

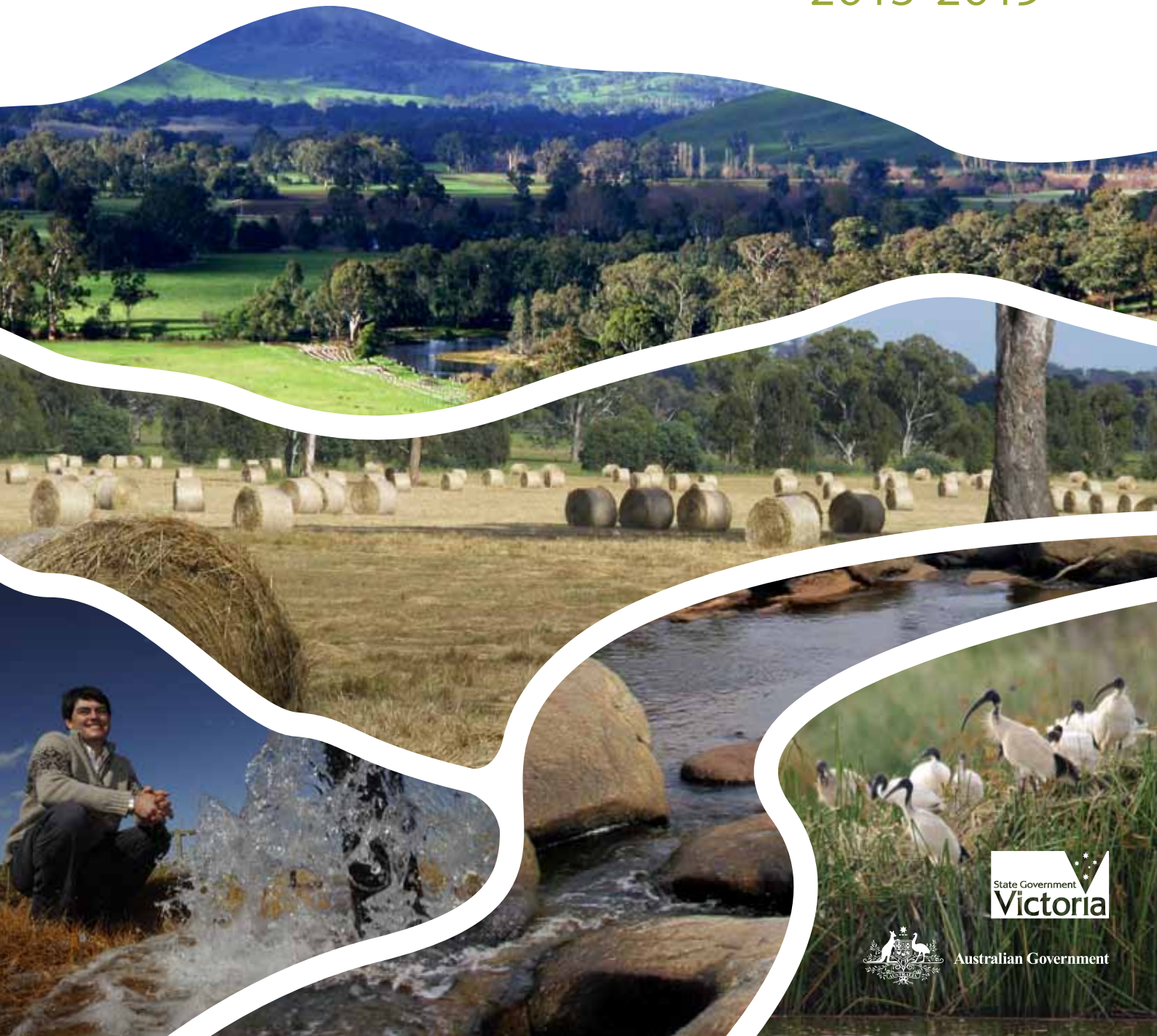


**GOULBURN  
BROKEN**

CATCHMENT  
MANAGEMENT  
AUTHORITY

# Goulburn Broken Regional Catchment Strategy

2013-2019



State Government  
**Victoria**



Australian Government

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## About this Regional Catchment Strategy

The Goulburn Broken Regional Catchment Strategy (RCS) 2013-2019 comprises three documents, each providing different levels of detail to meet the needs of 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 2013-2019* that provides a description of the Catchment, 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 detailed descriptions of biodiversity, land, water and people assets, including current condition and threats.

