supplies, to reduce firewood collection impact on roadsides, remnants and waterways. • In **consultation** with Goulburn Broken CMA, develop habitat management plans for streamside on freehold, with particular emphasis upon protecting and expanding habitat nodes (eg creekline/roadside intersections). On-ground Works • **Establish off stream watering points** for all affected sites on waterways, where required.

- Negotiate with landholders the **fencing (and grazing exclusion)** of unused roadsides and creeklines associated with their properties, and which contain remnants.
- Concentrate **revegetation and weed control** efforts in areas adjacent to streamside reserves.
- **Encourage** retention of fallen timber on all waterways and adjoining remnants.
- **Manage** recreational users of the area to reduce degradation of the area.

Pest Plant and Animals

- Continue ongoing **control of foxes and feral cats** for the protection of threatened species including Brush-tailed Phascogales, Sugar Gliders Golden Whistlers.
- Implement Trout (and other feral species) irradiation programs for the protection of fish species such as Mountain Galaxias, Bluenose Cod, MacQuarie Perch, River Blackfish and Growling Grass Frog
- Actively **weed management** to control and prevent infestation, especially Watsonia and Blackberry.

Landscape Processes (ie. hydrological regime, habitat connectivity):

- **Increase linkages** between Mt Disappointment State Forest and Tallarook State Forest and Dabyminga Creek.
- **Revegetate and link** Hughes, Creightons, Boundary, Woolshed, Emu, Castle and Seven Creeks to other remnant vegetation.

7) KEY BIODIVERSITY ASSET – SPRING SOAKS/PERCHED BOGS

7A) Introduction – Spring Soaks/Perched Bogs:

Spring-soak Woodlands are seasonal wetland communities commonly with plateaux and outwash slopes of granite. These springs support a range of vegetation types in a radial pattern around source of moisture. The wetter centre contains the taller sedges with species like Ground Fern surrounded by a shrubby or heathy woodland of Swamp Gum or Blakely's often dominated by Prickly Tea-tree, with Golden Spray found on most intact sites. On the outer edge where it is moist, but would occasionally dry out, a variety of herbs and small sedges occur. Species such as Yellow Star, Small Mud-mat, Sundews and Common Bog-sedge occur. Perched bogs occur on all aspects on very gentle slopes above drainage lines or across hillsides between drainage lines on granitic massif plateau. They are moist year round, and very wet in winter. Soils are saturated sandy clay, which may be associated with an impermeable clay layer or a hydrological phenomenon creating a soak or spring effect. The scattered overstorey consists of Mountain Swamp Gum or Swamp Gum. This occurs over an almost impenetrable shrub layer, which is a dense thicket of one or a combination of Baeckea, Prickly Tea-tree, Ovens Wattle and Heath species. The sedge-rich ground layer of Saw-sedge, Rush, Common Woodrush and Spiny-headed Mat-rush.

More than 81% of Spring Soak Woodlands and 23% of Perched Boggy Shrublands in the Goulburn Broken Catchment have disappeared since European invasion. Many of the plants and animals that rely on these habitats are now threatened or have become extinct. Much of the remnants now occur on private land and therefore landowner cooperation is essential for the long term protection of these key biodiversity assets. Current threats include, alteration of natural drainage regimes (particularly through damming and draining, grazing, lack of natural regeneration, ploughing and pugging, favouring weed species, weed invasion (particularly Paspalum and Phalaris), increases in nutrients.

7B) Photographic Example – Spring Soaks/Perched Bogs:

Example of a Perched Bog BAP Site of Good Condition – Hughes Creek Zone

Perched Bog – A Key Biodiversity Asset - Hughes Creek Landscape Zone
Photo: Janet Hagen

7C) Actions – Spring Soaks/Perched Bogs:

Size/Extent:

- **Encourage landholders** to protect 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 spring soaks and perched bogs.

Condition:

Education/Extension

- **Consult** with licensees of waterways, to fence the creeklines, through waterway incentives and encourage the removal of stock, especially during set times to allow regeneration.

On-ground Works

- **Fencing is critical**, not only the soak or bog but also a buffer around the site. Avoid stock access when soils are wet, to prevent pugging and in spring and early summer to allow flowering and seed-set of native plants.
- Retain or re-instate **natural hydrology** from pasture and link to other remnants
- **Avoid disturbance** to prevent pugging and weed invasion.
- **Establish off stream watering points** for all affected sites on waterways, where required.
- Negotiate with landholders the **fencing (and grazing exclusion)** of unused roadsides and creeklines associated with their properties, and which contain remnants.
- Concentrate **revegetation and weed control** efforts in areas adjacent to streamside reserves.
- **Encourage** retention of fallen timber on all waterways and adjoining remnants.
- **Manage** recreational users of the area to reduce degradation of the area.
- **Revegetate** around remnants to buffer from pasture and link to other remnants.

Pest Plant and Animals

- **Control weeds**, particularly blackberries using water-sensitive herbicide. Preclude chemical residue entering waterbodies.
- Continue ongoing **control of foxes and feral cats** for the protection of threatened species such as Lathams Snipe.
- Actively **weed management** to control and prevent infestation, especially Watsonia and Blackberry.

8) KEY BIODIVERSITY ASSET – RIVERINE FISH COMMUNITY

8A) Introduction – Riverine Fish Community:

Within the Hughes Creek Zone the major species of importance to the Riverine Fish Community are Mountain Galaxias (*Galaxias olidus*), Trout Cod (*Maccullochella macquariensis*), Macquarie Perch (*Macquaria australasia*) and River Blackfish (*Gadopsis marmoratus*). These species have declined considerably since European invasion due to factors such as: Riparian Vegetation removal, in stream habitat removal, sedimentation, Toxins entering the water, altered flow regimes, barriers to fish passage and introduced species.

Riparian vegetation acts as a buffer from surrounding activities and has continuos interactions with the stream. This riparian vegetation also contributes to the in stream habitat such as fallen logs, living roots, leaf matter which can shelter insects as a source of food for fish. The removal of this in stream habitat means that there is less shelter for fish, fewer plants to oxygenate the water and less habitat for food. Sedimentation can occur from runoff from farm dams, bare banks or dirt roads and can be lethal to fish and their eggs at high levels. Sediment can also blanket instream habitat and render it unusable for native fish.

