



Riparian and Instream Native Flora and Fauna of the Goulburn Broken

A Background Paper for the
Goulburn Broken Riverine Health Strategy



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Acronyms

ARI	Arthur Rylah Institute
BMP	Best Management Practice
CAMBA	China-Australia Migratory Bird Agreement
EMG	Environmental Management Grant
EMS	Environmental Management Systems
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act
EVC	Ecological Vegetation Community
FFG Act	Flora and Fauna Guarantee Act
GBCMA	Goulburn Broken Catchment Management Authority
G-MW	Goulburn Murray Water
ISC	Index of Stream Condition
JAMBA	Japan-Australia Migratory Bird Agreement
MDBC	Murray Darling Basin Commission
NRE	Department of Natural Resources and Environment
NVR	Native Vegetation Retention
RCS	Regional Catchment Strategy
SIRLWMP	Shepparton Irrigation Region Land and Water Management Plan
VROTS	Victorian Rare or Threatened Species
WFP	Whole Farm Planning
WMIP	Waterway Management Implementation Plan

1 Introduction

1.1 Why a Background Paper?

It is challenging to separate the components of catchment issues for bettering understanding while simultaneously integrating them to achieve efficient management. This Paper attempts to identify riparian and instream native flora and fauna issues to ensure they are considered in all works and planning that might affect them.

This Background Paper has been produced to provide information for the Goulburn Broken Riverine Health Strategy. The Riverine Health Strategy (in prep.) presents the strategic directions affecting the Catchment's riverine resources and encompasses wetlands, flows, floodplain, in-stream and riparian waterway management and recreation. The Biodiversity Integration Strategy (in prep.) also uses information from this Background Paper. These strategies in turn inform the overarching Goulburn Broken Regional Catchment Strategy.

The emphasis of this Paper, as with all components supporting the RCS, is to document information in a way that can be easily built on. This paper is a 'work in progress'. We have not gone to any great lengths to ensure the accuracy and comprehensiveness of the information. Rather, readily available information has been gathered to ensure timeliness with informing other documents.

1.2 Scope: What is riparian and instream native flora and fauna?

Rivers and their associated floodplains support a wide range of native flora and fauna, many of which are now rare or threatened. The distribution, abundance and health of these species and communities are closely associated with the condition of the riverine environment.

The Victorian River Health Strategy (2002) defines a river, stream or natural waterway as including the:

- Channel,
- riparian zone, which includes the area of land that adjoins, regularly influences, or is influenced by the river,
- regularly wetted floodplain and any associated floodplain wetlands, and the
- estuary or terminal lake.

For the purposes of this discussion paper we define riparian and in-stream native flora and fauna as any flora and fauna associated with or wholly dependent on the river, stream or natural waterway environment.

It should be noted that some flora species may be found both in the riparian environment and in 'fully' terrestrial environments (eg. River Red Gum) and some species of mobile fauna might also occupy riparian and terrestrial environments at different times (eg. woodland birds). This Paper refers to those species and communities of both flora and fauna that spend some or all of their life cycle within the riparian environment, recognising that these species may also be considered in other strategies that focus on terrestrial environments.

2 Legislation and Policy

There are numerous federal, State and regional legislation and policies that relate to the protection and management of flora and fauna and their associated riparian and aquatic environments in Australia. Only the most relevant legislation and policy and a broad summary of their purpose is listed below. This list is not exhaustive.

2.1 Commonwealth

Legislation

Environmental Protection and Biodiversity Conservation Act (1999)

This Act promotes the conservation of biodiversity by providing strong protection for species, communities and protected areas. Actions that are likely to have significant impact on matters of national environmental significance are subject to a rigorous assessment and approval process. An action includes a project development, undertaking or an activity or series of activities. Matters of national environmental significance identified in the act relevant to wetlands of the Goulburn Broken include:

- Ramsar Wetlands;
- Nationally threatened species and ecological communities; and
- Migratory species.

Policies

JAMBA (1974) and CAMBA (1986)

The Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA) are bilateral agreements which expect actions from designated countries for the protection of migratory birds, birds in danger of extinction and their environments.

Review of the National Strategy for the Conservation of Australia's Biological Diversity (2001)

The aim of this Strategy (produced in 1996) is to bridge the gap between current activities and those measures necessary to ensure the effective identification, conservation and ecologically sustainable use of Australia's biological diversity. This strategy addresses conservation of biological diversity across Australia and its integration with natural resource management, through the management of threatening processes, improving existing knowledge, involving the community and ensuring linkages with international agreements.

Convention on the Conservation of Migratory Species of Wild Animals (called the Bonn Convention).

Asia-Pacific Migratory Waterbird Conservation Strategy (2001 – 2005)

National Strategy for the Conservation of Australia's Biodiversity, 1996.

2.2 Murray Darling Basin

Policies

MDBC Draft Native Fish Strategy for the Murray-Darling Basin 2002-2012

The Draft Native Fish Strategy for the Murray-Darling Basin 2002-2012 has been released for public comment. According to the MDBC, 'this strategy seeks to initiate short, medium and long-term actions for rehabilitating native fish populations back to 60 percent of their estimated pre-European settlements levels after 50 years'.

2.3 Victoria

Legislation

Flora and Fauna Guarantee Act (1988)

Provides a framework and management approach for the promotion and conservation of Victoria's biodiversity, the sustainable use of flora and fauna across the State and the management of potentially threatening processes. Under this Act key species, communities and potentially threatening processes are listed and an action statement for conservation and/or management must be prepared.