## Acknowledgment of Traditional Owners

The Goulburn Broken Catchment Management Authority acknowledges the Traditional Owners of the land in the Goulburn Broken Catchment and strongly respects the rich culture and intrinsic connection the Traditional Owners have to the land.



# Foreword

The 215,000 people living in the Goulburn Broken Catchment have an important stewardship responsibility for the health of the natural environment. One of the key roles of the Goulburn Broken Catchment Management Authority (CMA) is to develop a Regional Catchment Strategy (RCS). The RCS describes the importance of the Catchment in terms of its key assets such as its unique biodiversity, land, water and people. Most importantly, it sets the priorities and targets for directing the Catchment's resources over the next six years towards achieving environmental, social and economic benefits.

Since the last RCS was developed in 2003, the Catchment and its community have been affected by a number of natural disasters that have, and will continue to shape the Catchment. Following a decade of below average rainfall, drought and fires there have been a number of floods resulting in damage to farmland communities and natural assets. Events such as these, as well as other factors including highly variable water allocations, dairy industry restructure, a high Australian dollar, and other pressures related to the global financial crisis and increased competition, have contributed to a significant fall in the gross value of agriculture production in the Catchment.

As a result of the complexity and variable nature of these social, economic and environmental factors, the commitment has been made to using resilience in developing this RCS. Resilience is defined as a system's (such as a region, catchment, ecosystem, farm or industry) capacity to absorb disturbances, recover and continue to function in a desired way. Resilience thinking considers regions as complex systems where people and the natural environment continually interact and where changes in one will inevitably result in changes in the other. Importantly, the process for developing the RCS using a resilience approach requires that a large number of opinions and expertise (community and scientific) are considered to bring together a picture of a dynamic region influenced by multiple and complex drivers.

Building or maintaining the resilience of a catchment requires an understanding of how the system functions and its limits to absorbing disturbances. Management measures are then designed to avoid reaching those limits or getting back within those limits where they have been reached.

To do this successfully the Goulburn Broken CMA recognises it has a critical role in forming and developing partnerships with the community and all

levels of government. A broad communication and engagement approach has been run that has, for the first time, embraced the use of social media and on-line engagement tools to bring together the information needed to develop this RCS. In tandem with more traditional face-to-face forms of consultation, we believe that this approach will lead to the development of a meaningful strategy with strong catchment ownership.

The RCS is a living document that will be regularly reviewed and updated over its life. This will require continuous engagement of community and partner agencies to ensure an adaptive management approach is used to enhance the resilience of the Catchment as we collectively face the challenges of the future.



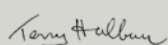
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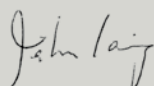


# We the undersigned ...

commend the consultative process that was undertaken by the Goulburn Broken Catchment Management Authority to develop the Goulburn Broken Regional Catchment Strategy 2013-2019 and look forward to working in partnership with other stakeholders to deliver the Strategy outcomes.



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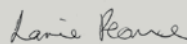
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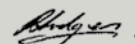
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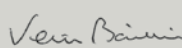
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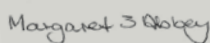
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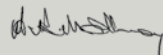
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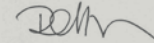
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# Introduction

The protection and conservation of natural resources is fundamental to the long-term viability of the Goulburn Broken Catchment and the wellbeing and prosperity of its people.