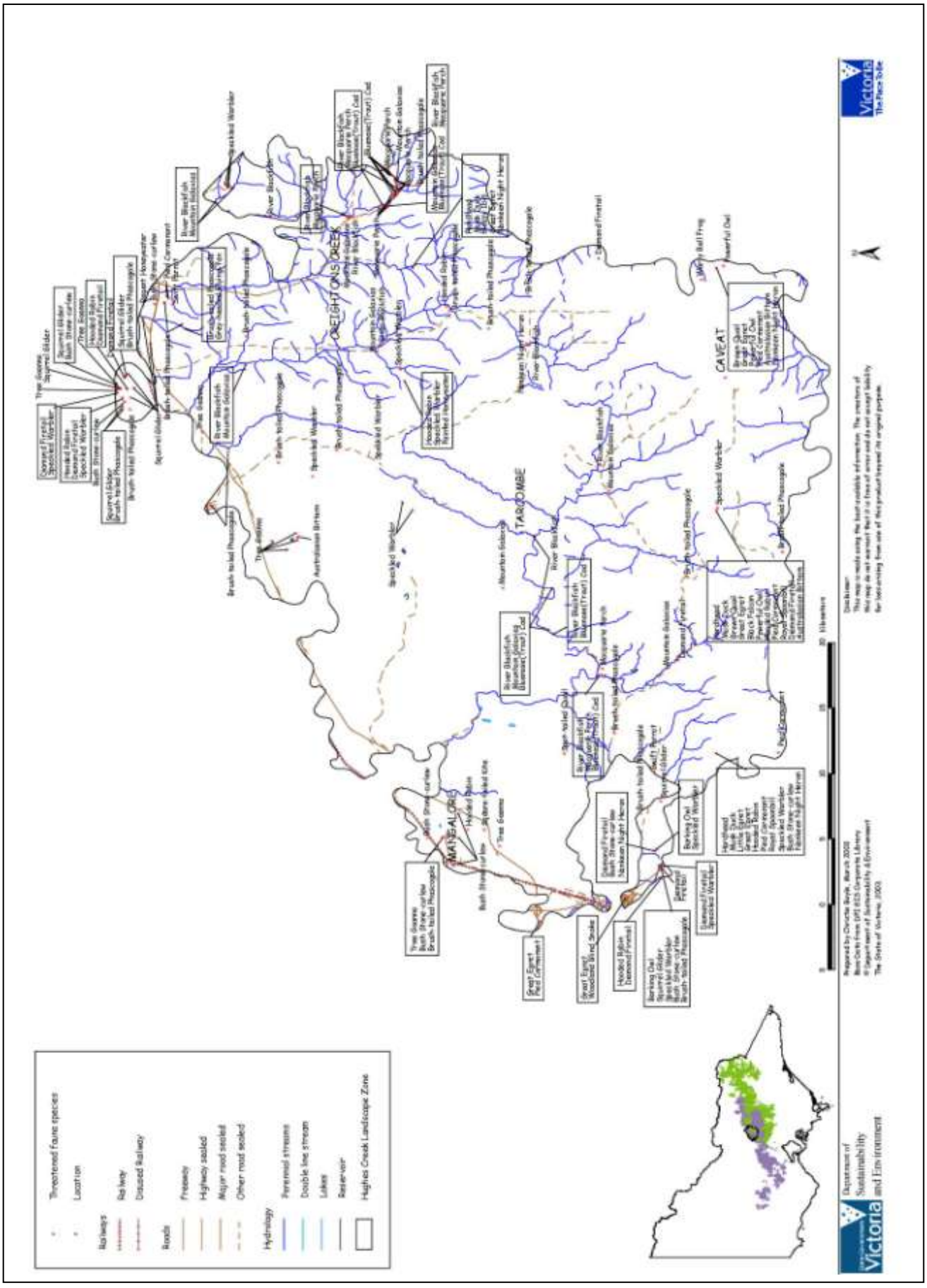
Toxins entering the water can either kill fish directly or can remove the oxygen available to fish. Altering the flow regimes of creeks and rivers can reduce the flow of water during breeding times, change the temperature and chemical composition of the water, and in some cases remove the environmental triggers such as flood events that initiate spawning. Dams and weirs can also act as barriers to fish passage can also prevent fish from reaching their breeding grounds and spawning. There are twelve species of introduced fish in Victorian waterways that either out compete or predate on native fish.

8C) Actions – Riverine Fish Community

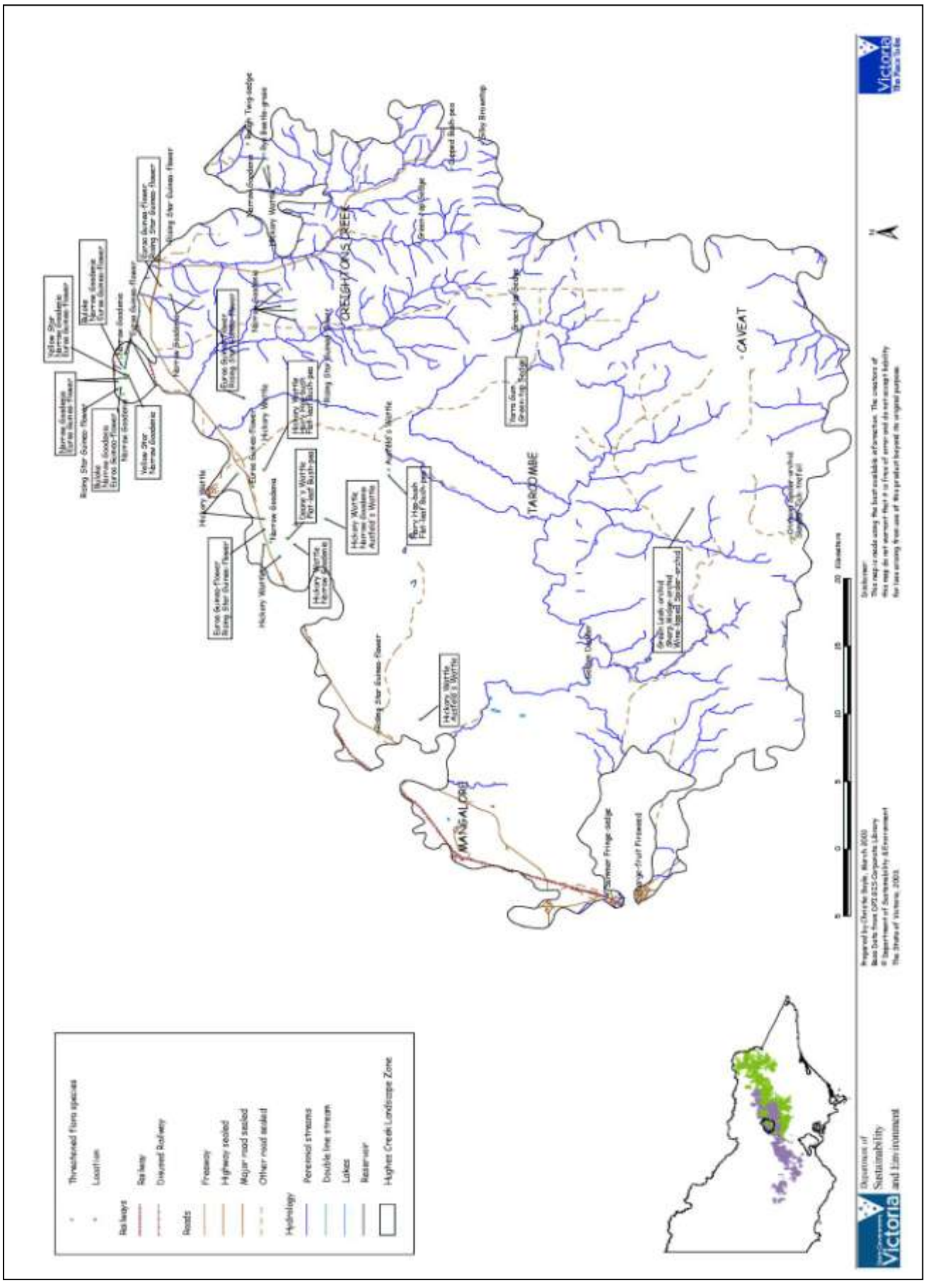
Condition:

- Identify the **threatening processes** at each of the sites where fish have been identified
- Conduct **eradication programs** for introduced fish species such as Carp, Trout (upper reaches) and Redfin (lower reaches) to remove the threats to Mountain Galaxias
- Identify sites for the **release** of native fingerlings
- **Improve riparian vegetation,** through revegetation and weed control to create habitat for both fish and their prey.
- **Remove stock** from grazing banks and put in off line watering troughs to reduce sedimentation
- **Reinstate snags** where they have been removed from creeks and rivers.
- **Educate** and manage recreational users of the waterways to be environmentally conscious.
- Identify important sections of waterways for known fish habitat and focus riparian protection and enhancement in these areas.
- **Control erosion** to reduce sediment instream and reduce the filling of instream deep holes and pools.
- **Construct and Maintain** fish ladders to restrict the movement of introduced fish species such as Trout.
- **Implement** Trout (and other feral species) **irradiation programs** for the protection of fish species such as Mountain Galaxias, Bluenose Cod, MacQuarie Perch, River Blackfish and Growling Grass Frog

8B) Locations of Riverine Fish Communities and other threatened Fauna



9) Locations threatened flora



8.0 FURTHER INFORMATION – PRIORITY SITES

Priority Site Data:
Information on the 1787 priority BAP sites within the Hughes Creek has been derived using the Geographical Information System - Arcview 3.3. It is intended that the priority site information and other information detailed in this plan, will allow groups and staff (ie. extension staff and community groups) to:

- Be pro-active in targeting sites
- Act as a basis for informed management of the site
- Provide a 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
- 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 organisational, agency 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 their 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 (ie. covenant, bush tender)?
- Are there threatened or significant species recorded at the site or nearby?
- What is the priority rating of the site and those near it (ie. Very high, high, medium or low)?
- What is the overarching management recommendation for the site (ie. protect or restore)?
- What are the actions recommended for the site (ie. pest plant management)? (Negotiations need to occur to get the best possible outcome for all involved).
- What are the options available to the landholders to fulfil these actions (ie. fencing incentive)?
- What are the options for joining the site to public land (ie. widening roadsides to provide a corridor/link)?
- Using the Landscape Context Map (Appendix 8), 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 they generally have not been identified as a site in this plan, they form an important element for providing links between the identified sites (especially trees with hollows).

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 actions. The 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 still a number of sites that require Vegetation Quality Assessments and Bird Surveys.

Further Information or To Provide Data:
For clarification of information or to provide further data, please contact Water and Biodiversity Group, Department of Sustainability and Environment, Alexandra on (03) 5772 0200.

9.0 LANDOWNER ASSISTANCE

There is a range of assistance available to 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 Upper Goulburn Broken Region. Also included are some of the programs within the community that will benefit from the information provided in this plan.

LOCAL AREA PLANS	WHOLE FARM PLANS
These Conservation Plans will 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 landowners.

Advice and Information:
Please contact your local Department of Primary Industries/Department of Sustainability and Environment Office, the Goulburn Broken Catchment Management Authority or the Upper Goulburn Landcare Network, 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, ground water management, revegetation and protection of remnant vegetation, threatened species protection and best management practices.

Incentives for On-Ground Works:
There is a range of incentives available for landholders within the Upper Goulburn Broken Region for catchment works; including:

- Environmental incentives to assist with the protection and/or enhancement of remnant vegetation, including wetlands and grasslands
- Whole Farm Planning, to assist with the development of Whole Farm Plans
- Native Grasses Management, area available to fence areas of native grasses to allow strategic grazing management,

For the above points, contact the Department of Primary Industries, Broadford. For more information on Grassland management, contact the Department of Primary Industries, Benalla.

- Waterways Incentives – for on-ground works along rivers and creeks

For the above point, contact the Goulburn Broken Catchment Management Authority, Yea

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 Goulburn Broken Catchment Management Authority, Yea or Benalla office for further information.*

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. *Trust for Nature (Vic) is the managing organisation in regards to Conservation Covenants; visit the website at www.tfn.org.au*

Other Assistance:

- Hughes Creek Catchment Collaborative – Highlands Landcare , Whiteheads Creek landcare , Upper Hughes Creek Landcare and Hughes Creek Landcare. Coordinator :Janet Hagen.
- **Granite Creeks Project**. - Burnt Creek Landcare , Longwood East Landcare , Creightons Creek Landcare and Goram Valley Landcare. Coordinator :Sarah Challis

- Land for Wildlife – a voluntary scheme aiming to encourage and assist landholders to protect and enhance biodiversity values on their properties. *Managed by the Department of Sustainability and Environment – for further information visit internet site at* www.dse.vic.gov.au*.*
- Local Government (Strathbogie, Mitchell and Murrundindi) – managing authority for native vegetation statutory planning requirements and managing authority for some of the Reserves mentioned in this plan.

10.0 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 Hughes Creek Landscape Zone. Where possible, this information will feed in to 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 (eg. 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 accuracy assessment of the Catchments progress, towards meeting the Biodiversity Resource Condition Targets (RCT's).

