GOULBURN BROKEN CATCHMENT MANAGEMENT AUTHORITY

Goulburn Broken Regional Catchment Strategy 2012 - 2018

Assets of the Goulburn Broken Catchment

DRAFT FOR MINISTERIAL APPROVAL

Contents

About the RCS

The Goulburn Broken Regional Catchment Strategy 2012-2018 (RCS) comprises three documents that support each other in providing different levels of detail for everyone involved in catchment management:

1. The **Summary for the Community** for people who want an overview of the RCS.

2. The **Goulburn Broken Regional Catchment Strategy 2012-2018** that provides a description of the Catchment, the RCS objectives, integration, implementation and evaluation detail and supporting information.

3. The **Assets of the Goulburn Broken Catchment Supplement** that supports the RCS document by providing descriptions of biodiversity, land, water and people assets.

   This is document three, *Assets of the Goulburn Broken Catchment*.

   This RCS is currently a draft and may be subject to change.

Assets of the Goulburn Broken Catchment

The Goulburn Broken Catchment boasts a wide diversity of landscapes including 1,800 metre snow covered alps, moist montane and dry sclerophyll forests, granitic outcrops, gentle sloping plains, box woodlands, red gum floodplains, mixed farms and irrigated pastures and orchards. Individually, each of these biophysical features can be classified as an asset which can be grouped by type or as single features. The people that reside in the Catchment should also be considered assets - they contribute significantly to the management of biodiversity, land and water, and without this contribution the objectives of the RCS cannot be achieved.

The Goulburn Broken Regional Catchment Strategy (RCS) 2012-2018, focuses on the connections between people and nature (or people and the biophysical assets) and how these connections influence the resilience of six social-ecological systems (SES) across the Catchment in response to four main drivers of change (identified through consultation with the community and technical experts).

The six sub-Catchment SESs are used as the basis for the development of the RCS as they are at the appropriate scale to address many catchment management problems: they are small enough for details to be well understood, including how different issues relate, yet large enough to achieve efficiencies in allocating resources aimed at achieving resilience.

In describing each SES, information on each of the asset themes of biodiversity, land, water and people, has been used to describe differences and similarities between each SES (by providing details on important features that people often identify in their landscape).

This document provides a summary of the attributes of each of the four assets classes identified. Further detail on each asset theme is provided through the relevant sub-strategies or the full RCS. For each asset theme, long-term objectives are articulated in the RCS, as well as in the relevant sub-strategies. The RCS also includes discussion on the long-term objectives and their relationship to resilience thresholds and each SES.

The process of updating sub-strategies will include testing how these objectives align with resilience thresholds and how they relate in each SES.

Biodiversity

Biodiversity is the 'variety of all life forms – the different plants, animals and micro-organisms, the genes they contain and the ecosystems of which they form part' (DSE 2012). Biodiversity underpins the health of connected natural and managed systems and provides ecosystem services that humans cannot imitate at large scales (Straker & Platt 2002; CSIRO 2003).

Biodiversity as an asset can be broken into further sub-categories including native vegetation, wetlands, rivers and streams, native fauna and soil biodiversity (GB CMA 2010a). For the purposes of the RCS, the assets considered in the biodiversity section of this supplement will be terrestrial habitat; and threatened species and communities. Wetlands, rivers and streams are considered in the water section and soil biodiversity in the land section.

Terrestrial habitat includes native vegetation as well as rocky outcrops, fallen timber and soil. Native vegetation occurs as remnants, linear patches, revegetated sites and large reserves.

Native vegetation provides a range of ecological, social and economic values including the provision of habitat for the majority of species. In fragmented landscape, native vegetation provides linkages to ensure species movement, which is important in gene flow and the ability of species to adapt to change (Coulon *et al* 2010; Lowe & Allendorf 2010).

There are several terrestrial habitat types and important conservation areas found across the Goulburn Broken Catchment. These include:

- Box Gum Grassy Woodlands of the Riverine Plains
- Red Gum woodlands, including Barmah Forest.
- Buloke remnants of the plains
- Herb Rich Forests of the Warby Ranges
- Box Ironbark Forests of Reef Hills State Park and Whroo Goldfields parks.
- Spring-soak wetlands and rocky outcrops of the Strathbogie Ranges
- Grassy woodlands of the Dookie and Chesney Hills
- Remnants associated with waterways
- Alpine Rocky Outcrops, fens and bogs
- Sub Alpine Dry Shrubland.

Within these terrestrial habitats there are a number of threatened species and ecological communities. These species and communities are important both for the role that they play in the boarder ecosystem as well as their socio economic value. Some threatened species and communities found within the Goulburn Broken Catchment that are identified in the RCS as being of focus in one or more of the SESs include:

- Superb Parrot
- Bush Stone-curlew
- Squirrel Glider
- Grey -crowned Babbler
- Swift Parrot
- Regent Honeyeater
- Legless Lizard
- Golden Sun-moth
- Crimson Spider Orchid
- Ant-blue Butterfly
- Western Rat-Tailed Grass
- Slender Bitter Cress
- Creeping Grevillea
- Matted Flax Lily
- Barking Owl
- Powerful Owl
- Diamond Firetail
- Specked Warbler
- Mountain Pygmy Possum
- Dendy's Toadlet
- Spotted Tree Frog
- Growling Grass Frog

- Brown Toadlet
- Alpine Tree Frog

Further details on threatened species and communities can be found in the Goulburn Broken CMA's Biodiversity Strategy (GB CMA 2010) and biodiversity interactive maps at dse.vic.gov.au.

CURRENT CONDITION

Past and current land management practices have resulted in the loss of much of the Catchment's native vegetation, particularly in production-focused areas. Catchment condition reports (VCMC 2007; GB CMA 2012) rate the Catchment's biodiversity as variable, from poor to good condition. This largely reflects the relatively good condition of the Southern Forests SES to the poor condition of biodiversity in much of the rest of the Catchment.

Table 1 provides an overview of what this rating means. The Catchment condition of poor is based on comparison with pre-European condition.

As the extent of native vegetation varies across the Catchment, so does the area of Ecological Vegetation Classes (EVCs) that are threatened with extinction (figure 1). Sixty four per cent of EVCs in the Catchment are classified endangered or vulnerable (DSE 2007).

The conservation of native vegetation has been, and is still is, in certain areas, in conflict with some human activities (e.g. land clearing for pivot irrigation, logging). Increasing the extent of native vegetation has recently been shown to be the most important action to achieve biodiversity conservation (Bennett *et al* 2006; Lindenmayer *et al* 2002), while also increasing habitat quality.

Table 1: Biodiversity values and condition of the typical ecological condition states

	Near Natural	Ecological Healthy	Sustainable Working	Modified / Degraded
Values	High degree of naturalness, significant species, few threatened species or communities. High diversity.	High degree of naturalness, significant species and high diversity. Some threatened species and communities.	Moderate naturalness, significant species, high levels of threatened species and communities, high diversity but in few places	Low level of naturalness, diversity of species in-situ rare, high levels of threatened species and communities, highly fragmented (relictual), remnants too small for viable communities
Condition	Excellent	Good	Moderate /Poor	Poor/Very poor
Modification	Very Low	Low	Moderate	Moderate to high
Basis	Intact native vegetation cover (>60%),	Intact native vegetation cover (30-60%)	Fragmented native vegetation cover (10 - 30%)	Relictual cover of native vegetation (<10%)
Examples	Alpine National Park	Barmah National Park	Longwood/Violet Town Plains	Irrigated farm land or landscapes
Naturalness	Very High	High	Medium	Low-Very Low
Socio Economic Benefit	High	High	High	High

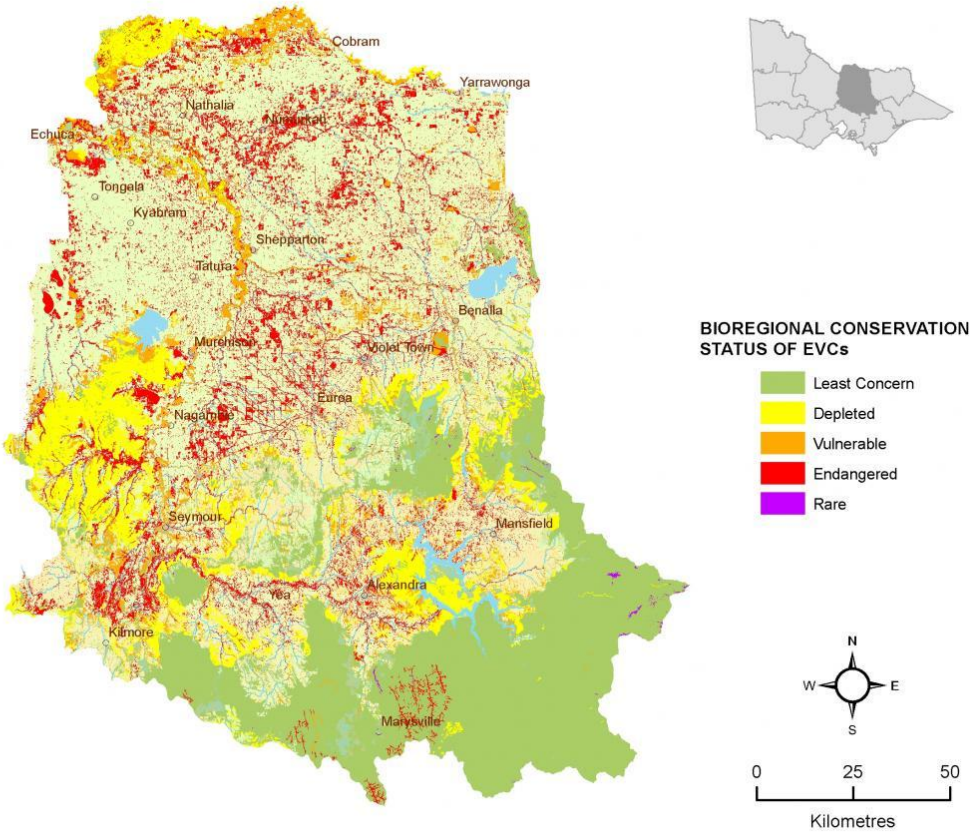

Figure 1: Current modeled tree cover extent expressed as Ecological vegetation classes

Threatened species are found across the Catchment (table 2). There are 2,750 native plant species, of which 337 (13 per cent) are threatened, and 493 vertebrates, of which 110 (43 per cent) are threatened (GB CMA 2010a).