The Goulburn Broken Regional Catchment Strategy (RCS) provides the integrated planning framework or 'blueprint' for management of land, water and biodiversity resources. It is the overarching strategy for directing action, under which there are sub-strategies and action plans that implement priorities of government and the community.

The approach to catchment management has evolved from a focus on the single threat of salinity in the 1980s to integrated catchment management (salinity, water quality, biodiversity) in the mid-1990s and then to a focus on valuing outcomes such as ecosystem services (including maintaining clean water and air and productive soils) in the early 2000s.

The focus now is placing greater emphasis on understanding the relationship between people and nature, and how to maintain and improve the resilience of these systems to continue to deliver the critical ecosystem services in a dynamic, ever-changing world.

## Evolving approaches to catchment management

This RCS builds on more than 25 years of lessons and achievements in integrated catchment management.

The community-agency partnership model that was fostered when salinity plans were developed and implemented in the late 1980s remains a feature today.

The first Goulburn Broken RCS coincided with the advent of catchment management authorities in 1997. The RCS was world's best practice and resulted in stronger integration of salinity, water quality and biodiversity management, significant progress towards objectives, and a greater understanding of challenges. Important activities included whole farm planning, surface and sub-surface water management, introduction of multi-benefit incentives, decentralised floodplain management decisions, factoring environmental needs into newly introduced bulk water entitlement processes, and supporting community involvement (GB CMA 2003).

Since the RCS was updated in 2003, the Catchment and management processes have been vigorously

tested by climate extremes: record-breaking droughts, fires and floods.

By 2009, the longest drought on record was causing fundamental shifts in priorities and partnerships, including a rapid bringing together of water users to develop water saving and sharing plans. Watering of environmental features and efficient use of water on farms have become high priorities for Catchment management (GB CMA 2009a).

Also in recent years, indigenous groups have become more active in catchment management partnerships, and understanding of progress at a whole-of-Catchment scale has significantly improved through detailed annual reporting (GB CMA 2009a).

This RCS renewal promotes more responsive approaches to inevitable and unforeseeable change. More than ever, strong and flexible partnerships with agencies and communities are seen as critical to Catchment health. All partners have been given an opportunity to be involved in RCS development using traditional and online means and are encouraged to be involved with implementation.

Against this background, the following guiding principles for developing the RCS were adopted.

## Guiding principles

The following principles define the scope and nature of the RCS beyond requirements of the *Catchment and Land Protection Act 1994* and the Victorian Catchment Management Council (VCMC) guidelines.

1. A systems approach will drive the RCS
2. Systems of common characteristics (instead of concrete boundaries) will be the scale of decision making
3. Prioritisation will be based on these systems and their assets
4. Understanding system resilience (and tipping points) will drive decision making
5. Science and data will underpin resilience definitions of systems and knowledge gaps will be filled (over time)
6. These systems should be used to guide land-use planning decisions
7. The cost-to-benefit ratio of strategies will be considered
8. A high level of engagement will be undertaken to involve community and partners
9. Engagement with investors/government is imperative (a 'no surprises' approach to be employed)

### ► RCS IN ACTION



### Waterwatch in the Goulburn Broken Region

Waterwatch is a community water quality monitoring program that has been operating in the Goulburn Broken Catchment since 1993. The program, coordinated and delivered by Goulburn Valley Water, brings together school and community groups, concerned individuals and landowners, councils and water authorities. Monitors test the quality of their local stream or water source so that practical actions can be taken to maintain and improve water quality.

The program provides water testing gear to interested people and trains them to use that equipment correctly. A large body of water quality data has been collected since the program's inception and can be viewed at: [www.vic.waterwatch.org.au](http://www.vic.waterwatch.org.au). Community volunteer monitors from widely separated sites can share their results to quickly identify problem areas. The more we understand the issues around river health, the better we can care for our waterways.

The data is also used by resource management agencies to monitor river health changes following improvement works.