A wide variety of monitoring actions are listed below. However this does not result in a binding commitment of those organisations (eg. 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 (eg. community groups may be interested in conducting future surveys). Interested persons can contact the Goulburn Broken Catchment Management Authority, Yea, or the Department of Primary Industries and Department of Sustainability and Environment Offices, Alexandra, 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 (eg. 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 – Hughes Creek Landscape Zone

Key Biodiversity Asset	Key indicators for monitoring	Frequency/Intensity
Grassy Forests	Refer to "All Key Biodiversity Sites" below	See below
Grassy Woodlands	Refer to "All Key Biodiversity Sites" below	See below
Herb-rich Foothill Forest	Refer to "All Key Biodiversity Sites" below	See below
Box Ironbark	Refer to "All Key Biodiversity Sites" below	See below
Granitic Hills Outcrops	Refer to "All Key Biodiversity Sites" below	See below
Riparian Systems **Perched Bogs/ Spring Soaks**	Trends in environmental flows and in-stream habitat condition (as measured by ISC) Trends in water quality – Waterwatch program run through Goulburn Valley Water Authority and Local Landcare Groups. 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) Surveying of mean habitat width of waterways in Zone Overlay of on-ground works areas against this plans mapping data	Five yearly* ISC assessments Once yearly as part of EPA monitoring: five yearly as part of ISC: at least 30 sites (GBCMA 2004b) Every 5 years, 30 sites: part of ISC; CAMS inputs Every 5 years, all sites (or in accordance with existing waterways monitoring), aerial photography Once yearly, all sites

All Key Biodiversity sites	Trends in vegetation condition (resurvey the 100 sites using VQA assessments) (this includes threats data)	Every 5 years - 30 sites
	Trends in bird survey data (resurvey the 100 sites using bird survey method)	Every 5 years – 30 sites
	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 (eg. if not already an identified site)	Once yearly, all new information; all sites
	Trends in Focal Species reporting/sightings (eg. population size, age distribution, frequency of records, number of birds/pairs recorded, habitat (eg 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 VROTPop 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 (eg. size of remnants)	Every 5 years; aerial photography
	Overlay of on-ground works areas against this plans mapping data to determine the number of incentives processed and implemented for priority sites for all Key Biodiversity Assets (private land only) Trends in plants of special concern (eg. undertake monitoring of River Swamp Wallaby-grass in the zone to further determine management requirements)	Once yearly, in accordance with incentive mapping and overlaying of on-ground works areas (as per above action) Once; then as required

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12.0 ACKNOWLEDGMENTS

This project is funded as part of the Goulburn Broken Catchment Management Authority Regional Catchment Strategy, in the Upper Goulburn Broken Region and is provided with support and funding from the Australian and Victorian Governments. This project is delivered primarily through partnerships between the Goulburn Broken Catchment Management Authority (GBCMA), Department of Primary Industries (DPI), Department of Sustainability and Environment (DSE), Trust for Nature (Vic) (TfN) and other community bodies. Personnel from these agencies provided generous support and advice during the development of this plan.

We also thank numerous Landholders, Landcare Groups, Local Area Planning Groups, Agency representatives and individuals, who provided generous support, advice, information and assistance. This included, guidance, technical knowledge, attendance at meetings, plan review, provision of literature and survey data, and property access.

Thank-you also to person's who have provided photographs. Photographer credit (names) are included under each photograph throughout the report.

A special acknowledgment to all representatives (current and past) on the Goulburn Broken Biodiversity Action Planning (BAP) Steering Committee. This steering 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). Core committee members are detailed below, along with contributors to BAP in the Goulburn Broken (eg. meeting attendance, trial implementation, and plan development). Thank you to person's whom have attended meetings as invited guest's (names not listed) and provided valuable comment.

BAP Steering Committee Members:

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

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

DSE - Merritt, Bronwyn – Biodiversity Landscape Plan Project Officer (Upper) (past)
Smith, Stephen – Senior Flora and Fauna Officer, DSE (Upper) (current)
Edmonds, Tobi – Threatened Flora Projects Officer, DSE (Lower) (current)
Wilson, (Dr) Jenny – Biodiversity Projects Officer, DSE (Dryland) (current)
Colbourne, Debbie – (as) Flora and Fauna Planner, DSE (Dryland) (past)
Sheahan, Mark – (as) Biodiversity Team Leader, North East, DSE (past)

TFN (Vic) - Robinson, (Dr) Doug – Regional Manager, Goulburn Broken – TfN (Vic) (current)

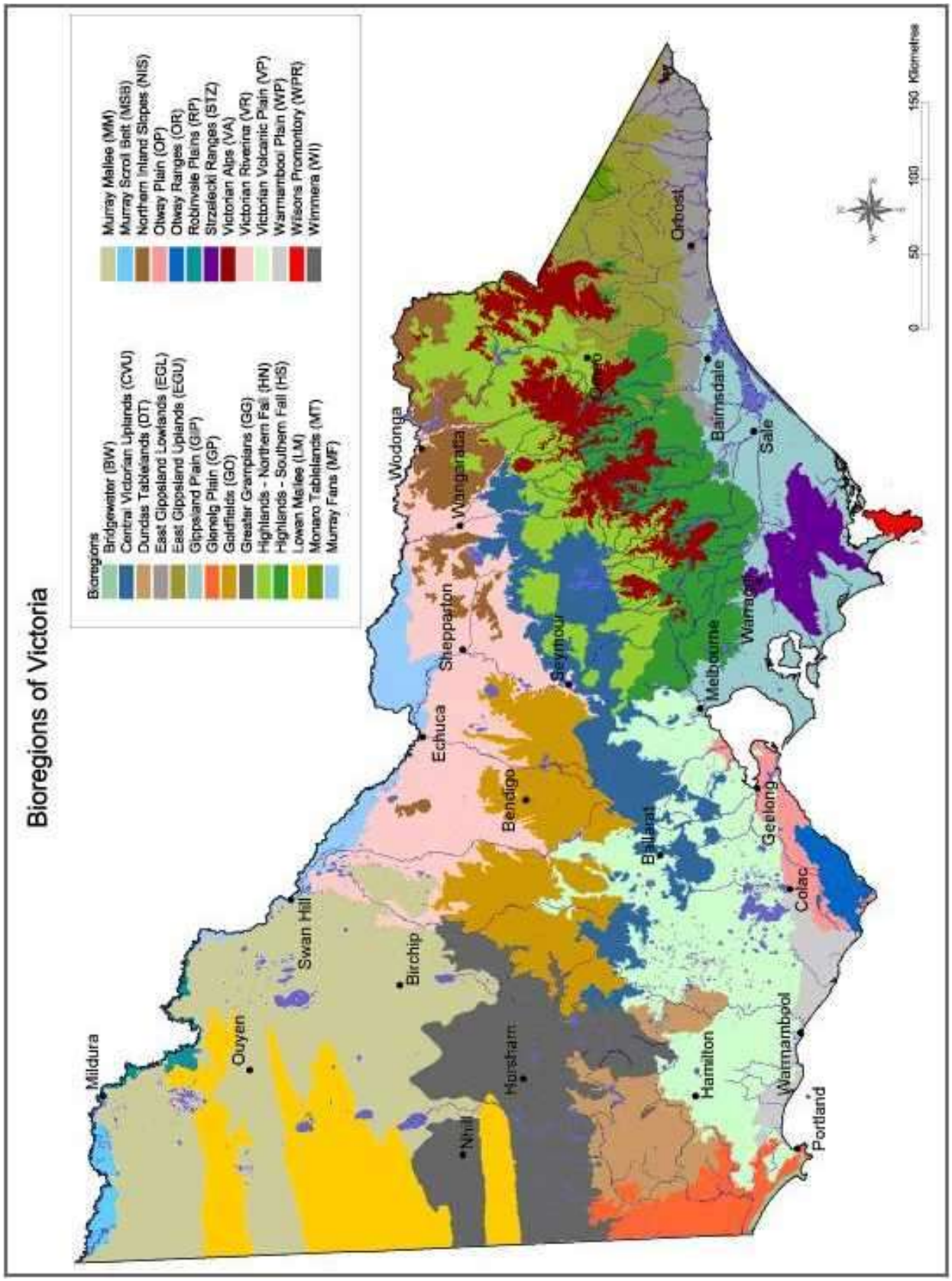
Biodiversity Action Planning Contributors:

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

13.0 APPENDICES

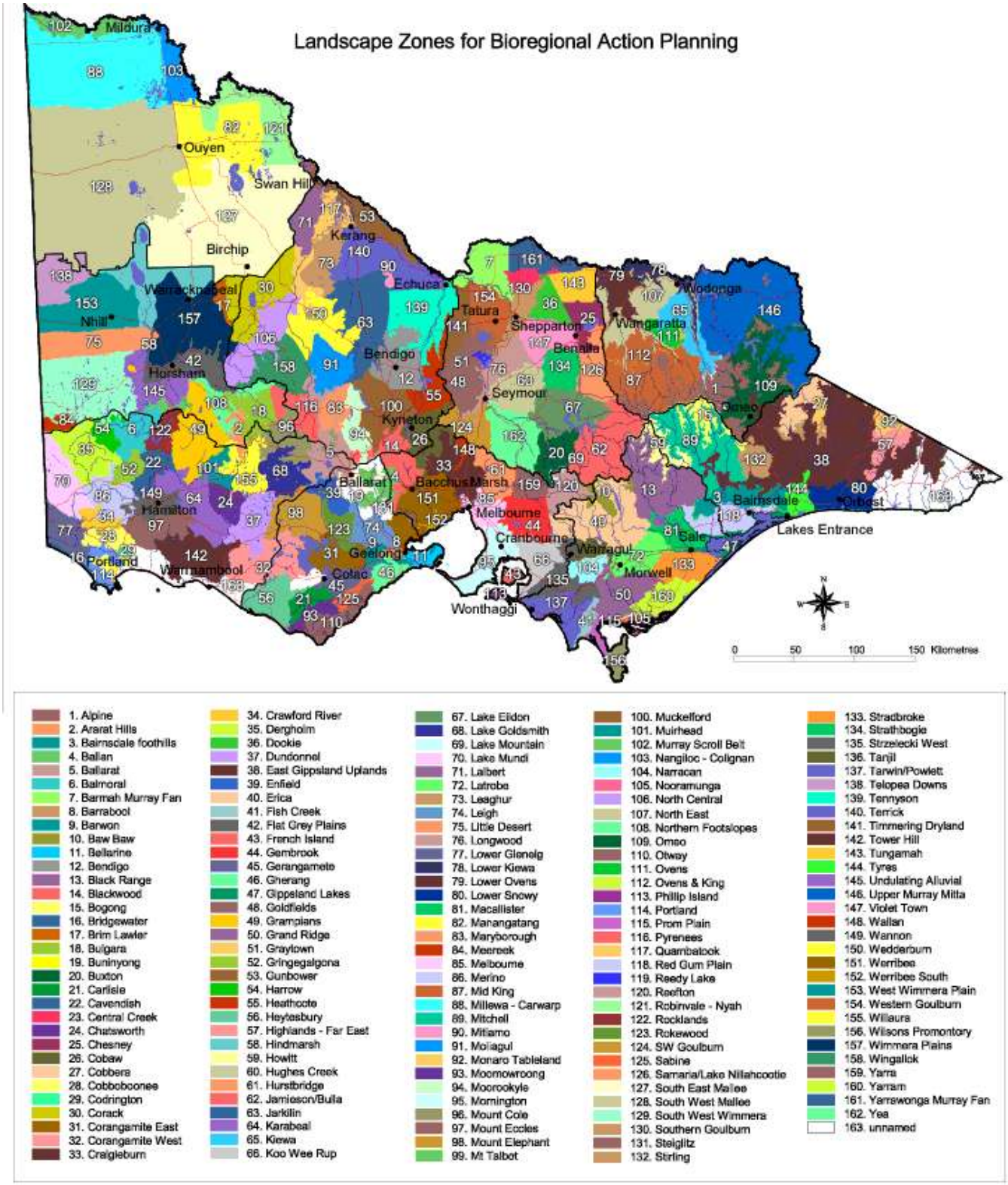
APPENDIX 1 – VICTORIAN BIOREGIONS

Source: www.dse.vic.gov.au



APPENDIX 2 – VICTORIAN LANDSCAPE ZONES

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.

The Goulburn Broken Catchment Management Strategy identifies the following biodiversity resource condition targets for native vegetation in the catchment:

7. 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,
8. Improve the quality of 90% of existing (2003) native vegetation by 10% by 2030,
9. Increase the cover of all endangered and applicable vulnerable Ecological Vegetation Classes to at least 15% of their pre-European vegetation cover by 2030,
10. Increase 2002 conservation status of 80% threatened flora and 60% threatened fauna by 2030,
11. Maintain the extent of all wetland types at 2003 levels where the extent (area and number) has declined since European settlement, and
12. 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 are driven by the conservation significance of the biodiversity asset. Regional investments in biodiversity conservation in the Goulburn Broken Catchment are driven by the following goals (in order of priority):

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

APPENDIX 4 – THREATENED FLORA

List of threatened flora and their conservation status in the Hughes Creek Landscape Zone (NRE 2002e). Table from FIS 2005.