Some species that once occupied the Catchment are now extinct, such as the Eastern Bettong. Many threatened species now persist only in small patches of remnant habitat dominated by human influences (Bennett *et al* 2006).

Table 2: Number of taxa by class and Victorian Conservation Status Category of fauna in the Goulburn Broken Catchment (DSE 2007 and Victoria Fauna Database)

Threat Category[1]	Birds	Mammals	Reptiles	Amphibians	Fish	Total
Regionally Extinct	0	2	0	0	1	3
Critically Endangered	5	2	0	3	3	13
Endangered	13	3	4	2	3	25
Vulnerable	23	4	1	1	2	31
Data Deficient	0	2	2	1	2	7
Near Threatened	25	4	2	0	0	31
Total Threatened	66	17	9	7	11	110
No. of native species in catchment	298	70	72	31	22	493
No. of introduced species in catchment	13	14	0	0	8	35

SIGNIFICANT THREATS

In 2009 the Goulburn Broken CMA undertook a risk analysis to identify the important risks to biodiversity across the Goulburn Broken Catchment, with a particular focus on risk posed by climate change (Brunt & Miles 2009). The assessment identified a significant number of extreme threats to biodiversity as outlined in table 3. Many of these extreme threats result from or relate to, one or more of the four drivers of change identified in the RCS, however the assets and threats with the highest number of extreme risks (shaded in grey in table 3) suggests that the greatest threats relate to land use change (reduced habitat function, isolation and simplification and weed invasion) and climate variability. While at the time of the assessment, saline water and high water tables were deemed to be less threatening because of reduced rainfall, the swing back to higher rainfall could again see salinity again pose a major threat to biodiversity, especially in the context of other multiple threats.

THREAT	Native vegetation	Wetlands	Rivers & Streams	Flora/fauna	Threatened species	Soil biota	No. assets affected by threat
Clearing (direct removal of native veg)			E			E	2
Cultivation, cropping and pasture management	E			E		E	3
Stock grazing		E					1
Introduction of weeds	E		E	E			3
Introduction of pest animals			E				1
Transportation of pathogens			E			E	2
Poaching and hunting of native spp			E				1
Fish stocking of introduced, translocation spp			E				1
Irrigation (current practice)			E				1
Reduced habitat function (due to size, quality or fragmentation)	E	E	E	E	E		**5**
Dieback	E			E			2
Lack of regeneration	E	E	E	E	E		5
Isolation and simplification (includes lack of pollinators and species populations size, isolation or genetic decline)	E	E	E	E	E	E	**6**
Weed Invasion	E	E	E	E	E		**5**
Pest animals			E		E		2
Fire*	E			E			2
On-stream barriers (includes culverts & regulators)		E					1
On-stream storages (Flow regulation)		E	E				2
On-stream storages (water harvesting)			E				1
Infrastructure – waterways and floodplain development – including levees		E	E				2
Infrastructure – road and rail						E	1
Fire Management (suppressions and regime)		E					1
Landforming and drainage		E					1
Irrigation (in new areas)	E	E	E	E			4
Changed flow pattern and water availability		E	E				2
Drought*		E					1
Groundwater extraction			E				1
Mining						E	1
Soil sodicity						E	1
Climate change (CC) in general	E	E	E	E	E	E	6
Total threats per asset (excluding specific CC threats)	10	**14**	**19**	10	6	8	
CC - increase in intensity and occurrence of drought	E	E	E		E		4
CC - Eutrophication - increases in loads of nutrients to water bodies							0
CC - increased occurrence and severity of fire	E	E	E	E		E	5
CC - Increased fire prevention activities	E	E					2
CC -Increased Fire recovery activities	E			E		E	3
CC -Changed flood regime - fewer more severe floods			E				1
CC -Increase in stream salinity		E	E				2
Cc - change in Land Use leading to land use intensification						E	1
CC - Changes to pest distribution and species (include pathogens, viruses and ppa)		E	E			E	3
CC - increase in mosquito borne diseases leading to drainage of wetlands			E				1
CC - Overall increase in temperature		E					1
CC - Temp increase in spring summer							0
Cc - reduced environmental flows			E				1
CC -change in Snow regime	E	E		E	E		4
CC - Increase in summer storms (wind storms, lightning, rainfall intensity)							0
CC -change in rainfall patterns	E	E	E	E	E		5
CC -Increases in summer rainfall							0
CC - Decreased frost days							0
CC - reduced runoff	E	E	E	E			4
CC - reduced rainfall in winter	E	E	E	E			4
Cc - Change to phenology (timing of events)	E	E		E			3
CC - change in political focus (biodiversity becomes less important)							0
CC - climate refugees - causing population increase							0
CC - climate refugees - causing population decrease							0

Table 3: Summary of extreme (E) risk across broad biodiversity assets in the Catchment (GB CMA 2010a).

Note: threats in italics are 'induced threats'. Standard text generally refers to land and water use practices, including new areas. Threats in red are 'natural' processes now potentially more serious because the environment has been modified). The yellow section highlights climate change threats. Assets and threats with a high number of extreme risks are shaded in grey.

While the drivers of change identified in the RCS pose risks to biodiversity assets in the Catchment, they also provide opportunities. For example natural regeneration is occurring as land-use moves from traditional farming to lifestyle (e.g. in the dry box-ironbark forests). This type of vegetation has been shown to have biodiversity benefits (Lunt *et al* 2010). Further detail on the relationship between assets and the drivers of change can be found in each SES description in the RCS.

MANAGEMENT

It is not feasible, possible or desirable to return the Catchment to pre-European condition as the social and economic systems important to the resilience of the Catchment would not function under these conditions. There is however some evidence that increasing native vegetation extent to approximately 30 per cent may be enough to create functioning landscapes, increase species diversity and richness (Radford *et al* 2002), increase production (Straker & Platt 2002) and improve waterway health (Lefroy *et al* 2012).

Across the Catchment, significant investment is made to protect and restore biodiversity assets in line with the objectives of the Biodiversity Strategy for the Goulburn Broken Catchment, Victoria 2010-2015 (the Biodiversity Strategy) (GB CMA 2010a). Projects and activities are undertaken by a broad range of organisations, including the Department of Sustainability and Environment (DSE), the Department of Primary Industries (DPI), Trust for Nature, Local Government, Yorta Yorta Nation Aboriginal Corporation (YYNAC), Taungurung Clans Aboriginal Corporation (TCAC) and community-based natural resource management groups in the protection of biodiversity assets.

Many communities have identified biodiversity assets in their local area and are working as individual landholders and/or collectively to protect and enhance these assets on both public and private land through activities including regeneration and revegetation and weed management. Community groups including Landcare, Conservation Management Networks (CMNs), Committees of Management of Crown Land and community initiatives including the Superb Parrot and Regent Honeyeater Projects, all have a proud history across the Catchment in harnessing funding and community participation to protect and enhance biodiversity assets.

GUIDING CURRENT THINKING

The Biodiversity Strategy (GB CMA 2010a) outlines key management measures for how long-term biodiversity objectives will be met. This strategy sets the 20-30 year strategic objectives for biodiversity of the Catchment, including the rationale for the objectives and how they will be achieved.

Key policies and strategies that guide the identification and protection of threatened species and communities are the *State Flora and Fauna Guarantee Act 1988*, Commonwealth *EPBC Act 1999* and the State Native Vegetation Framework 2002 (DSE 2002), as well as state and federal policies which guide the ways in which funding for biodiversity is distributed.

ASSET IDENTIFICATION AND PRIORITISATION

Priority biodiversity assets at the Catchment scale were identified during the development of the Biodiversity Strategy (GB CMA 2010a) through an assessment process that included consideration of existing biodiversity attributes and the potential to contribute to ecological objectives. Local and expert knowledge was used to asses and weight biodiversity values and objectives, enabling a prioritisation process across 14 geographical zones to be undertaken and represented spatially (GB CMA 2010a).

At a statewide level, NaturePrint has been developed based on species distribution and other models to inform the identification of priorities. Figure 2 shows the alignment between the spatial priorities identified in the Biodiversity Strategy (GB CMA 2010a) and NaturePrint.

While the two approaches are different, the identification of spatial priorities demonstrates a strong correlation between the two approaches. High value zones for protection from the Biodiversity Strategy coincides with high values in NaturePrint, and high value zones for restoration and connectivity coincide with moderate values in NaturePrint. For example, high value (red) areas for NaturePrint are areas recognised in the Biodiversity Strategy (GB CMA 2010a) as requiring protection of ecosystem services.

Similarly, moderate to high value areas for NaturePrint (dark green dark purple) are recognised in the Biodiversity Strategy (GB CMA 2010a) as areas of priority for restoration and improving connectivity. There are of course, priorities and important assets at finer scales, and landscape and site level priorities within these broader areas require identification and appropriate management intervention (e.g. wetlands and remnants that connect to the rivers within the 'low' priority areas of the Riverine Plains).