Fisheries Act (1995)

Provides a framework for the conservation, management, development and use of Victoria's fisheries, aquaculture industries and associated aquatic biological resources in an efficient, effective and ecologically sustainable manner and to protect and conserve fisheries resources, habitats and ecosystems.

Policies

Victoria's Biodiversity Strategy (1997)

Outlines the importance of biodiversity in Victoria and has five main goals as follows:

- To ensure there is a reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation leading to a net gain.
- To ensure ecological processes and the biodiversity dependent upon terrestrial, freshwater and marine environments are maintained and where necessary restored.
- The present diversity of species and ecological communities and their viability is maintained or improved across each bioregion.
- There is no further preventable decline in the viability of any rare species or of any rare ecological community.
- There is an increase in the viability of threatened species and the extent and quality of threatened ecological communities.

Victorian Riverine Health Strategy (2002)

Provides the framework in which the Government and community will make decisions on the management and restoration of rivers and sets Statewide targets for river restoration including targets for freshwater-dependent focal species, native fish and riparian environments.

There is numerous other legislation and policy at regional, State and national levels relevant to the conservation of riparian and instream aquatic flora and fauna. Many of these relate to the management of the habitat that these species occupy and are listed in detail in the Goulburn Broken Riverine Health Strategy (2002 in prep.) and the Goulburn Broken Wetlands Directions Paper (2002).

3. Assets and Threats

3.1 Riparian and instream native flora and fauna in the Goulburn Broken

A wide range of native flora and fauna that occur within the Goulburn Broken Catchment rely on aquatic habitats, either directly or indirectly. A complete list of all taxa can be found in the Appendices of the ARI Report *Native Aquatic and Riparian Flora and Fauna Resources Paper* (2002).

Some taxonomic groups such as fish require water throughout their life cycle; some may use aquatic areas for a specific stage of their life cycle such as birds or invertebrates, while others may require aquatic environments for resources such as food or as a corridor for movement. Many species of riparian and aquatic flora and fauna have declined considerably in the catchment and are recognised as threatened at the State or national level.

Figure 1 shows what proportion of all Victorian Rare and Threatened Species (VROTS) in the State that threatened riparian and instream flora and fauna in the Goulburn Broken catchment represent. Tables 1 and 2 show the number of each category of flora and fauna in the Goulburn Broken Catchment that are wholly or partly dependant on aquatic and riparian environments.

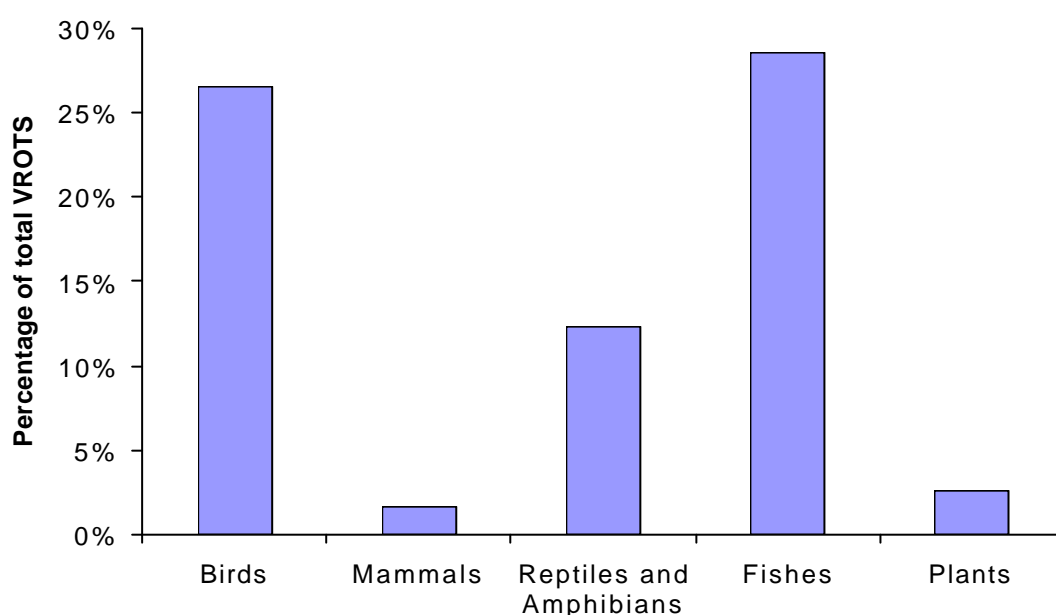


Figure 1. Proportion of all Victorian Rare or Threatened Species (VROTS) in the State that taxa dependent on riparian and instream habitat in the Goulburn Broken represent.

Fauna wholly or partly dependent on aquatic or riparian environments.	Number of aquatic or riparian species in the Goulburn Broken	Goulburn Broken species that are threatened in Victoria	Goulburn Broken species that are FFG / EPBC listed	Total number of all taxa in the Goulburn Broken
Birds	85	25	6/0	281
Reptiles & Amphibians	23	7	3/2	81
Fish	18	11	8/3	18
Mammals	3 (+46 occasional)	1	0 (+7 occasional)	51
TOTAL	129 (+46)	44	17 (+7 occasional) / 5	431

Table 1. Vertebrate fauna wholly or partly dependent on aquatic environments in the Goulburn Broken Catchment.