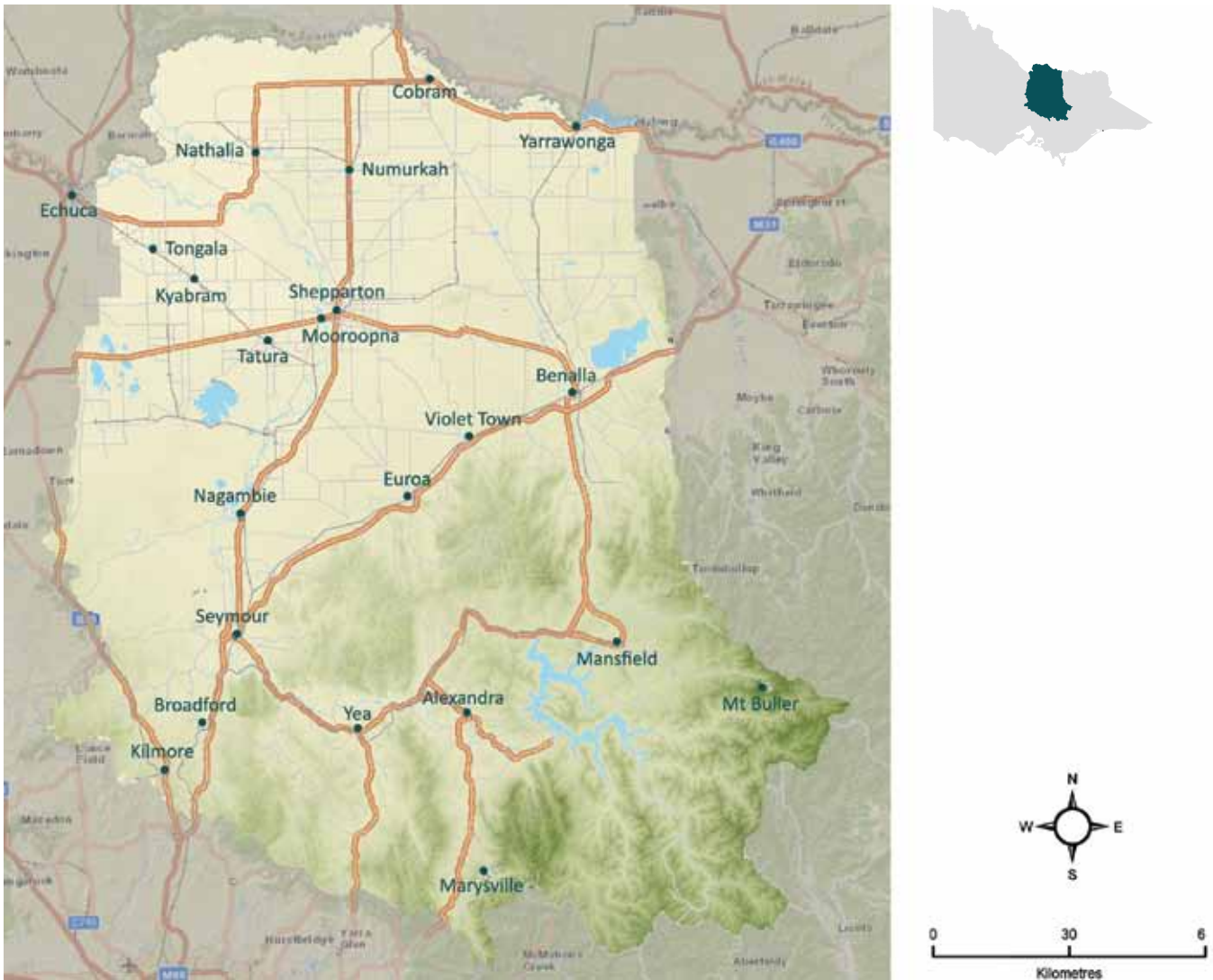
CHAPTER ONE

# The Goulburn Broken Catchment



Goulburn River valley from the Acheron Cutting  
Photo: Mark Turner Goulburn Broken CMA





Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, PC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

*Figure 1: The Goulburn Broken Catchment*

This chapter summarises the Goulburn Broken Catchment's biodiversity, land, water and people assets, including their values and condition. The supplement *Assets of the Goulburn Broken Catchment* provides further details.