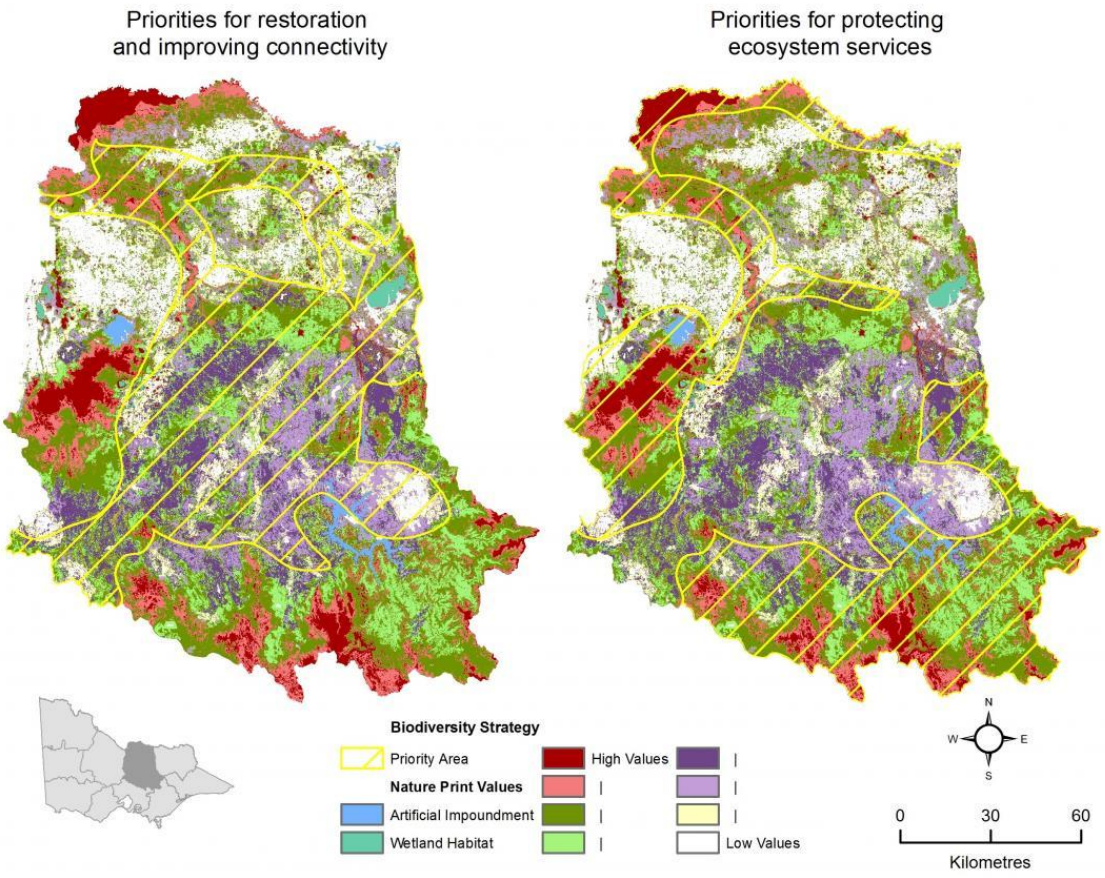

Figure 2: Goulburn Broken Biodiversity Strategy (GB CMA 2010a) and NaturePrint asset prioritisation alignment

THREATENED SPECIES PRIORITISATION

The objective of threatened species management is to increase the numbers of animals and plants of a particular species so that populations are self-sustaining, resilient and able to adapt to change. There is a need for effective decisions to achieve the balance between 'saving' threatened species while also preventing more common species becoming threatened.

Mostly, management interventions revolve around increasing habitat elements required by specific species or groups of species, and this in turn requires research to understand their distribution and habitat requirements. However, in most instances there is not the luxury of time in which to 'save' species based on a full knowledge set, so the approach is often to undertake habitat improvement to provide more resources for a range of species.

This improvement can include reducing habitat fragmentation through revegetation (for example Grey-crowned Babblers will not fly between habitat where the gap is greater than 200 metres), erecting nest-boxes (to compensate for the lack of large-old trees that provide hollows) and enhancing native vegetation remnants through reducing weed invasion.

A prioritisation process can aim for:

- Functioning ecosystems, which are important to maintain all species (threatened, near-threatened and secure),
- Conserving as many threatened species as possible by shifting their status towards secure.

The guiding principles for managing threatened species are:

- To increase the security of threatened species and communities by targeting key threats.
- To work with partner organisations to increase knowledge about the management needs of these species.
- To ensure that the decision-making process for managing threatened species and investment is inclusive, transparent and effective.

Land

The majority of land in the Catchment is privately owned, with 1.4 million hectares used for dryland agriculture and 270,000 hectares used for irrigated agriculture. Major industries include dairying, irrigated horticulture and viticulture, dryland grazing and cropping, timber production, thoroughbred and standardbred horse breeding, food processing, tourism and recreation. There are 800,000 hectares of public land (Montecillo 2012). Major land-use is shown in figure 3.

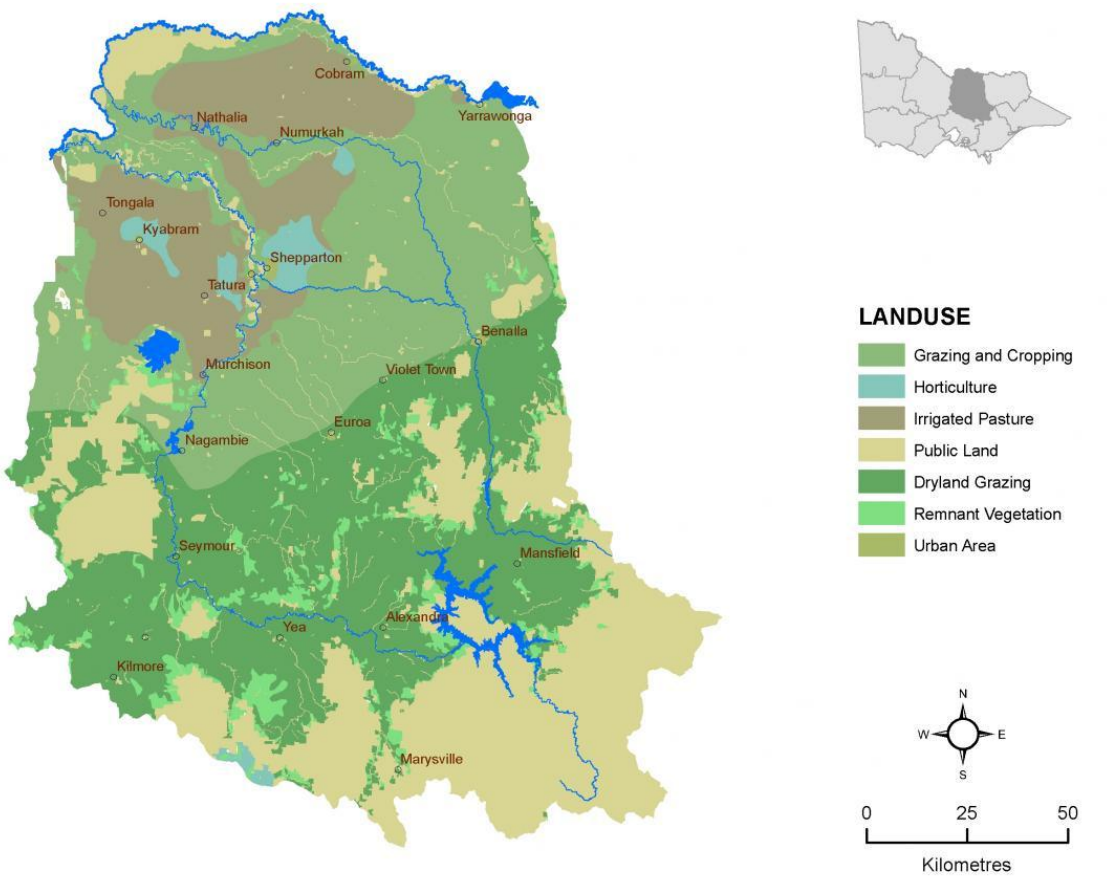

Figure 3: Goulburn Broken Catchment land use

The term 'land' includes considerations of geology, geomorphology (study of landforms and the processes that shape them) and soils. Soils are a component of land. Soil health is the capacity of soil to function as a vital living system that sustains biological and economic productivity, promotes environmental quality, and maintain plant and animal health. Soil health is synonymous with sustainability (Doran & Zeiss 2000).

The ecosystem services provided by land and soil underpin sustainable land use and fundamental ecological processes in the catchment for rural communities. Whilst there is an extensive list of services (Bennett *et al* 2009, Dominati *et al*

2010) most are not readily amenable to being managed and even if they were there would be too many. For this reason it is important to focus on a selection of key services that underpin our environment and region while not losing sight of the need to look at the soil as a system, not a set of discrete issues to be dealt with in isolation. The services of interest are soil carbon, soil structure, soil biology and soil hydrology.

Settlement and economic development of the region has increased the rate of soil loss several hundred fold above the rates prior to European settlement, degraded soil structure, depleted soil carbon, simplified soil biodiversity and accelerated soil acidification. As the soil ecosystem functions degrade so do the services they provide and at the same time, the disservices increase.