Habit	Number of Goulburn Broken species	Goulburn Broken species threatened in Victoria	%
Obligate Lacustrine (found primarily on lakes edge)	1	1	100
Obligate Aquatic (totally aquatic)	19	0	0
Riparian Obligate Aquatic	1	1	100
Riparian Wetland Obligate Aquatic	1	1	100
Riparian Obligate (always in riparian zone)	16	5	32
Riparian Wetland Amphibious	3	2	67
Riparian Amphibious	8	4	50
Amphibious (both in and out of water)	91	18	20
Wetland Amphibious	32	3	1
Alpine bog – may include sup-alpine bog.	16	4	25
TOTAL	188	39	21%

Table 2. Flora found in riparian and instream environments in the Goulburn Broken catchment.

3.1.1 Birds

A total of 85 bird species which have some association with water have been recorded within the Goulburn Broken catchment, of which one, the Mallard (*Anas platyrhynchos*), is introduced. Twenty-five of these species are recognised as threatened within Victoria including six which are listed under the *Flora and Fauna Guarantee Act 1988* (Table 3). 89% of these birds are considered true waterbirds, with the remainder either being land birds found mainly in or near water or ones which rely heavily on aquatic habitats for resources such as food. Rivers and their banks are important habitats specifically for the Azure Kingfisher (*Alcedo azurea*), the Darter (*Anhinga melanogaster*) and the Dusky Moorhen (*Gallinula ventralis*).

Fifteen species are listed on two international treaties, the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA). These include the following threatened species; Great Egret (*Ardea alba*), the White-bellied Sea-eagle (*Haliaeetus leucogaster*), the Glossy Ibis (*Plegadis falcinellus*), Painted Snipe (*Rostratula benghalensis*) and the Caspian Tern (*Sterna caspia*).

3.1.2 Reptiles and Amphibians

There are 23 species of reptiles and amphibians that are dependent upon aquatic environments within the Goulburn-Broken Catchment; the majority of which occur in both riverine and wetland environments. Seven of these species are categorised as threatened in Victoria and those listed under the FFG and EPBC Acts are presented in Table 3.

3.1.3 Fish

There are 18 native and nine introduced fish species that occur within the Goulburn-Broken Catchment. Those listed under the FFG and EPBC Acts are listed in Table 3.

3.1.4 Mammals

Only three species of mammal recorded within the Goulburn Broken Catchment are considered water dependent; the Water Rat (*Hydromys chrysogaster*), Platypus (*Ornithorhynchus anatinus*) and one bat species the Southern Myotis (*Myotis macropus*). There are a further 28 species which may occasionally or regularly occur in riparian habitats. Southern Myotis, which is recognised as threatened in Victoria forages exclusively over water, preying on aquatic insects and small fish. While the species usually roosts in caves, it can use tree hollows including within large River Red Gums. Those species listed under the FFG and EPBC Acts are presented below in Table 3.

Taxa	FFG Listed (Victorian Status)	EPBC
Birds		
Great Egret (<i>Ardea alba</i>)	L (endangered)	-
Intermediate Egret (<i>Ardea intermedia</i>)	L (critically endangered)	-
Brolga (<i>Grus rubicunda</i>)	L (vulnerable)	-
White-bellied Sea-eagle (<i>Haliaeetus leucogaster</i>)	L (endangered)	-
Blue-billed Duck (<i>Oxyura australis</i>)	L (vulnerable)	-
Freckled Duck (<i>Stictonetta naevosa</i>)	L (endangered)	-
Reptiles and Amphibians		
Carpet Python (<i>Morelia spilota metcalfei</i>)	L (endangered)	-
Giant Bullfrog (<i>Limnodynastes interioris</i>)	L (critically endangered)	-
Spotted Tree Frog (<i>Litoria spenceri</i>)	L (critically endangered)	Endangered
Warty Bell Frog (<i>Litoria reniformis</i>)	- (vulnerable)	Vulnerable
Fish		
Silver Perch (<i>Bidyanus bidyanus</i>)	L (critically endangered)	-
Barred Galaxias (<i>Galaxias fuscus</i>)	L (critically endangered)	Endangered
Trout Cod (<i>Maccullochella macquariensis</i>)	L (critically endangered)	Endangered
Murray Cod (<i>Maccullochella peelii peelii</i>)	L (vulnerable)	-
Macquarie Perch (<i>Macquaria australasica</i>)	L (endangered)	Endangered
Murray Rainbowfish (<i>Melanotaenia fluviatilis</i>)	L (depleted)	-
Non-speckled Hardyhead (<i>Craterocephalus stercusmuscarum fulvus</i>)	L (endangered)	-
Freshwater Catfish (<i>Tandanus tandanus</i>)	L (vulnerable)	-
Mammals		
Mountain Pygmy -possum (<i>Burramys parvus</i>)	L (endangered)	Endangered
Spot-tailed Quoll (<i>Dasyurus maculatus</i>)	L (endangered)	Vulnerable
Leadbeater's Possum (<i>Gymnobelideus leadbeateri</i>)	L (endangered)	Endangered
Common Bent-wing Bat (<i>Miniopterus schreibersii</i>)	L (vulnerable)	-
Squirrel Glider (<i>Petaurus norfolcensis</i>)	L (endangered)	-
Brush-tailed Phascogale (<i>Phascogale topoata</i>)	L (vulnerable)	-
Eastern Horseshoe Bat (<i>Rhinolophus megaphyllus</i>)	L (vulnerable)	-

Table 3. Aquatic and riparian vertebrate taxa listed under the FFG and EPBC Acts in the Goulburn Broken.