Latin Name	Common Name	Australian Status	Victorian Status	FFG Act#	Recovery Plan	Action Statement	BNA Unassessed	Species No.
Allocasuarina luehmannii	Buloke			L			Un	5083
Arachnorchis concolor	Crimson Spider-orchid	Vul	e	L		143	Un	74
Pultenaea vrolandii	Cupped Bush-pea		r				Un	3694
Acacia deanei	Deane's Wattle		r				Un	5083
Hibbertia humifusa erigens	Euroa Guinea-flower	Vul	v	L			Un	1513
Pultenaea platyphylla	Flat-leaf Bush-pea		r				Un	1367
Cuscuta tasmanica	Golden Dodder		k				Un	5083
Prasophyllum lindleyanum	Green Leek-orchid		v	X			Un	894
Carex chlorantha	Green-top Sedge		k				Un	74
Dodonaea boroniifolia	Hairy Hop-bush		r				Un	74
Acacia penninervis penninervis	Hickory Wattle		r				Un	1513
Senecio macrocarpus	Large-fruit Fireweed	Vul	e	L		68	Un	4347
Goodenia macbarronii	Narrow Goodenia	Vul	v	L		72	Un	26
Hibbertia humifusa	Rising Star Guinea-flower		r				Un	1670
Baumea planifolia	Rough Twig-sedge		k				Un	2865
Tripogon loliiformis	Rye Beetle-grass		r				Un	4425
Corunastylis despectans	Sharp Midge-orchid						Un	74
Eulalia aurea	Silky Browntop		r				Un	74
Desmodium varians	Slender Tick-trefoil		r				Un	1670
Fimbristylis aestivalis	Summer Fringe-sedge		k				Un	2865
Arachnorchis oenochila	Wine-lipped Spider-orchid		k				Un	1087
Eucalyptus yarraensis	Yarra Gum		v	X			Un	1513
Hypoxis vaginata var. brevistigmata	Yellow Star		k				Un	1326

* 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 5 – THREATENED FAUNA

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

Latin Name	Common Name	Australian Status	Victorian Status	FFG Act#	Recovery Plan	Action Statement	BNA Unassessed	Species No.
Botaurus poiciloptilus	Australasian Bittern		EN				Un	197
Ninox connivens connivens	Barking Owl		EN	L			Un	246
Falco subniger	Black Falcon		VU				Un	238
Coturnix ypsilophora australis	Brown Quail		NT				Un	10
Phascogale tapoatafa tapoatafa	Brush-tailed Phascogale		VU	L		79		1017
Burhinus grallarius	Bush Stone-curlew		EN	L		78	Un	174
Stagonopleura guttata	Diamond Firetail		VU				Un	652
Plegadis falcinellus	Glossy Ibis		NT				Un	178
Ardea alba	Great Egret		VU	L			Un	187
Pteropus poliocephalus	Grey-headed Flying-	Vul	VU				Un	1280
Litoria raniformis	Growling Grass Frog	Vul	EN				Un	3207
Aythya australis	Hardhead		VU				Un	215
Melanodryas cucullata cucullata	Hooded Robin		NT				Un	385
Varanus varius	Lace Goanna		VU				Un	2283
Egretta garzetta nigripes	Little Egret		EN				Un	185
Macquaria australasica	Macquarie Perch	End	EN	L				4096
Galaxias olidus	Mountain Galaxias		DD	L			Un	4036
Biziura lobata	Musk Duck		VU				Un	217
Nycticorax caledonicus hillii	Nankeen Night Heron		NT				Un	192
Grantiella picta	Painted Honeyeater		VU	L			Un	598
Phalacrocorax varius	Pied Cormorant		NT				Un	99
Ninox strenua	Powerful Owl		VU	L		92		248
Xanthomyza phrygia	Regent Honeyeater	End	CR	L	Y	41	Un	603
Gadopsis marmoratus	River Blackfish		CR					4127
Platalea regia	Royal Spoonbill		VU				Un	181
Chthonicola sagittata	Speckled Warbler		VU				Un	504
Dasyurus maculatus maculatus	Spot-tailed Quoll	Vul	EN	L		15	Un	1008
Lophoictinia isura	Square-tailed Kite		VU					230
Petaurus norfolcensis	Squirrel Glider		EN	L		166	Un	1137
Lathamus discolor	Swift Parrot	End	EN	L	Y	169	Un	309
Maccullochella macquariensis	Trout Cod	End	CR	L	Y	38		4093
Ramphotyphlops proximus	Woodland Blind Snake		NT				Un	2603

* 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 Analaysis) Assessment: Un = Unassessed
* Species Number: State identification number/code attributed to individual species.

APPENDIX 6 – 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 (eg. more than 100 sites required survey), the minimum priority status was applied. *LCM refers to the Landscape Context Model.

Conservation 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 7 –VEGETATION QUALITY ANALYSIS (VQA) ASSESSMENT FORM

There are several survey forms for vegetation types in the Hughes Creek Landscape Zone (eg. grassy woodlands or forests). The example below is the dry forests sheet. Refer to DSE 2004 for further information on assessments. Recording of site information and other factors (eg. threatening processes) was also recorded at each of the surveyed sites.

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 3 OR 4 or *more* boxes for ticked WOODLANDS 5 or *more* boxes ticked for FORESTS 4	
		adequate	COVER *more than* 75% AND *less than* 4 boxes for ticked WOODLANDS *less than* 5 boxes ticked for FORESTS 4 OR 4 or *more* boxes for ticked WOODLANDS 5 or *more* boxes ticked for FORESTS 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	