Land degradation leading to loss of ecosystem services from soils and associated decreases in the function and productive capacity of soils is a pressing ecological and economic concern in the region. Whilst production has increased and landholders have shown the capacity to adapt to changing climatic and economic conditions, it is becoming increasingly difficult to maintain viable production systems without large amounts of energy inputs, evidence of both the long-term decline in terms of trade and the long-term decline in the capacity of soils to provide services.

Appropriate land use and good management, matched to land capability, are essential to ensure that these resources are available for future generations. The variable qualities of soil (such as depth, texture, acidity, stoniness) and land (slope, aspect, geology) affect their capability to support different land uses without degradation of the soil resource.

There are three key landscapes and dominant soil types that support these land-uses, as described in table 4 and shown in figure 4. These are based on the Victorian Geomorphic Framework that combines information about landforms and landscapes. These provide a useful basis for understanding land-use across the Catchment.

Table 4: Landscapes and dominant soil types across the Goulburn Broken Catchment (VRO 2012)

Landscape and Dominant Soil Type Description	
Eastern Uplands (including Victorian Highlands and Northern Valleys and Plains)	The **Eastern Uplands** has extensive native forests, parks and production forestry. Private land is primarily used for production for dryland agriculture including grazing. Primary production occurs on the fringes of the highlands in the cleared valleys and plains. Shallow (generally stony) finely structured loam to clay soils with high organic matter are found in the Highlands, while valleys and plains soils are sand to loam surfaces over weakly structured clay loam to heavy clay subsoils
Western Uplands	The **Western Uplands** comprise a diversity of land-uses and farming practices including mixed farming (grazing and cropping), forestry and irrigated agriculture (mainly horticulture). Dryland farming is the dominant agricultural land-use with nature conservation interspersed as state forests and parks across the region. The sedimentary rocks generate texture contrast soils.
Northern Riverine Plain (Riverine Plains and North-East Plains and Slopes)	The **Northern Riverine Plain** comprises nearly 70% of Victoria's irrigated agriculture. This is supported in the Shepparton Irrigation Region (SIR) by an irrigation supply and drainage network with regulated water delivery. Water is also extracted directly from waterways to support irrigated production across the Catchment. Dryland agriculture farming includes mixed farming; livestock production and cropping. The distribution of cropping to livestock production varies according to soil type and climatic factors. In the Riverine Plains soils generally have a loamy (fine sandy) surface over clay subsoil.

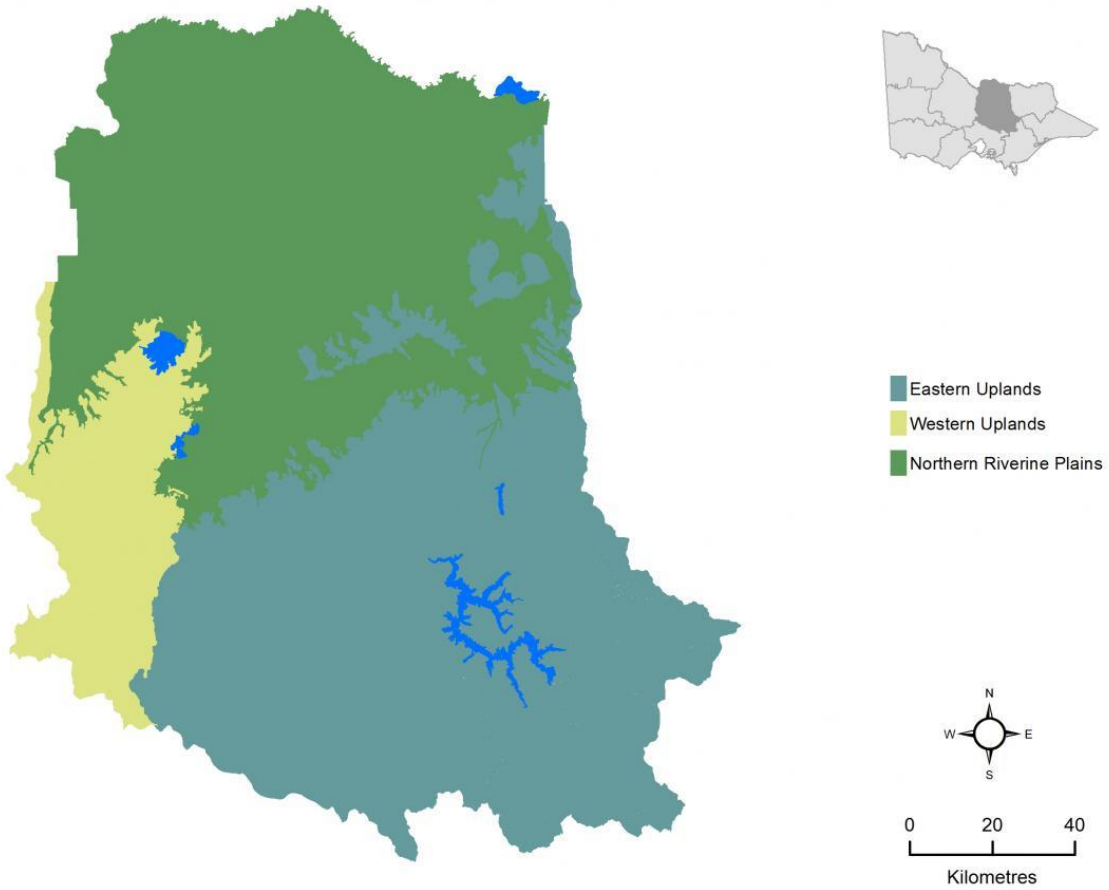

Figure 4: Goulburn Broken Catchment Geomorphic Management Units

CURRENT CONDITION

Catchment condition of key land and soil health indicators; salinity and invasive plants and animals, is variable (GB CMA 2012). The Irrigation Region Salinity condition rating is good and land health, including dryland salinity is satisfactory. However the invasive plant and animal condition rating is poor.

Forty per cent of the Catchment has strongly to very strongly acidic soils. Over half of this is on private land and experiences accelerated rates of acidification. There is more than 400,000 hectares of soils at high to very high risk of soil erosion, mainly from soils on sedimentary and granitic rises (Cotter, M 2012 pers. comm., 8 October). Soil biology is sub optimal across most of the cleared part of the catchment as are levels of soil carbon.

There is in excess of 600,000 hectares of sodic soils in the Goulburn Broken Catchment (Cotter, M 2012 pers. comm., 8 October). These dominate the riverine plains, are poorly structured and prone to sealing and are difficult to manage when wet or dry, a situation made worse in areas of high watertables.

The variable qualities of soil (such as depth, texture, acidity, stoniness) and land (slope, aspect, geology) affect their capability to support different land-uses without degradation of the soil resource. Land management for soil health, as well as pest plant and animal invasion relies on collaborative partnerships between private and public land managers.

MANAGEMENT

While there are many management activities undertaken on both private and public land across the Catchment to improve the condition of natural resources, the focus of land management (consistent with the technical definition of land), is on soil condition. This encompasses the:

- Protection or enhancement of the soil capital from the major degrading processes erosion, organic matter decline acidification, contamination, compaction, salinisation and biodiversity decline
- Restoration or preservation of services from soil, soil carbon, soil structure, soil biology and soil hydrology
- Protection of other terrestrial and aquatic assets by reducing the impact of soil acidity, soil sodicity (including soil salinity), and water erosion

Many organisations including DPI, DSE, Goulburn-Murray Water (G-MW) and the Goulburn Broken CMA work with individuals and community groups to improve private land management. DSE, Parks Victoria (PV), Goulburn Broken CMA, Crown Land Committees of Management and other community groups work to restore and protect public land.

Efficient water use on farm helps to minimise salinity, water logging and nutrient impacts by reducing surface run off and seepage to the water table. Australian and Victorian Government and individual investment made in significant infrastructure assets, supports land and soil assets deemed best matched to irrigated agricultural production. A predicted outcome of this modernisation program is more land under dryland production, but the impact of this change on land and soil health is unknown.

Private land managers undertake activities including whole farm planning, land class fencing, the installation of groundwater bores, the draining of land with high water tables, and promotion of regeneration and revegetation of native vegetation. This contributes to improved soil stability and soil carbon, encourages soil biological activity and helps to manage soil acidity and salinity.

Significant effort across public and private land also occurs in the management of invasive pest plants and animals. Partnerships between PV, DPI, YYNAC and TCAC, community groups and landholders all contribute to the delivery of activities that improve the land asset, but which also contribute achieving outcomes for biodiversity and water across the Catchment.

SIGNIFICANT THREATS

Significant changes occurring in the Goulburn Broken Catchment reflect the ongoing competition for land for various purposes. Land-use change such as an increase in the number of absentee landholders can result in increased threats from invasive pests and plants that affect the productive capacity and biodiversity (GB CMA 2010d) on land in the Catchment. Key invasive plant species across the Catchment include Blackberry, Paterson's Curse, Serrated Tussock, Gorse, Willow and Arrowhead. An emerging invasive plant species of concern is Chilean Needle Grass. Key threatening invasive animal species include foxes, feral cats, rabbits and European Carp. Some native species are also considered pests at times. The risk to land from invasive plants and animal species is also likely to increase with climate variability.

The main threats to soils in the Goulburn Broken Catchment come from inappropriate land use or management practices on soil of high to very high risk from erosion, organic matter decline, acidification, contamination, compaction, salinisation and biodiversity decline. The main threats from soil are erosion, acidification, contamination, compaction and salinisation.

The link between the state of biodiversity in the catchment and the condition of the soil is still poorly understood. The increase in disservices from the soil threatens the broader biophysical and economic health of the catchment. The relationships between the soil, its condition and other natural assets are summarised in table 5.