3.1.5 Invertebrates

There are a vast range of invertebrates that inhabit riverine environments in the Catchment and are likely to constitute the far majority of all animal species. However due to the limited number of invertebrate surveys we are unaware of the total number of species associated with aquatic environments or in the catchment. Available data shows there are 141 species that have been identified in the Goulburn Broken Catchment based on museum records. These represent a small fraction of the total number of species in the Catchment, many of which are likely to be associated with riverine environments.

3.1.6 Flora Species

There are 188 species of native vascular plants variously dependent upon aquatic environments within the Goulburn-Broken Catchment. Thirty nine species (21%) are considered threatened. Seven of these are listed under the *Flora and Fauna Guarantee Act 1988*. Eight species (including four listed under the FFG) are also listed federally as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*.

Amphibious species

Ninety one species of flora (48%) are regarded as amphibious. These species, although still dependent on water for much of their life cycle are capable of surviving dry periods. The typical substrate of amphibious species is mud.

Juncus ingens, the rare *Rorippa eustylis* and endangered *Panicum queenslandicum* are restricted to riparian wetlands, whereas *Carex chlorantha*, *Cyperus bifax*, *C. victoriensis*, *Eulalia aurea* (all threatened) and *Cyperus difformis*, *C. pygmaeus*, *Myriophyllum papillosum* and *Schoenoplectus tabernaemontani*. occur in broader riparian habitats. Thirty two species (17%) are found only in wetlands. Representative genera include *Eleocharis*, *Marsilea* and *Ranunculus*. Twenty percent of amphibious species are threatened.

Non-amphibious species

The next largest group is those species that are found only in the aquatic environment (19 species, 10% of taxa). *Azolla*, *Lemna*, *Triglochin*, *Typha*, and *Vallisneria* are represented by more than one species. Interestingly, this is the only habitat group that does not contain a threatened taxon.

Sixteen species are only found in the riparian zone. Half of these are trees and shrubs including the myrtaceous taxa *Callistemon sieberi*, *Eucalyptus crenulata* (nationally endangered), and *Leptospermum* spp., and *Acacia pendula* (endangered), *Lomatia myricoides* and *Rapanea howittiana*.

Three threatened species each had their own unique classification: *Melaleuca halmaturorum* ssp. *halmaturorum* (vulnerable) was restricted to lacustrine (lake) environments; *Hydrilla verticillata* (rare) was considered a riparian obligate aquatic, and *Brasenia schreberi* (nationally rare and endangered in Victoria) was designated as a riparian wetland obligate aquatic.

The final group of 16 species included those taxa restricted to alpine and sub-alpine bogs. *Baeckea*, *Juncus* and *Richea* are characteristic genera.

3.2 Riparian and instream habitat in the Catchment

3.2.1 Rivers

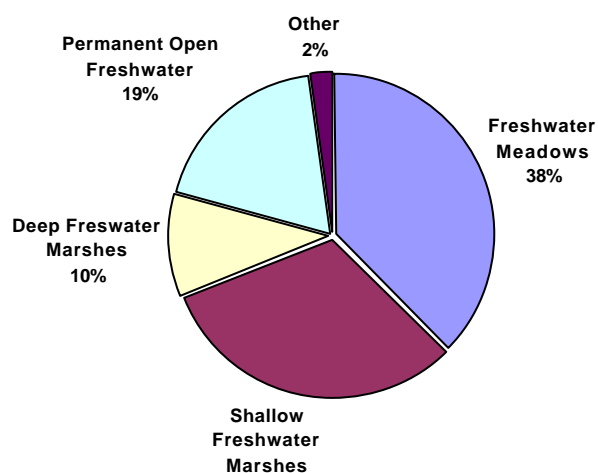
There are approximately 10,000km of rivers in the catchment of which three are declared Heritage rivers, the Goulburn River below Eildon, the Big River and the Howqua River. Some 30% of the Catchment's streams are in good condition as measured by the Index of Stream Condition (see below).

Parameter	Good or excellent condition	
	Goulburn	Broken
Stream length	11-30%	<10%
Streamside zone	10-39%	1-9%
Physical form	10-39%	10-39%

The recent review (2000) of licensed Crown Water Frontages examined above bank vegetation width, tree health, tree regeneration, weed presence, soil disturbance, species richness and vegetation structure. The assessments concluded that most frontages have been modified to some extent and many are in a degraded condition. The majority were in poor (25%) or moderated condition (43%), with far fewer in good (21%) or excellent (3%) condition.

3.2.2 Wetlands

Within the catchment there are 1818 wetlands (greater than 1ha) covering an area of 82,181ha. (This includes natural and man-made wetlands). The Barmah-Millewa Forest wetland is the region's most significant wetland and is listed under the *International Ramsar Convention on Wetlands & the Register of the National Estate*.



The region also has wetlands listed in the *Directory of Important Wetlands in Australia (1995-2000)*: Barmah-Millewa Forest, Broken Creek, Kanyapella Basin, Lower Broken River, Lower Goulburn River Floodplain, Muckatah Depression, Wallenjoe Wetlands and Central Highlands Peatlands.

Many of these wetlands also provide habitat for JAMBA/CAMBA listed species: Barmah-Millewa Forest, Broken Creek, Kanyapella Basin, Lower Goulburn River Floodplain, Muckatah Depression and Wallenjoe Wetlands. In addition to these listed wetlands, the region has many high value wetlands along the floodplains of the middle reaches of the Goulburn River and its tributaries.