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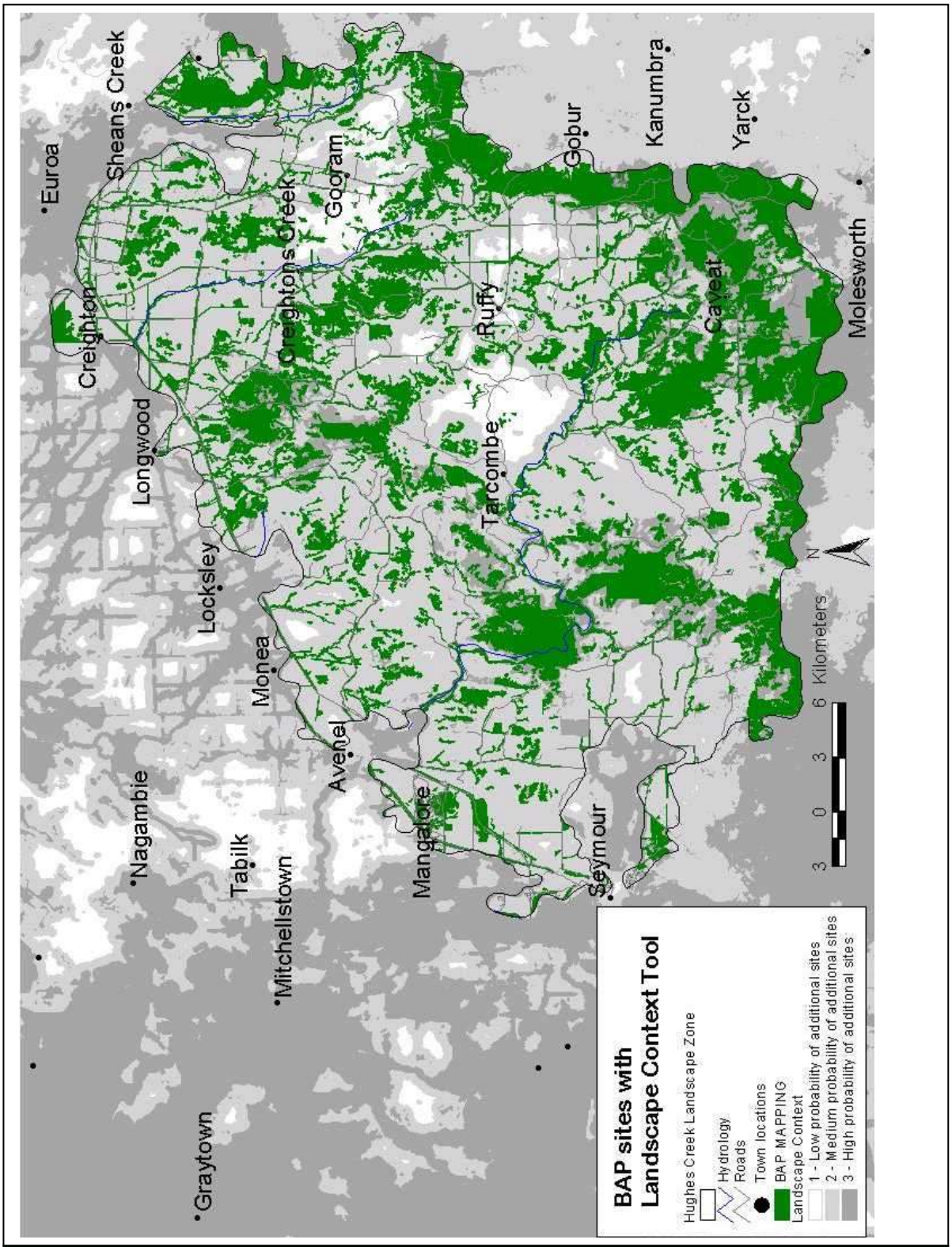
Assessment of Habitat Quality (total)

APPENDIX 8 – LANDSCAPE CONTEXT MODEL

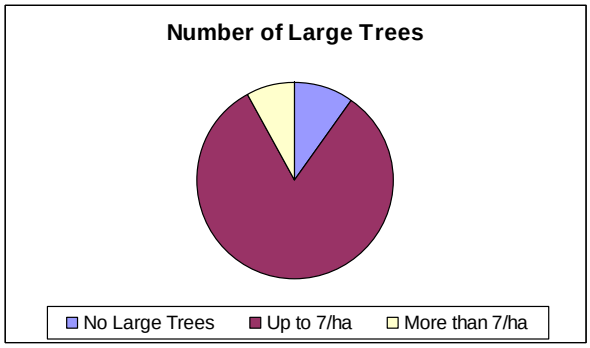
The Landscape Context Model Mapping is now also contained on the BAP CD (Version 1, January 2008)* or on the GBCMA website (www.gbcma.vic.gov.au). This mapping can be used in conjunction with the BAP mapping and this Conservation Plan.

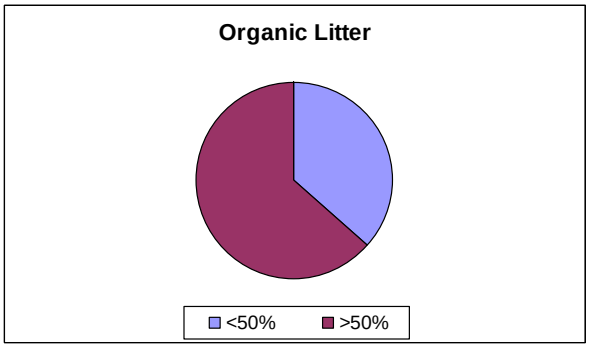


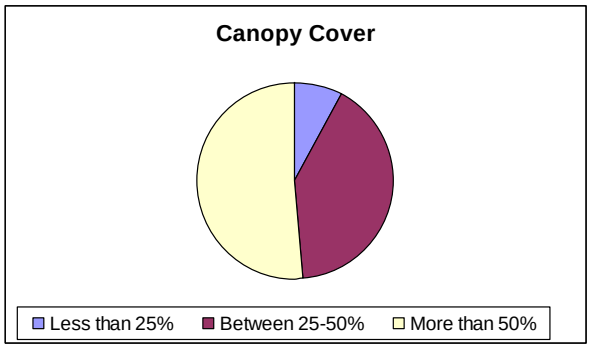
HUGHES CREEK LANDSCAPE ZONE LANDSCAPE CONTEXT MODEL

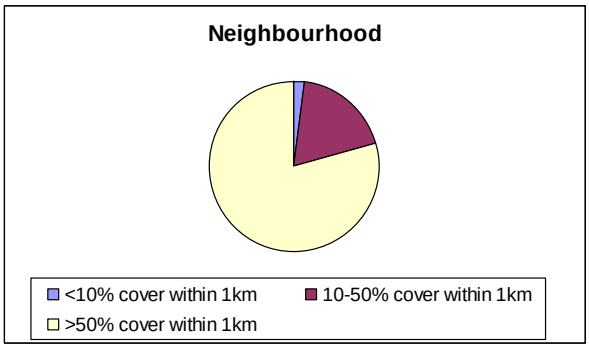
* To obtain copies of the BAP CD (Version 1, January 2008), or for further information on BAP, please contact bap@gbcma.vic.gov.au OR the Biodiversity Action Planning Officer, Department of Sustainability and Environment (DSE) Benalla at Ph: (03) 57 611 611