Soil threat	System component and asset class			
	Rivers	Wetlands	Species populations & communities	Terrestrial habitat
Water and wind erosion	Y	Y	Y	Y
Salinity/sodicity	Y	Y	Y	Y
Waterlogging			Y	Y
Soil acidity		Y?	Y?	
Soil structure deterioration		Y?		
Soil fertility and organic carbon	Y?	Y?	Y	Y
Soil biodiversity			Y	Y
Soil and water contaminants	Y	Y	Y?	

Note: Entries marked with a question mark (?) indicates processes that are poorly understood

Table 5: The relationship between soil threats to Catchment components or assets

GUIDING CURRENT THINKING

The Goulburn Broken Dryland Landscape Strategy (GBCMA 2009), Shepparton Irrigation Region Catchment Implementation Strategy (GB CMA,2010f), Goulburn Broken Invasive Plants and Animals Strategy (GB CMA 2010d), Soil Health Action Plan (GB CMA 2006) and Mid Goulburn and Upper Goulburn Sustainable Irrigation Action Plan (GB CMA 2008) provide a basis for action on land and soil.

Key policies that guide the current direction for Land are the Victorian Soil Health Strategy (DSE 2012), the Victorian Irrigation Drainage Program Strategic Direction 2010-2015 (DSE 2010), the Biosecurity Strategy for Victoria (Government of Victoria, 2009) and the Invasive Plants and Animals Policy Framework (DPI 2012).

ASSET IDENTIFICATION AND PRIORITISATION

The identification of specific land assets, and a subsequent process for prioritisation of identified assets, is problematic because of the ubiquitous nature of soils and their condition. There are some principles that can be used to guide the identification of both the location and activity(ies) for land. These principles are built on an acknowledgement that:

- The range of activities and enterprises available to land managers is limited. The need is to reduce soil disturbance, increase perennially and manage soil biology with the same attention we pay to soil chemistry.
- Land managers are committed to improving the condition of the land they manage.
- Land managers are innovative and, given the right opportunities, will continue to adapt their systems to meet the needs of the catchment, their farm and their business.

The principles guiding investment in soil health are:

- Farmer to farmer learning, with emphasis placed on demonstrations and group supported activities.
- The importance of seeking solutions to problems from the land manager's point of view.
- Ensuring that solutions are evidence based, both in the science of land management and the engagement with and response of the land manager community.
- Supporting improved communication around soil and land health management so that the community is aware of opportunities and is engaged in the ongoing improvement in soil and land condition.
- Promoting whole of landscape approaches to soil and land health, including farming and land manager activities to manage the soil that are complementary to the biophysical and economic condition of the Catchment.

Water

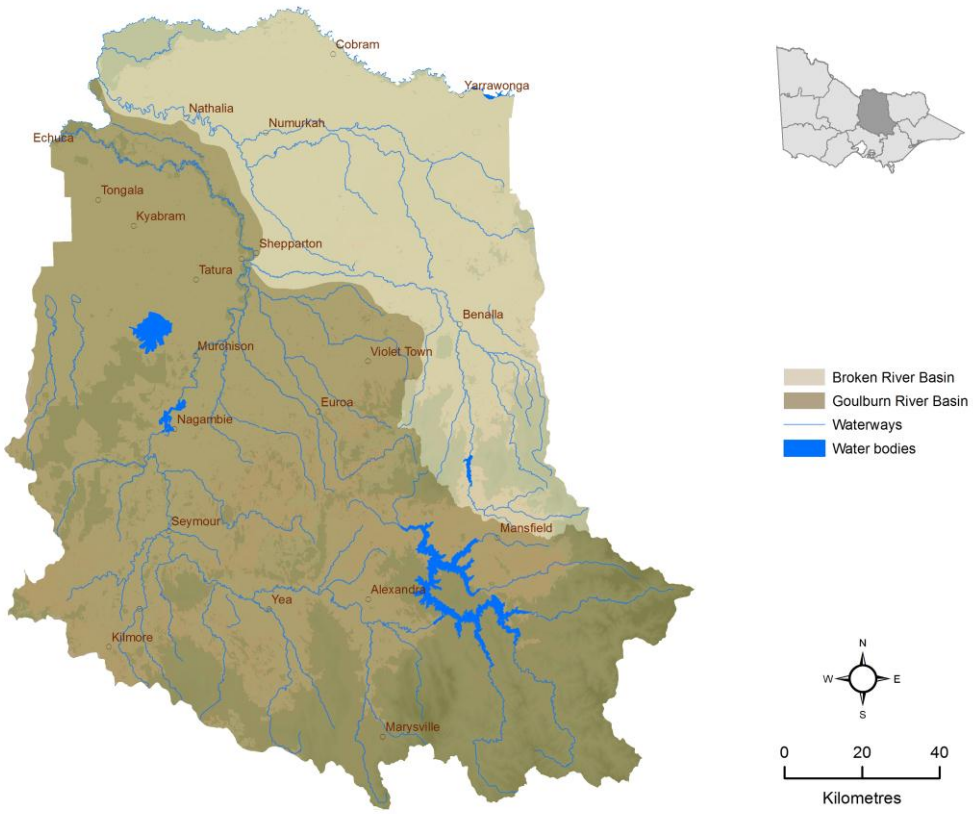

Figure 5: River basins of the Goulburn Broken Catchment

Waterways, wetlands, floodplains and groundwater aquifers are an integral part of the Catchment providing many environmental, social and economic services. They underpin livelihoods, support agriculture and urban centres, contain significant flora and fauna habitat, have high recreational and aesthetic values, and are central to the culture of the Traditional Owners. There are two major river basins in the Catchment (Figure 5).

Goulburn River Basin

The Goulburn River Basin is Victoria's largest, covering 1.6 million hectares or 7.1 per cent of Victoria. The Goulburn River is 570 kilometres long, flowing from the Great Dividing Range upstream of Woods Point to the Murray River east of Echuca (figure 5).

Stream flow along the Goulburn River has been modified by two major features, Lake Eildon and the Goulburn Weir. Lake Eildon is located in the river's upper catchment. It has a capacity of 3,330 gigalitres, with 91 per cent of water released, on average, diverted for irrigation and urban purposes (G-MW 2012). With such a large storage capacity, operation of the lake fully regulates downstream flows in all but wet years (GB CMA 2005).

The Goulburn Weir is approximately 235 kilometres downstream of Lake Eildon, north of Nagambie. It holds 25 gigalitres and is usually held close to full capacity to facilitate the diversion of water to supply Waranga Basin and the irrigated lands of the Central Goulburn Irrigation Area. Waranga Basin holds 432 gigalitres and is used to store winter and spring flows from tributaries downstream of Lake Eildon to be used across the irrigated region from Tatura to Echuca and into the North Central Catchment.

Broken River Basin

The Broken River Basin is 772,386 hectares or 3.4 per cent of Victoria's total area. The Broken River is a tributary of the Goulburn River. The basin also includes the catchment of the Broken Creek that diverges from the Broken River west of Winton Wetlands and flows north-west to the Murray River.

Flow in the Broken River is extremely variable between seasons and years. Two major storages have been constructed within the catchment, Lake Nillahcootie and Lake Mokoan. Lake Nillahcootie is located in the Broken River's upper catchment and stores flows to provide water for irrigation, urban and stock and domestic use. Lake Mokoan was constructed in 1971 but was decommissioned as an active reservoir in 2010 and its natural wetland habitat is being restored.

Floodplains

Natural floodplains across the Catchment have an important ecological function with floods supporting vegetation and wetlands on the floodplain as well as the river channel ecology. Floodplains have been highly modified with built infrastructure to support and protect urban centres and agricultural production, as well as levees to protect these areas from flooding impacts. River regulation has altered flood frequency and patterns.

Across the Goulburn Broken Catchment, some 5,800 square kilometres of floodplain areas have been mapped up to the extent of the 100-year Average Recurrence Interval flood.

Wetlands

Wetlands exist at the interface between land and water and play a key role in the maintenance of the hydrological, physical and ecological health of river systems. Wetlands perform numerous vital functions including water purification, nutrient processing and retention, maintenance of watertables, flood protection, erosion control and groundwater recharge. They also provide habitat, refuge, and breeding and nursery areas for many species. Wetlands are also valued for recreation by many communities.

Over 2,000 wetlands have been mapped and classified covering approximately 86,000 hectares of the Catchment. These wetlands include large permanent lakes, floodplain billabongs, small spring soaks, alpine bogs and shallow freshwater depressions. Most wetlands hold water for short periods of time, occur on private land, are less than 10 hectares in size and occur on the region's floodplains.

Of these a number have been formally recognised for their conservation significance. These include the internationally significant Barmah Forest Ramsar site, 10 wetlands of national significance listed in the Directory of Important Wetlands of Australia (DIWA) and 111 wetlands of bioregional significance identified for the National Land and Water Resource Audit (Bioregional). In addition, a large number of wetlands support state and nationally threatened species and communities, and birds listed on international agreements and conventions.

Groundwater aquifers

Groundwater is found in aquifers across the Catchment (layers of underground sediments or fractured rock). There are a number of significant deep and shallow groundwater aquifer systems that are varied in their character and connectivity.

In the upper and mid parts of the Catchment, fresh groundwater is primarily used for domestic and stock consumption. In the lower Catchment groundwater is used to support agricultural production, as well as stock and domestic supply.

More saline shallow aquifers across the lower floodplains are also managed as a threat to prevent degradation of land productivity, natural assets and downstream assets including the River Murray.