Figure 2. Current proportion of wetland categories (by number) in the Goulburn Broken Catchment.

Almost half of the remaining wetlands (47%) are naturally small in size (1-5ha). While 4% of wetlands are greater than 100 ha in size, these larger wetlands account for 75% of the total area of the region's wetlands. 73% of wetlands occur on public land with the remainder on private land. This includes man-made lakes and dams – not all natural wetland ecosystems.

Details on the habitat assets for riparian and instream flora and fauna are further discussed in detail in the Wetlands Directions Paper for the Goulburn Broken Catchment and the Goulburn Broken Riverine Health Strategy (in prep.).

3.3 Threats to riparian and in-stream native flora and fauna

The Goulburn Broken Catchment Management Strategy recognises that the region's natural assets are under threat. Many of the major changes we have created since settlement have resulted in problems within our waterway environment. These include:

- Increased stream and gully erosion.
- Increased rate and incidence of bank erosion.
- Threats to public and private assets by stream damage.
- Decline in the quality of water.
- Loss of riparian vegetation and decline in stream frontage condition.
- Decline in the condition of aquatic and terrestrial habitat.
- Loss of connectedness between rivers and floodplains

These problems now threaten the biodiversity values of our riverine environments by altering and degrading habitat for riparian and instream flora and fauna.

3.3.1 Threatening Processes

Aquatic and riparian flora and fauna are currently influenced by a range of detrimental processes that affect habitat (both physical and biological environments) and have led to reductions in aquatic species diversity. There are numerous threatening processes that impact both directly and indirectly on the aquatic and riparian environment. The impacts of many activities can take a long time to become apparent and the ecological health of many rivers and streams may be declining as they continue to respond to past activities.

A range of threatening processes has been formally recognised through State legislation (*Flora and Fauna Guarantee Act 1988*) and federally (*Environment Protection and Biodiversity Conservation Act 1999*). The main Potentially Threatening Processes (process which may have the capability to threaten the survival, abundance or evolutionary developments of any taxon or community) listed under the FFG Act can be found in Table 4.

Number	FFG Key Threatening Process	Action Statement
1.	Alteration to the natural flow regimes of rivers and streams.	
2.	Alteration to the natural temperature regimes of rivers and streams.	
3.	Degradation of native riparian vegetation along Victorian rivers and streams.	
4.	Habitat fragmentation as a threatening process for fauna in Victoria.	
5.	Increase in sediment input into Victorian rivers and streams due to human activities.	
6.	Input of toxic substances into Victorian rivers and streams.	
7.	Introduction of live fish into waters outside their natural range within a Victorian river catchment after 1770.	
8.	Loss of hollow-bearing trees in Victorian native forests.	
9.	Predation of native wildlife by the cat <i>Felis catus</i> .	✓
10.	Predation of native wildlife by the introduced Red Fox (<i>Vulpes vulpes</i>)	✓
11.	Prevention of passage of aquatic biota as a result of the presence of instream structures.	
12.	Removal of wood debris from Victorian streams.	
13.	The invasion of native vegetation by environmental weeds.	
14.	The use of lead shot in cartridges for the hunting of waterfowl.	✓

Table 4. Key Threatening Processes listed under the FFG Act that are relevant to riparian and instream flora and fauna in the Goulburn Broken catchment.

The major threatening activities in the Goulburn Broken are listed in Table 5; this table follows the Victorian River Health Strategy and the Goulburn Broken Regional Catchment Strategy in attempting to separate threatening activities from impacts. The categories of threatening activities used in Table 5 are the same as those used in the RCS for consistency, however we have attempted to show the linkages with Statewide Potentially Threatening Processes. Although priority areas for some threats are easily recognisable further investigation is required to comprehensively identify priority areas for each threat within the Goulburn Broken Catchment.

Threatening Activities	Link to Potentially Threatening Process Number.	Likelihood	Consequence	Key Impacts / Consequence
Grazing banks	3. 4. 5.	H	H	<ul style="list-style-type: none"> - Reduced habitat value. - Fragmentation of habitat. - Reduced regeneration of flora. - Competition from weed invasion.
Landforming / Agricultural development / Cultivation.	1. 4. 5.	H	H	<ul style="list-style-type: none"> - Fragmentation of habitat. - Reduction in vegetation cover and reduced regeneration. - Weed invasion. - Poor water quality – habitat alteration.
Poor land management	3. 5. 6.	M	H	<ul style="list-style-type: none"> - Salinisation of water environment. - Algal blooms leading to death. - Poor water quality altering habitat..
Removal of woody debris.	12..	M	H	<ul style="list-style-type: none"> - Removal of habitat (snag removal). - Loss of natural flow patterns (eg. scouring)
Recreation	14.	M	L/M	<ul style="list-style-type: none"> - Loss of vegetation quality and quantity. - Impact on breeding species. - Removal of habitat (snag re moval).
Timber harvesting	8.	M	M	<ul style="list-style-type: none"> - Loss of habitat (hollow bearing trees). - Altered flows changes available habitat.
Water regulation	1. 2. 11.	H	H	<ul style="list-style-type: none"> - Altered flow changes available habitat. - Altered temperature (thermal pollution). - Barriers to species migration. - Altered habitat.
Introduced flora & fauna	7. 9. 10. 13.	H	H	<ul style="list-style-type: none"> - Loss of native species (predation and competition). - Proliferation of carp. - Reduced regeneration of flora. - Reduction in available habitat. - Spread of disease.

Table 5. Major threatening activities that affect riparian and instream native flora and fauna.