The Goulburn Broken Catchment covers 2.4 million hectares, extending north from near the outskirts of Melbourne to the River Murray on the border with New South Wales (Figure 1). The Catchment boasts a diversity of landscapes, including seasonally snow-covered alps, forests, granitic outcrops, gentle sloping plains, box woodlands and red gum floodplains.

Average annual rainfall varies across the Catchment, from 1600 millimetres in the high country to 400 millimetres in the north-west (Bureau of Meteorology 2012). Two major river basins cover 2 per cent of the Murray-Darling Basin, or about 10.5 per cent of Victoria. Inflows to the Catchment are 3,559 gigalitres per year, or about 11 per cent of the total annual inflows to the Murray-Darling Basin (Murray Darling Basin Authority 2010).

## BIODIVERSITY

Biodiversity in the Goulburn Broken Catchment encompasses a variety of ecosystems, including native vegetation communities, wetlands and waterways, and the associated plants, fungi, animals, microbes and genetic diversity they contain. Although terrestrial habitat is largely about native vegetation, it also includes rocky outcrops, fallen timber and soil.

Native vegetation is found across the Catchment as remnants, linear patches such as roadsides, revegetated sites and large reserves. Native vegetation types include the riverine forests in the Barmah and Lower Goulburn National Parks with associated Murray Pine and Buloke woodlands; spring-soak wetlands and rocky outcrops of the Strathbogie Ranges; box-ironbark forests; box-gum grassy woodlands; and wet forests interspersed with temperate rainforests to the south of the Catchment.

These native vegetation types provide important habitat for many species found across the Catchment, including many that are threatened. There are 2,750 native plant species, of which 337 or 13 per cent are threatened, and 493 vertebrates, of which 110 or 22 per cent are threatened (GB CMA 2010c). 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).

## LAND

Land and soil across the Catchment is a fundamental part of the natural environment, supporting ecosystems and the lifestyles and livelihoods of the Catchment's communities.

Most land in the Catchment is privately owned, with 1.4 million hectares used for dryland agriculture and 270,000 hectares for irrigated agriculture. There are 800,000 hectares of public land (Montecillo 2012), including extensive areas for conservation.

Primary industries include dairy, horticulture, viticulture, livestock production (beef, sheep, goats, pigs and poultry), cropping, timber production and aquaculture. Smaller enterprises include thoroughbred and standardbred horse breeding, nurseries, mushrooms, turf and cut-flower production. Other industry includes food processing, tourism and recreation. Land use increasingly supports lifestyle living, particularly towards the south of the Catchment.

The Victorian Geomorphological Framework combines information about landforms and landscapes to provide a useful basis for understanding land use across the Catchment. Three key landscapes and dominant soil types support the variety of land uses: the Eastern Uplands to the south, containing extensive native forests, parks and production forestry and primary production, mainly on the highland fringes; the Western Uplands, which has a variety of land uses on the western edge of the Catchment; and the Northern Riverine Plain, which comprises nearly 70 per cent of Victoria's irrigated agriculture (Feehan 2012).

## WATER

Waterways, floodplains, wetlands and groundwater aquifers are an integral part of the Catchment, providing many environmental, social and economic values. They underpin livelihoods, supporting agriculture and urban centres, contain significant flora and fauna habitat, have high recreational and aesthetic values, and are central to the culture of Traditional Owners.

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. Streamflow along the Goulburn River has been modified by two major features, Lake Eildon and the Goulburn Weir, which regulate river flow and supply water for irrigation, urban and environmental purposes. Along its course, users of the Goulburn River have adapted to the altered state or modified flow regime introduced by regulation. The lower reaches of the Goulburn River are bordered by the Lower Goulburn National Park. The National Park is a linear park protecting the lower Goulburn River from Shepparton to its junction with the Murray River near Echuca and is home to an array of aquatic-dependent native plant and animal communities (GB CMA 2002b).