Many ecosystems rely on groundwater for some or all of their water requirements including terrestrial vegetation, waterways, wetlands and their dependent fauna. Except for rivers and streams that have groundwater sustained base flows, these are known as groundwater

dependent ecosystems (GDEs). To date they have not been broadly identified or mapped across the Catchment. The impact of changes in groundwater quantity and quality on GDEs is determined by the degree and nature of their groundwater dependency.

CURRENT CONDITION

River and wetland condition in Victoria is assessed using the Index of Stream Condition (ISC) and the Index of Wetland Condition (IWC). These measures assess factors such changes in hydrology, water quality, form and condition, vegetation health and species diversity. The ISC and IWC can be used to classify rivers and wetland ecosystems into the following condition states outlined in table 6.

In 2004, the ISC assessment of selected river reaches in the Goulburn and Broken basins indicated that most are in moderate (54 per cent) and poor (23 per cent) condition, with a small proportion in very poor condition (6 per cent). About 11 per cent of reaches were assessed to be in good condition and 5 per cent in excellent condition.

Since European settlement the extent of some wetland types have declined by 20 to 60 per cent in the Catchment. These have predominantly been smaller and less permanent wetlands as they are more susceptible to threats such as drainage and water regulation. Conversely, the construction of artificial impoundments has increased the total extent of wetlands in the region since European settlement.

Since 2009 IWC assessments have been carried out on 116 wetlands across the region. Results indicate that most are in good (38 per cent) and moderate (40 per cent) condition, and a small proportion are in excellent (6 per cent), poor (15 per cent) and very poor condition (<2 per cent). The fact that about 57 per cent of wetlands are in moderate to very poor condition indicates that many wetlands in the region are still subject to threatening processes. The results also indicated that wetlands on public land are generally in better condition than those on private land, although there are still examples of wetlands in good condition on private land.

State	Near Natural	Ecological Healthy	Sustainable Working	Highly Modified / Degraded
Values	High degree of naturalness, moderate-low recreational, wilderness, tourism	High degree of naturalness, high recreational and tourism, water supply	Moderate naturalness, some significant species, high recreational and tourism, water supply and delivery, low to medium agriculture and/or urban pressure	Low level of naturalness, moderate recreational and tourism, intensive production, high flow modification / water supply, agriculture or urban pressure high
Condition	Excellent	Good	Moderate /Poor	Poor / very poor
Modification	Very Low	Low	Moderate	Moderate to high
Basis ISC	50-45	44-35	34-15	24-0
				
Examples	Big River R68 / Ryans Creek R17	Howqua River R70 / Yea River 55-57	Seven Creeks / Hollands Creek R14	Goulburn River R 1-9 / Mollisons Creek R42,43
Naturalness	Very High	High	Med	Low-Very Low
Socio-Economic	Low	Low	High	High

Table 6: Waterway values and condition states

Note: Waterways in near natural states generally have low socio economic values as they are often located in remote and intact catchments that limit public access and recreational opportunities. They are also generally unregulated and not directly used to supply water for agricultural or urban consumption.

SIGNIFICANT THREATS

Four drivers of change identified in the RCS: climate variability, land-use change, water policy reform, and increasing farm production, providing both threats and opportunities to water. Specific activities and processes that threaten the condition of waterways, floodplains, wetlands and groundwater, which can result from one or more of the drivers, include:

- catchment clearing
- groundwater extraction
- pest plant and animal invasion
- snag removal
- stock access to riparian zones
- waterway regulation and flow diversion
- urban and agricultural development, including irrigation

These activities and processes are linked to:

- physical degradation of riverbanks and channels
- reduced water quality and temperature
- loss of instream and riparian habitat and complexity
- modified flow and flood regimes
- decline in the diversity and abundance of biodiversity
- reduced primary production and nutrient cycling
- changes to river and floodplain morphology
- disruption of lifecycles and breeding cues
- high watertables and salinity
- waterlogging
- reduced groundwater resources

Whilst the ecological value of floodplains is well recognised, they also pose a significant flood risk to the many town centres established within floodplain areas. Examples of these centres include Shepparton, Seymour, Benalla, Euroa, Numurkah and other centres on floodplains and valley floors. Floods also impact on agricultural production.

In monetary terms, the average annual flood damage (AAD) cost within the Goulburn Broken Catchment is well over $30 million per annual (Read Sturgess & Associates (2001). In addition to monetary losses, there are significant recovery issues associated with human suffering. The AAD determined in 2001 would have increased in light of inflation (CPI), additional infrastructure build on floodplains, greater population, etc. It is anticipated that AAD increases could double to $60 million per annum (pers. comm. Guy Tierney).

Climate variability, leading to reduced rainfall, and extraction pressures are threats to groundwater aquifer assets, in terms of water availability and quality.

MANAGEMENT

The monitoring and management of water assets across the Goulburn Broken Catchment is undertaken by multiple organisations including G-MW, Goulburn Valley Water (GVW), Environmental Protection Authority (EPA), DPI, DSE and Local Government as well as the Goulburn Broken CMA. These, and other organisations partner with community groups and individual landholders to undertake a range of natural resource and community based activities, including fencing, revegetation, pest plant and animal control, resnagging and monitoring to protect water assets across the Catchment. These onground works are complemented by projects including the development and implementation of environmental water delivery plans (with the Commonwealth and State Environmental Water Holders and through multi-agency forums such as the River and Water Contingency Planning Group and the Regional Water Quality Forum) and floodplain management and planning.

In the Shepparton Irrigation Region, infrastructure including groundwater pumps, surface water drains and the undertaking of intensive groundwater and drain monitoring is seeking to protect wetlands and rivers from rising groundwater and high salinity levels.

At a local level, community involvement in the management of water across the region continues to be strong with programs such as WaterWatch and RiverConnect continuing to

deliver a highly successful community education program with activities being integrated into natural resource management programs. Works undertaken by landholders and the community to improve terrestrial biodiversity and soil health can also improve the condition of water assets.

GUIDING CURRENT THINKING

The Goulburn Broken Regional River Health Strategy Addendum 2010 (GB CMA 2010e), the Water Quality Strategy 2002 (GB CMA 2002) and the Floodplain Management Strategy 2002 (GB CMA 2002) provide a basis for action on water. Groundwater management plans or water supply protection areas have been developed to manage extraction of deep lead groundwater aquifers. The revised Regional Waterway Management Strategy, currently under development, will be critical in guiding future direction in response to the State Government's new policies as outlined in the Victorian Waterway Management Strategy.

There is a range of Federal and State treaties, conventions, initiatives, legislation, policies and strategies that direct the management of rivers, floodplains and wetlands. Those of particular relevance include the Commonwealth *Water Act 2007 and EPBC Act 1999*, State *Water Act 1989* and Northern Region Sustainable Water Strategy (DSE 2009), with a full listing found in Appendix one and two of the full RCS.

Important international treaties, conventions and initiatives that direct management:

- China Australia Migratory Birds Agreement 1986
- Republic of Korea Australia Migratory Birds Agreement 2002
- Japan Australia Migratory Birds Agreement 1974
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979
- The Ramsar Convention on Wetlands 1971.

ASSET IDENTIFICATION AND PRIORITISATION

The River Value and Environmental Risk System (RiVERS) was used to help develop the first round of Regional River Health Strategies (RRHS). RiVERS is an asset inventory, which documents the environmental, social and economic values and threats associated with river reaches across Victoria. The priority river reaches identified in the current Goulburn Broken RRHS with the use of RiVERS are listed in table 7 and identified in figure 6.

The development of the next iteration of RRHs will be informed by the Aquatic Values Identification and Risk Assessment (AVIRA) system. AVIRA builds on RiVERS, however it will importantly identify priority wetlands in addition to priority river reaches. AVIRA values and threats process are documented in Peters (2009). To date priority wetlands have been identified by their international, national and bioregional significance and the conservation status of the flora and fauna they support. Some of these priority wetlands are listed in table 8 and identified in figure 6.

Groundwater is considered as both an asset and a threat. Sustainable groundwater management of is undertaken through the establishment of groundwater management areas and the development of groundwater management plans. Local management rules are developed that outline specific arrangements for managing the groundwater resource, for example how water will be shared in times of shortage. Management plans are designed to protect and support both agricultural productivity and natural resources.