3.4 Prioritising assets and threats

There are several tools used in the catchment to identify and prioritise riparian and instream flora and fauna assets and the threats that they face.

3.4.1 Bioregional Network Analysis

One of the important messages that bioregions bring to CMAs is that species and communities should not always be viewed in terms of their status within a particular catchment. Bioregions are based on biogeographic boundaries depicting the patterns of ecological characteristics. Management strategies undertaken within a catchment should always be compatible with the view of plans formulated at a bioregional level.

Native flora and fauna are divided into threat categories according to their status within a bioregion. Bioregional status for each taxon is determined via the following steps. The percentage of the Statewide population of the taxon which occurs within the bioregion is estimated, based upon distributional information on NRE flora and fauna databases. The percentage occurrence of the taxon within important land tenures in the bioregion is also estimated, based on local knowledge and expertise. A priority ranking (1, 2, 3 or 4) is allocated for each taxon on a particular land tenure. This is determined according to the importance of its contribution to the overall occurrence of the taxon within the bioregion and the state. The occurrence of a taxon on a particular land tenure within a given bioregion is referred to as a parcel. Similarly, an estimate of risk ranking (A, B or C) is allocated to each parcel, based on the level of concern for the conservation status of the taxon on each land tenure within the bioregion and its estimated population trend.

3.4.2 Biodiversity Action Planning

The use of bioregional network analysis provides a useful tool for the development of priority areas for management of riparian and in-stream flora and fauna. Draft Biodiversity Action Planning documents have been prepared for the Goulburn Broken Catchment. These documents collate data on key biodiversity assets and their conservation status and details in what land tenure they occur. Focal species and threatened ecosystems are used as the fundamental driver for prioritisation of areas for protection in the belief that these will act as surrogates for many of the species and biodiversity assets in an area. Part of this approach recognises that while specific requirements for many species of flora and fauna may be poorly understood, a tactic to deal with this is to recognise that groups of taxa are likely to have similar ecological requirements and to plan conservation activities around these.

3.4.3 River Values and Environmental Risk System (RiVERS)

The Goulburn Broken Catchment Management Authority are involved in developing a tool to assist in setting priorities for waterway management known as the River Values and Environmental Risk System (RiVERS). This tool stores information on environmental, social and economic assets of waterways and threats to the asset. Priority species (based on bioregional network analysis) and the threats that they face form part of this assessment tool for identifying priority areas for works. RiVERS is described in more detail in the Goulburn Broken Riverine Health Strategy (in prep.).

4 Goals and targets for riparian and instream native flora and fauna: what will we achieve?

If we are going to manage riparian and in-stream native flora and fauna we need to set goals and agree to what the priorities for action are. Riparian and instream aquatic flora and fauna are closely associated with the health of the riverine environment. Goals for riparian and instream flora and fauna will therefore likely be achieved in parallel with the goals for riverine systems.

The Goulburn Broken Regional Catchment Strategy sets the context for the broader needs of the catchment through its vision and catchment standard practices. The Riverine Health Strategy will fit within the context of the Regional Catchment Strategy and reflect the broader needs of the catchment.

4.1 Biodiversity Context for Decision-making

Biodiversity Goal

The Goulburn Broken Biodiversity Committee developed the following goal (NAP "Aspirational Target") for native biota from its 1999 Mission and the Board adopted it as the catchment community's goal.

To protect and enhance ecological processes and genetic diversity to secure the future of native species of plants, animals and other organisms.

4.2 Resource Condition Targets for Riparian and Instream Native Flora and Fauna

The Goulburn Broken Riverine Health Strategy (in prep.) and the Goulburn Broken Wetlands Directions Paper (2002) set broad resource condition targets for the catchment. These targets are listed in Table 6 below.

Parameter	Goal	Resource Condition Target
Channel Stability / Sediment Control	To protect and enhance the ecological health of 3000km of rivers by 2017 while responding to the catchment and broader communities' needs for other benefits provided by the river.	<ul style="list-style-type: none"> Protect 2,600km of streams by 2012. Improve 1000km of riparian condition by one point by 2012.
Flows	To provide effective control and management over the water cycle with consideration of the environmental, social and economic value provided by the allocation of water.	<ul style="list-style-type: none"> Significantly improve environmental flow regimes of 5 high value river reaches currently flow stressed by 2012.
Water Quality	To protect and enhance the quality of water for native biota and domestic, agricultural and industrial uses within the catchment and downstream.	<ul style="list-style-type: none"> Reduce potential catchment phosphorus loads by 65% by 2016.
Recreation	To provide a process for the balanced management of recreational activity within the riverine environment.	<ul style="list-style-type: none"> Manage recreation activities so as to maintain existing resource condition.
Native Biodiversity	To protect and enhance ecological processes and genetic diversity to secure the future of native species of plants, animals and other organisms.	<ul style="list-style-type: none"> Protect 1,400km (1,400 ha) of remnant riparian vegetation will be protected by 2012. Enhance 1,000km (1,000 ha) of rivers' riparian condition by one point (Index of Stream Condition)
Instream	To enhance and maintain recreational fishing opportunities for economic, social and environmental assets.	<ul style="list-style-type: none"> Increase length of river accessible to native fish by 200km by 2005. Enhance 50km of rivers by reinstating in-stream habitat by 2012.
Wetlands	<p>Maintain the extent of all wetland types where the extent (area and number) has declined since European settlement.</p> <p>Improve the condition of 70% of wetlands by 2030 using 2002 as a benchmark for condition.</p>	<ul style="list-style-type: none"> Protect 1,441 wetlands / 48,626 ha of wetlands by 2030. Enhance the condition of 1,009 wetlands / 34,038 ha of wetlands by 2030.