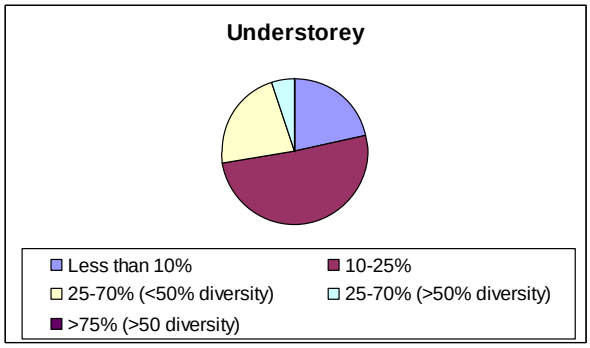
APPENDIX 9 – VEGETATION QUALITY ASSESSMENT RESULTS

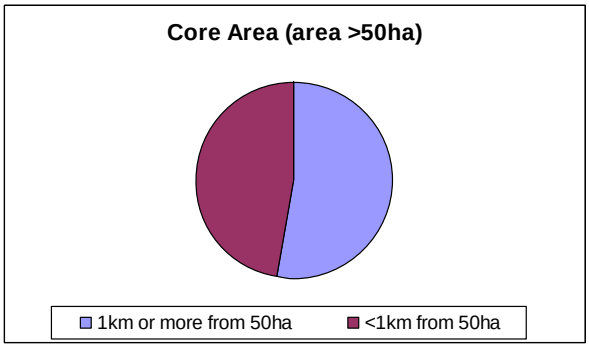


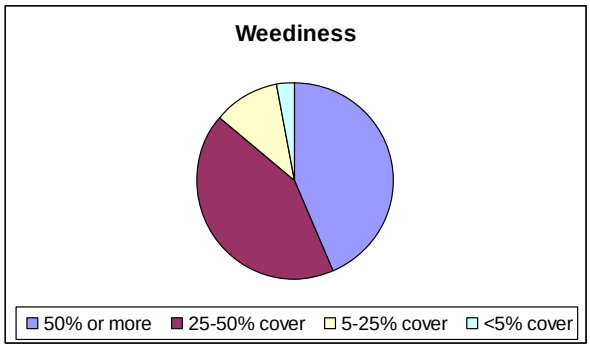


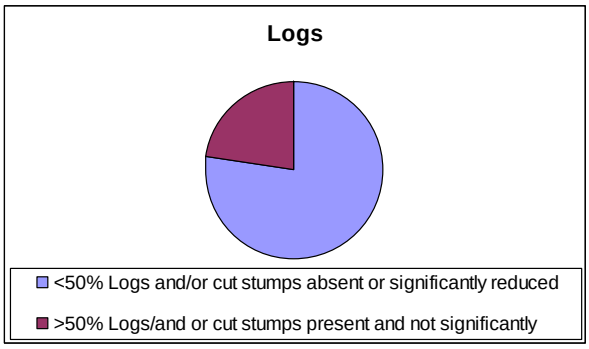


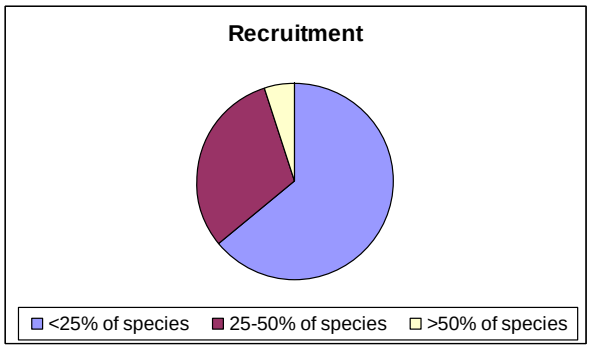


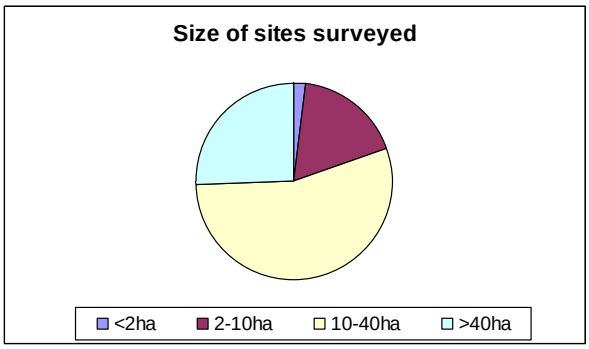












APPENDIX 10 – BIRD LIST

List includes birds surveyed during 100 site (20 minute) surveys. It is not intended to represent the entire bird population in the Hughes Creek Landscape Zone.

Common Name	Scientific Name
Australian Raven	*Corvus coronoides*
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Brown Thornbill	*Acanthiza pusilla*
Brown Treecreeper	*Climacteris picumnus*
Crimson Rosella	*Platycercus elegans*
Diamond Firetail	*Stagonopleura bella*
Eastern Rosella	*Platycercus eximius*
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Eastern Yellow Robin	*Eopsaltria australis*
Flame Robin	*Petroica phoenicea*
Galah	*Cacatua roseicapilla*
Gang Gang Cockatoo	*Callocephalon fimbriatum*
Grey Currawong	*Strepera versicolor*
Grey Fantail	*Rhipidura fuliginosa*
Grey Shrike-thrush	*Colluricincla harmonica*
Golden Whistler	*Pachycephala pectoralis*
Jacky Winter	*Microeca fascinans*
Laughing Kookaburra	*Dacelo novaeguineae*
Lathams Snipe	*Gallinago hardwickii*
Little Eagle	*Hieraaetus morphnoides*
Long-billed Corella	*Cacatua tenuirostris*
Magpie	*Gymnorhina tibicen*
Magpie Lark	*Grallina cyanoleua*
Maked Lapwing	*Vanellus miles*
New Holland Honeyeater	*Phylidonyris novaehollandiae*
Noisy Miner	*Manorina melanocephala*
Pacific Black Duck	*Anas superciliosa*
Pied Currawong	*Strepera graculina*
Red-browed Finch	*Neochmia temporalis*
Red-rumped Parrot	*Psephotus haematonotus*
Red Wattlebird	*Anthochaera carunculata*
Richards Pipit	*Anthus novaeseelandiae*
Rufous Whistler	*Pachycephala rufiventris*

Common Name	Scientific Name
Scarlet Robin	*Petroica multicolor*
Silvereye	Zosterops lateralis
Spotted Pardalote	*Pardalotus punctatus*
Striated Pardalote	*Pardalotus striatus*
Striated Thornbill	*Acanthiza lineata*
Sulphur Crested Cockatoo	*Cacatua galerita*
Superb Fairy Wren	*Malurus cyaneus*
Varied Sittella	*Daphoenositta chrysoptera*
Welcome Swallow	*Hirundo neoxena*
Wedge-tailed Eagle	*Aquila audax*
White-browed Scrubwren	*Sericornis frontalis*
White-eared Honeyeater	*Lichenostomus leucotis*
White-faced Heron	*Egretta novaehollandiae*
White-naped Honeyeater	*Melithreptus lunatus*
White-plumed Honeyeater	*Lichenostomus penicillatus*
White-throated Treecreeper	*Cormobates leucophaeus*
White-winged Chough	*Corcorax melanorhamphos*
Willie Wagtail	*Rhipidura leucophrys*
Wood Duck	*Chenonetta jubata*
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*
Yellow Thornbill	*Acanthiza nana*

APPENDIX 11 – PRIORITY SITE INFORMATION (MAPPING):

Mapping and accompanying information for each of the 'priority BAP sites' is now 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 the 'BAP Mapping' 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',
11. '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.

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