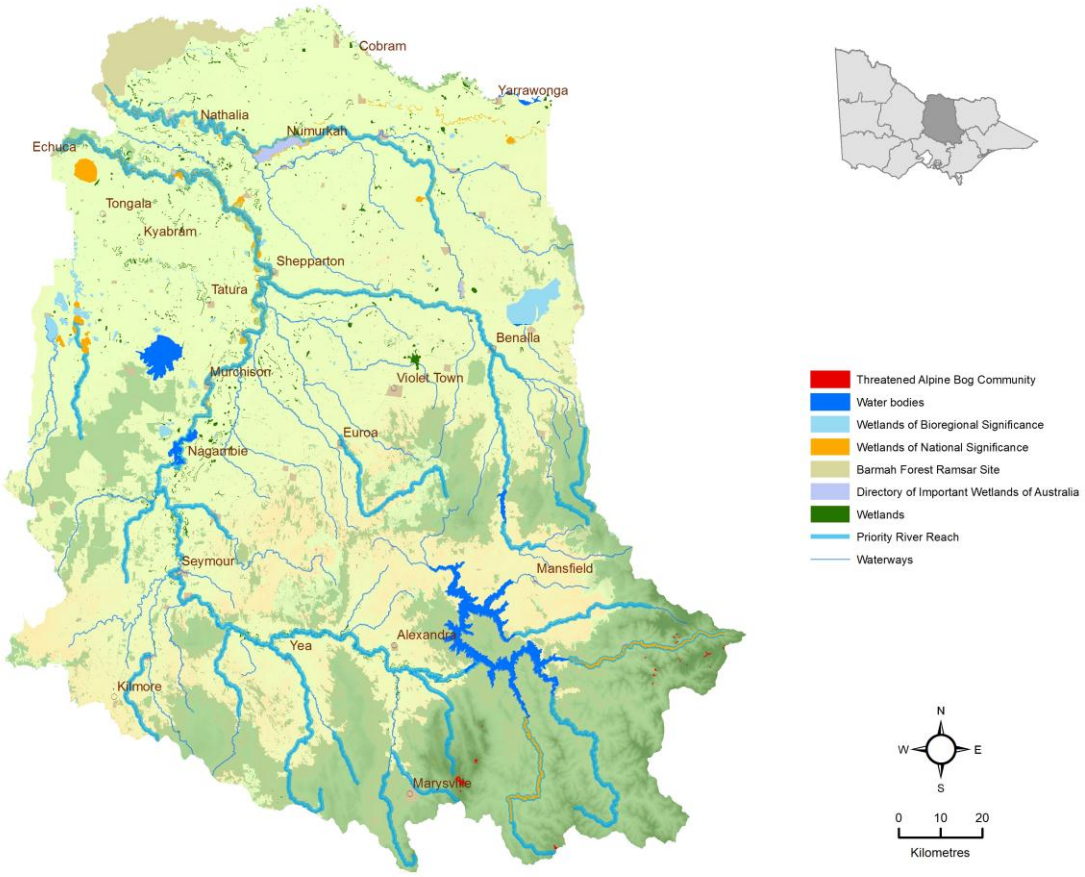

Figure 6: Priority waterways and wetlands of the Goulburn Broken Catchment

Table 7: Priority waterways and their significance

Waterway	Significance
Goulburn Basin	
Goulburn River	The river has many environmental, social and economic values. It is a Heritage River and is association with wetlands of national significance and contains an ecologically healthy reach. It supports many **threatened species** including **Murray cod, Silver perch, Macquarie perch, Barred galaxias, Spotted tree frog and Alpine bent**. It contains many important cultural heritage sites, provide water for agriculture and urban centres within and downstream of the basin, and supports a variety of recreational activities such as fishing and boating.
Seven Creeks	The waterway supports the **threatened Trout cod** and **Macquarie perch**.
Seven Creeks	The waterway supports the **threatened Macquarie perch**.
Gobarup Creek	Association with wetlands of national significance.
Hughes Creek	The waterway supports the **threatened Macquarie perch** and **Murray cod**.
King Parrot Creek	The waterway supports the **threatened Macquarie perch**.
Yea River	The waterway supports the **threatened Macquarie** perch.
Acheron River	Environmental Site of Significance.
Taggerty River	The river contains ecologically healthy and representative reaches and supports the **threatened Barred galaxias.**
Rubicon River	The waterway supports the **threatened Barred galaxias**.
Big River	It is a Heritage River, contains ecologically healthy and representative reaches, and supports the **threatened Spotted tree frog**.
Howqua River	It is a Heritage River and has high economic values.
Delatite River	It has high economic values and supports the **threatened Murray cod**.
Broken Basin	
Broken River	The river is association with wetlands of national significance and supports the **threatened Murray cod, Macquarie perch** and **Silver perch**.
Holland Creek	The creek supports the **threatened Macquarie perch**.
Ryans Creek	The creek contains ecologically healthy and representative reaches.
Broken Creek	The creek supports the **threatened Murray cod** and is association with wetlands of international (Ramsar) and national significance.

Table 8: Priority waterways and their significance

Wetland(s)	Area (ha)	Significance	Description
Barmah Forest	29,500	Ramsar listed TLM Icon Site	Along with the adjoining Millewa forest in NSW, it forms the largest river red gum forest in the world. One of Victoria's largest waterbird breeding areas. **Protects 38 rare or threatened plant species.**
Kanyapella Basin	2,581	DIWA listed	Mixed river red gum forest and black box woodland. Protects the nationally **threatened River Swamp Wallaby Grass**. Provides flood retardation. Important waterbird breeding area.
Muckatah Depression	2,909	DIWA listed	A long (over 60 km) and narrow prior stream depression connecting larger wetlands. It protects a number of threatened plant species and provides important habitat for waterbirds including the **threatened Brolga**.
Central Highlands Peatlands	33	DIWA listed	Five separate Sphagnum moss dominated bogs located along rivers and gullies in the Central Highlands surrounded by wet to dry sclerophyll forest.
Gaynor Swamp	300	DIWA listed	A large red gum lignum swamp that supports tens of thousands of water birds including migratory species.
Wanalta Wetland Complex	1,572	DIWA listed Bioregional	Four hydrologically connected wetlands. Valued for their size, rarity, species diversity and waterbird habitat, including breeding habitat for the **threatened Brolga**. Can receive environmental water via the Wanalta creek and irrigation infrastructure.
Doctors Swamp	200	Bioregional	One of the most intact red gum swamps in Victoria. Supports a diverse number of species including 73 wetlands flora species and 44 wetland fauna species. Can receive environmental water via irrigation infrastructure.
Reedy Swamp	130	DIWA listed (part of the lower Goulburn listing)	Supports thousands of waterbirds. It is a significant breeding area for colonial nesting waterbirds including the **threatened Royal Spoonbill**. Can receive environmental water via irrigation infrastructure and provides important drought refuge.
Kinnairds Swamp	96	Regional	A red gum swamp that protects the largest known population of the nationally threatened rigid water milfoil in Victoria. It provides important breeding habitat for waterbirds including the **threatened Royal Spoonbill**. The wetland is a popular recreational site for local and regional community members. Can receive environmental water via irrigation infrastructure.
Black Swamp	16.5	Bioregional	A small red gum swamp that protects the nationally **threatened River Swamp Wallaby Grass** and **Australasian Bittern**. It can receive environmental water via the Nine Mile Creek and irrigation infrastructure.
Moodies Swamp	180	DIWA listed (part of the Broken Creek listing)	A large cane grass wetland that provides important habitat for waterbirds including the **threatened Brolga** and **Eastern Great Egret**. It protects the nationally threatened rigid water milfoil and can receive environmental water via the Broken Creek and irrigation infrastructure.
Winton Wetlands	8,750	Bioregional	The largest wetland restoration project in the southern hemisphere. The wetland complex provides important habitat for a large number of waterbird species including the migratory Lathams Snipe and **protects seven nationally threatened flora species.**
Alpine bogs	54	National	Areas that protect the nationally **endangered Alpine Sphagnum Bogs** and Associated fens ecological community. Found in small pockets across alpine, subalpine and montane areas in the south of the region.
Stockyard Plains	225	Bioregional	A cane grass dominated wetland that provides important breeding habitat for the **threatened Brolga**. The wetland is a mix of public and private land and can receive environmental water via irrigation infrastructure.
Tahbilk Lagoon	280	Bioregional	A large billabong connected to the Goulburn River near Nagambie. The wetland is a biological hot spot that protects a number of **threatened species** including the **broad-shell turtle**, the most **southerly remnant freshwater catfish population in Victoria** and the largest known **watershield (native waterlily) population** in Victoria. The water is managed by G-MW and the majority of the surrounding freehold land has been owned and managed by Tahbilk Winery for over 100 years.
Carlands Swamp	68	DIWA listed (part of the Broken Creek listing)	On private land the wetland is the most eastern tangled lignum swamp in Victoria.
Lades spring wetland	<1	Regional	A rare button grass dominated spring wetland on private property in the Highlands. Pollen cores indicate the wetland is over 1000 years old. Recent investigations have found this and other spring wetlands in the area support culturally significant Aboriginal artefacts.
Yea Wetlands	6	Regional	Protects the nationally and internationally threatened hemiphlebia damselfly (living fossil). The wetland is also an important local and regional recreational and educational resource.
Horeshoe Lagoon	20	Bioregional	A billabong on the mid Goulburn River. One of only few wetlands in the region in excellent condition.

People

The Goulburn Broken CMA (2012) estimates that for every $1 spent by government in natural resource management, at least another $1.50 (and as high as $4) is spent by the Catchment community (VCMA 2012). The community's ongoing investment in catchment management has been critical to the success of past RCSs, and will be critical to the success of this one.

Involvement by the community in catchment management is broad based. For example in 2006–07, 86 per cent of agricultural-based businesses surveyed in the Catchment reported NRM issues on their property. Encouragingly, 99 per cent of those, or 5,055 businesses reporting NRM issues also reported they were actively addressing these problems on their farm (Montecillo 2012).

In addition to the effort undertaken by landholders on private land, community-based networks and groups achieve significant catchment management outcomes on public and private land across the majority of the Catchment. Figure 7 shows the coverage of Landcare networks and CMNs alone.