Table 6. Goulburn Broken resource condition targets for riparian and instream environments.

At this point in time the GBCMA does not see a need to develop specific targets for riparian and instream native flora and fauna. The riverine and wetland targets outlined above also take riparian and instream flora and fauna into consideration and achievement of these targets (in combination with all the catchment targets) is likely to improve habitat for riparian and instream flora and fauna. These targets will need to be reviewed over time as new information arises and a specific target for riparian and instream flora and fauna will need to be considered as part of the Riverine Health Strategy review process.

4.3 Suggested management actions for riparian and instream native flora and fauna.

In the preparation of the Native Aquatic and Riparian Flora and Fauna Resource Paper, ARI identified a series of major actions recommended for the catchment. This report was prepared to provide background information on the status of riparian and instream flora and fauna in the catchment, threats and some recommended actions. The recommended actions covered a range of management actions, both works and capacity building. Table 7 details the series of works and capacity building management activities that results in progress towards the above goals and targets and where these management actions are currently being addressed. It is acknowledged that there may be gaps in where these management actions are being addressed and we continually strive to improve the programs or avenues where these actions are addressed.

The four actions recommended by ARI that are not addressed under existing programs or strategies are listed at the end of this paper and will need to be considered for inclusion in the final Goulburn Broken Riverine Health Strategy.

Management Action	Existing program that addresses management action.	Lead Implementation Agency	Example (this list is not exhaustive)
Riparian			
Control grazing	<ul style="list-style-type: none"> • Crown Frontage Licences • WMIP (private land) 	<ul style="list-style-type: none"> • Land Victoria • Parks Victoria • GBCMA • Landholders 	<p>Conditions on licences on timing and management of grazing.</p> <p>Fencing of water frontages to control intensity and timing of grazing.</p>
Prevent further clearing	<ul style="list-style-type: none"> • Native Vegetation Retention Controls 	<ul style="list-style-type: none"> • NRE • Local Government 	<p>Assessment of application to ensure compliance with NVR.</p>
Manage exotic flora and fauna.	<ul style="list-style-type: none"> • WMIP • Extension 	<ul style="list-style-type: none"> • GBCMA • NRE • Landholders • NRE 	<p>Willow management programs.</p> <p>Fox baiting programs.</p> <p>Extension programs to educate landholders.</p>
Identify priority areas for protection of significant habitat (also applies to in-stream)	<ul style="list-style-type: none"> • WMIP • Biodiversity Action Plans • Native Vegetation Management Strategy. • Riverine Health Strategy 	<ul style="list-style-type: none"> • GBCMA • NRE 	<p>Identify priority areas for waterway rehabilitation works and targeting with EMGs.</p>
Revegetate frontages.	<ul style="list-style-type: none"> • WMIP • EMGs 	<ul style="list-style-type: none"> • GBCMA • NRE 	<p>Provide incentives for enhancement plantings.</p>
Minimise recreational impacts.	<ul style="list-style-type: none"> • Recreation Strategy • Parks and Forests Rangers 	<ul style="list-style-type: none"> • GBCMA • NRE & Parks Victoria 	<p>Provision of designated recreational areas.</p>
Instream			
Improve instream habitat	<ul style="list-style-type: none"> • WMIP 	<ul style="list-style-type: none"> • GBCMA • G-MW • DNRE • Community 	<p>Construction of fishways on barriers to migration.</p> <p>Dismantling of redundant weirs.</p> <p>Resnagging.</p> <p>Revegetation where possible.</p>
Manage on-stream storages	<ul style="list-style-type: none"> • Bulk Water Entitlements • Groundwater Management Plans • Streamflow Management Plans 	<ul style="list-style-type: none"> • G-MW • NRE 	<p>Management of releases from major storages eg. Eildon.</p>

Management Action	Existing program that addresses management action.	Lead Implementation Agency	Example (this list is not exhaustive)
	<ul style="list-style-type: none"> Environmental Flows 	<ul style="list-style-type: none"> MDBC 	Provision of environmental water allocations.
Stabilise channel	<ul style="list-style-type: none"> WMIP 	<ul style="list-style-type: none"> GBCMA 	Bed and bank stabilisation works to reduce sediment input.
Pest animal management	<ul style="list-style-type: none"> Pest Plant and Animal Strategy 	<ul style="list-style-type: none"> NRE 	Carp control. Fox eradication programs.
Threatened species protection (also applies to riparian)	<ul style="list-style-type: none"> Recovery Plans Native Fish Management Strategy Biodiversity Action Planning 	<ul style="list-style-type: none"> NRE NRE GBCMA NRE 	Specific management actions to conserve particular species eg. Trout Cod. Management of native species to ensure ongoing protection. Identification of priority species and priority sites for management.
Catchment Improve cropping & pasture management	<ul style="list-style-type: none"> SIRLWMP. Dryland Salinity Management Plan. Soil Health Strategy. 	<ul style="list-style-type: none"> GBCMA 	Management of gully erosion. Encouragement of EMS / WFP. Farm Program of SIRLWMP. Managing saline discharge and salt loads.
Maintain natural flow paths	<ul style="list-style-type: none"> Floodplain Strategy 	<ul style="list-style-type: none"> GBCMA 	Management of levees and drainage to ensure positive impact on wetlands and riverine environment.
BMP in surface water management	<ul style="list-style-type: none"> SIRLWMP Floodplain Strategy 	<ul style="list-style-type: none"> GBCMA NRE G-MW GBCMA 	Water regime included in drain design. Retaining natural flow paths to provide watering regime.
BMP in sub-surface water management	<ul style="list-style-type: none"> SIRLWMP Dryland Salinity Plan 	<ul style="list-style-type: none"> GBCMA NRE 	Wetland and riverine systems threatened by high water tables protected by installation of groundwater pump.
Sediment stabilisation	<ul style="list-style-type: none"> Dryland Salinity Management Plan WMIP 	<ul style="list-style-type: none"> GBCMA NRE 	Management of gully erosion. Stabilising near and instream sediment sources. Incentives for revegetation programs.
Manage salinity and soil acidity	<ul style="list-style-type: none"> Dryland Salinity Management Plan SIRLWMP Soil Health Strategy Water Quality Strategy WMIP 	<ul style="list-style-type: none"> GBCMA NRE G-MW 	Incentives for revegetation program. Irrigation drainage. End of valley targets for salinity.
Urban stormwater management	<ul style="list-style-type: none"> Water Quality Strategy 	<ul style="list-style-type: none"> Municipalities 	Implementation of urban stormwater management plans to reduce nutrient / contaminant input into rivers and wetlands associated with urban runoff
Wastewater management	<ul style="list-style-type: none"> Water Quality Strategy 	<ul style="list-style-type: none"> Rural Water Authorities 	Provision of habitat values in and around wastewater management facilities. Recognition of sites important for threatened species.
Intensive agriculture & local water quality management	<ul style="list-style-type: none"> Water Quality Strategy 	<ul style="list-style-type: none"> Industry EPA 	Containment of dairy / piggery effluent. Management of septic systems for containment of waste on-site.

Management Action	Existing program that addresses management action.	Lead Implementation Agency	Example (this list is not exhaustive)
Non-works Action Identify focal species and management actions.	<ul style="list-style-type: none"> Biodiversity Action Plans 	<ul style="list-style-type: none"> GBCMA NRE 	Inclusion of aquatic and riparian species in biodiversity action planning process.
Management agreements	<ul style="list-style-type: none"> Native Vegetation Retention Controls. Forest Management Plans. 	<ul style="list-style-type: none"> NRE 	Between relevant stakeholders to assign responsibility for management actions eg. protecting hollow-bearing trees during timber harvesting, management conditions on Crown frontage licences.
Education.	<ul style="list-style-type: none"> Extension programs 	<ul style="list-style-type: none"> GBCMA NRE G-MW Local Government EPA Industry Parks Victoria 	Education on the importance of protecting riparian and riverine environments, maintaining large woody debris, providing fish passage etc. Encourage landholder support for the protection and enhancement of water frontages. Education into the potential effects of uncontrolled recreational activities on riverine environments.
Improved knowledge (Research and Development)	<ul style="list-style-type: none"> Riverine Health Strategy. Native Vegetation Strategy. 	<ul style="list-style-type: none"> GBCMA NRE 	Linkages with key research bodies to investigate issues and management options such as sedimentation, sand slugs, threatened species requirements, provision of artificial habitat eg. artificial macrophytes. Use of threatened EVCs, Heritage Rivers, Ecologically Healthy Rivers and ISC to develop targets for priority actions. Application of bioregional planning and focal species approach for identification and protection of priority areas.

Table 7. Summary of existing programs and strategies to manage riparian and in-stream native flora and fauna in the Goulburn Broken Catchment.

Additional management actions specifically for riparian and instream flora and fauna as recommended by ARI that will need to be considered for inclusion into the Goulburn Broken Riverine Health strategy are as follows:

Suggested action	Key Responsibility
Investigate species specific effects of thermal pollution.	GBCMA NRE
Identify further research areas for riparian and in-stream species.	GBCMA
Establish local management units for carp control.	GBCMA NRE
Identify priority sites that are highly dependent on appropriate flooding regimes or specific watering requirements.	GBCMA NRE

5 Bibliography

1. Arthur Rylah Institute for Environmental Research, DNRE (2002). *Riparian and Instream Native Flora and Fauna Technical Information for the Goulburn Broken Catchment*. Department of Natural Resources and Environment. State Government of Victoria, July 2002.
2. Arthur Rylah Institute for Environmental Research, DNRE (2002). *Wetlands Technical Information for the Goulburn Broken Catchment*. Department of Natural Resources and Environment. State Government of Victoria, July 2002.
3. Goulburn Broken Catchment Management Authority (2002). *Goulburn Broken Riverine Health Strategy* (in preparation).
4. Goulburn Broken Catchment Management Authority (2002). *Draft Regional Catchment Strategy*. Goulburn Broken Catchment Management Authority, Shepparton 2002.
5. Howell, M and McLennan, R. (unpublished). *Wetlands directions paper for the Goulburn Broken catchment*. Prepared for the Goulburn Broken Catchment Management Authority, Shepparton 2002.
6. McLennan, R., Handley, K. and Howell, M. (2002). *Draft Biodiversity Integration Strategy for the Goulburn Broken Catchment*. Goulburn Broken Catchment Management Authority, Shepparton, October 2002.
7. Ryan, P. (2002). *Threatened species and non-threatened vertebrate fauna in the Goulburn Broken Catchment: status, trends and management*. Ecolines Environmental Services, Canberra, Draft June 2002.