As at 2012, these community networks and groups include:

- Landcare groups (78 groups, 3000 volunteers)
- Landcare networks (six networks, see figure 7)
- Conservation Management Networks (five networks, see figure 7)
- Community sustainability, climate change action, sustainable farming groups (about 25)
- Waterwatch Community Waterways Monitoring Program
- Traditional Owner organisations
- Committees of management

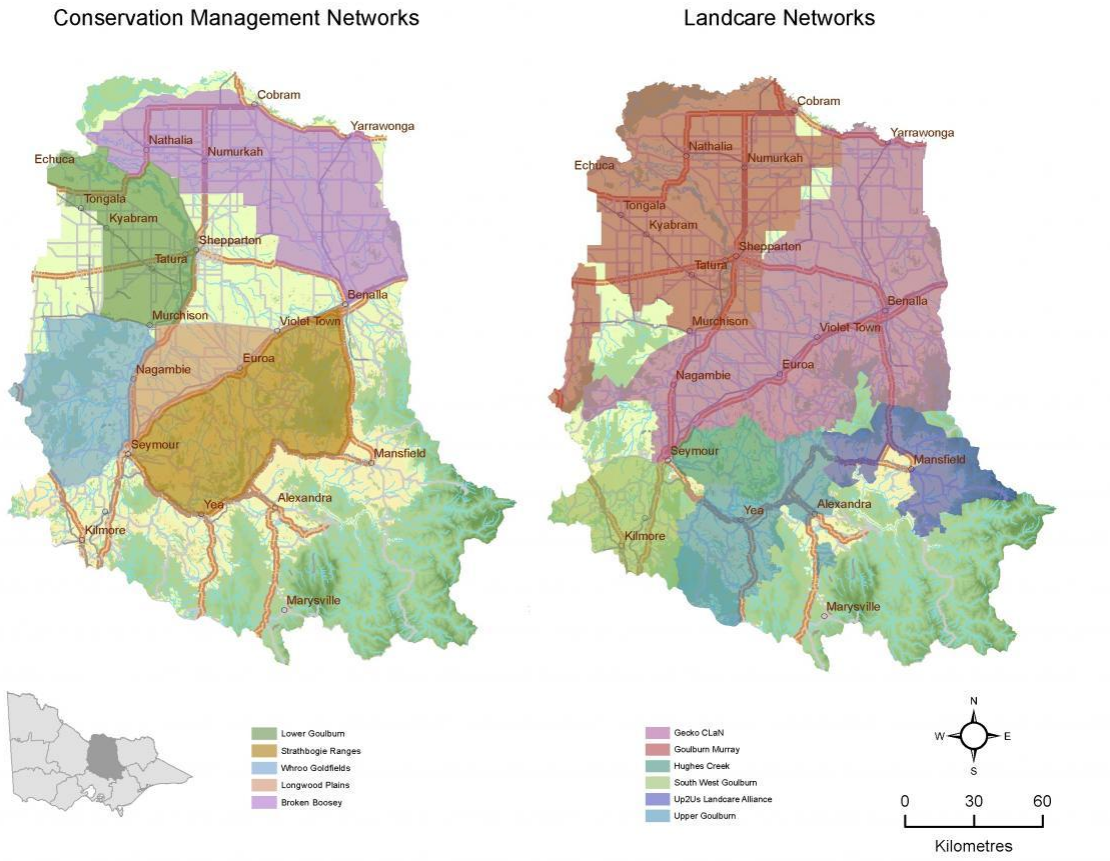

Figure 7: Conservation Management Networks and Landcare Networks across of the Goulburn Broken Catchment

These groups are critical partners in RCS implementation. They bring labour, skills, experience, knowledge and vision. For example, in 2009-10, Landcare groups and networks conducted 262 activities in the Catchment involving 6,217 people who donated 28,101 hours of volunteer time (GB CMA 2011)

Formal groups of people with an interest and/or technical expertise are also brought together to inform and achieve NRM outcomes in partnership with government organisations. These groups are important, contributing local information and skills to management of the Catchment. Examples of these groups include:

- Goulburn Broken CMA Community Advisory Committees
- Issue or sub-strategy based community working groups
- Program based technical advisory committees
- Governance networks, for example all agencies involved in the implementation of strategic priority actions identified in the Hume Strategy for Sustainable Communities 2010-2020
- Partnership projects with Registered Aboriginal Parties.

Because successful catchment management depends on individual land managers and groups to implement most of the changes, an understanding of their capacity and motivation helps to develop appropriate support tools. It is difficult to assess ongoing involvement of individuals in catchment management, although some indicators are available for groups. For example the Goulburn Broken CMA collects information about community-based groups via an annual report card process. These reports provide an indication of how Landcare groups see themselves. In 2010-11, the average network health self-rating was 4.5 out of 5, while the average group health self-rating was 3.5 (GB CMA 2012). Overall, Landcare group health is variable, depending on such factors as viable projects, funding and group and member activity.

Collaborations between organisations, including community groups and government agencies, have been critical to success catchment management in the Goulburn Broken for more than two decades. The overall condition of these collaborations, as indicated by the "collaborations and communities" was rated in the Goulburn Broken CMA Annual Report 2011-2012 (GB CMA 2012) as satisfactory.

In order to ensure that ongoing collaborations are possible with community groups, threats to their resilience need to be understood and addressed. These threats include:

- volunteer burnout and waning enthusiasm
- changing government priorities and support, including funding
- loss of access to co-coordinators
- limits to voluntary action
- financial ability to invest
- increasing competition for time and resources resulting in less ability to undertake NRM activities

Changes in community dynamics inherent in trends like amenity migration and increased numbers of absentee landholders (Barr 2011) may also affect a collective vision for catchment management and operation of community-based programs such as Landcare. Farmer investment in catchment management may not be a high priority where market instability and an ageing farm population are disincentives for investment in future farm production. Alternatively, emerging farm industries in some areas might require modified approaches to catchment management (Barr 2011).

The key State policy guiding this area is the Victorian Landcare Program Strategic Plan (DSE 2012). Relevant Goulburn Broken CMA sub-strategies include the Community Landcare Support Strategy, Communication and Marketing Strategy 2010-2011 (GB CMA 2010b) and Community Engagement Action Plan 2011- 2012 (GB CMA 2011).

Organisations across the Goulburn Broken will continue to work to strengthen the involvement of the Catchment's people in natural resource management. This will be in part facilitated by the Goulburn Broken CMA and will include a review of existing sub-strategies, including the Community Landcare Support Strategy (Draft) (GB CMA 2010c) to identify the actions required to achieve this.

Planning at the SES scale will assist in achieving this aim as actions can be tailored specifically to community strengths and needs. As the state of Landcare, Conservation Management Networks and other community based natural resource groups improves, they will continue to be a valued part of the achievement of NRM objectives across the Catchment.

Glossary

Average Recurrence Interval (ARI): the likelihood of occurrence, expressed in terms of the long-term average number of years, between flood events as large as or larger than the design flood event. For example, floods with a discharge as large as or larger than the 100-year ARI flood will occur on average once every 100 years.

Connectivity: the degree to which the landscape facilitates or impedes movement between resource patches; thus, a landscape with high connectivity is one that provides functional connectivity regardless of what it looks like in terms of structural connectivity.

Drivers: external forces or conditions that can cause a system to change.

Ecological communities: are unique and naturally occurring groups of plants and animals. Their presence can be determined by factors such as soil type, position in the landscape, climate and water availability.

Ecological Vegetation Classes (EVC's): are a component of a vegetation classification system. They are groupings of vegetation communities based on floristic, structural, and ecological features.

Ecosystem: community of organisms plus the environment in which they live and interact.

Ecosystem services: resources and processes that are supplied by natural ecosystems including clean water and nutrient cycles.

Fragmented: refers to the absence or the underdevelopment of connections between the society and the groupings of some members of that society on the lines of a common culture, nationality, race, language, occupation, religion, income level, or other common interests.

Habitat: a place suitable for survival and/or reproduction of a particular plant or animal species; Note that structural connectivity could be used by a species for dispersal, but this is not considered to be habitat.

Intact: untouched, especially by anything that harms, defiles, or the like; uninjured; whole; undefiled; left complete or entire; not damaged.

Long term objectives: long term (20-30 year) goals for the system components of the Catchment -people, land, water and biodiversity. These objectives are found in the sub-strategies of the Goulburn Broken CMA. Achieving these objectives will contribute to the Vision being realised. In some instances these objectives may be related to known (or assumed) thresholds and tipping points.

Management measures: specific activities at an asset or SES scale aligned to the strategic priorities. Management measures will be found in the relevant sub-strategies and investment plans as they are operational in nature.

Relictual: a group of animals or plants that exist as a remnant of a formerly widely distributed group in an environment different from that in which it originated.

Resilience: the amount of change a system can undergo based on (its capacity to absorb disturbance) while retaining the same function, structure and feedbacks.

Social-ecological systems: linked systems of people and nature, taking into account cultural, political, social, economic, ecological and technological components.

State: commonly refers to either the present condition of a system or entity, or to a governed entity (such as a country) or sub-entity.

System: the set of state variables together with the interactions amongst them, and the processes and mechanisms that govern these interactions.

Thresholds: levels in underlying controlling variables of a system where feedbacks to the rest of the system change.

Tipping points: is the event of a previously rare phenomenon becoming rapidly and dramatically more common.

Vision: an aspirational statement outlining how the Catchment will look in 50 years' time.

Acronyms

ABA - Asset Based Approach

CaLP Act 1994 - Catchment and Land Protection Act 1994

CMA - Catchment Management Authority

CSIRO - Commonwealth Scientific and Industrial Research Organisation

DPI - Department of Primary Industries

DSE - Department of Sustainability and Environment

EPBC Act 1999 - Environment Protection and Biodiversity Conservation Act 1999

EVC - Ecological Vegetation Classes

G-MW – Goulburn-Murray Water

Goulburn Broken CMA - Goulburn Broken Catchment Management Authority

ISC - Index of Stream Condition

IWC - Index of Wet Condition

LGA - Local Government Area

MDB - Murray-Darling Basin

NRM - Natural Resource Management

RCS - Regional Catchment Strategy

SES - Social- Ecological System

SEWPAC – Department of Sustainability, Environment, Water, Populations and Communities

YYNAC - Yorta Yorta Nation Aboriginal Corporation

TCAC - Taungurung Clans Aboriginal Corporation

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