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, which 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 were constructed within the basin, Lake Nillahcootie and Lake Mokoan. Lake Nillahcootie is in the Broken River's upper catchment and stores flows to provide water for irrigation, urban, stock and domestic use. Lake Mokoan was constructed in 1971, but was decommissioned as an active reservoir in 2010. Its natural wetland habitat is being restored (GB CMA 2002b) and is now known as Winton Wetland.

Wetlands are also an important feature, with over 2,000 wetlands 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 are on private land on the Catchment's floodplains, hold water for short periods of time and cover less than 10 hectares (GB CMA 2002b).

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 from flooding impacts. River regulation has altered flood frequency and patterns. Across the Catchment, some 5,800 square kilometres of floodplain have been mapped up to the extent of the 100-year Average Recurrence Interval (ARI) flood.

Groundwater is found in aquifers, which are layers of underground sediments or fractured rock (DSE 2009). The significant deep and shallow groundwater aquifer systems across the Catchment vary in character and connectivity. Fresh groundwater is extracted for domestic and stock use as well as irrigation and urban supply. Some shallow and saline aquifers across the floodplains are managed as a threat to productivity and natural assets. Several groundwater systems are important elements of the river and wetland ecosystems.

#### ► RCS IN ACTION



### Barmah a forest of significance

Barmah Forest is Victoria's largest River Red Gum reserve (approximately 28,500ha), located on the Murray River floodplain between Tocumwal and Echuca.

Together with the adjoining Millewa Forest in NSW, the Barmah-Millewa Forest is one of six 'icon sites' of The Living Murray Program managed by the Murray-Darling Basin Authority. The forest has been reserved as a National Park, and is also Ramsar-listed, containing internationally-significant wetlands that support many threatened native plants, birds, fish, frogs and reptiles. Management partners include the Yorta Yorta Nation Aboriginal Corporation, Parks Victoria and a range of agencies and contractors.

Partner agencies have roles in land and water management for Barmah Forest, including planning, monitoring and reporting on water related outcomes (including the use of environmental water).





## PEOPLE

The Goulburn Broken Catchment has a rich and diverse community. The Catchment has an estimated population of 215,000 people (Montecillo 2012), which includes 6,000 Indigenous Australians, many who identify as Traditional Owners of this area.

The Traditional Owners of the Goulburn Broken Catchment have an intrinsic connection to the land and water resources within the landscape. Traditional Owners in the north of the Catchment are represented by Yorta Yorta Nation, whose traditional lands include the northern plains of the Goulburn and Murray Rivers. Yorta Yorta Nation is defined by eight

clan groups: Moira; Kailtheban; Wollithiga; Nguaria-iliam-wurrung; Ulupna; Kwat Kwat; Bangerang and Yalaba Yalaba. Some Bangerang people and other groups prefer to be recognised as a distinct cultural group.

The Cooperative Management Agreement 2004, between the State of Victoria and Yorta Yorta Nation, is significant for land managers as it provides Yorta Yorta with a formal role in managing designated areas of Crown Land in northern Victoria.

The south of the Catchment forms part of the traditional lands of Taungurung Clans, which includes the mountains and rivers to the Great Divide. Taungurung Clans

is defined by nine clans: Buthera Balug; Look William; Moomoom Gundidj; Nattarak Balug; Nira Balug; Warring-Illum Balug; Yarran-Illam; Yeeren-Illam-Balug and Yowung-Illam Balug. Traditional Owners' knowledge of land and water resources and cultural heritage in the landscape is rich and unique.

The Catchment boasts a strong history of Indigenous advocacy and leadership locally, nationally and internationally. The Yorta Yorta Nation Aboriginal Corporation (YYNAC) and Taungurung Clans Aboriginal Corporation (TCAC) are Registered Aboriginal Parties, under the *Aboriginal Heritage Act 2006* (Figure 2).

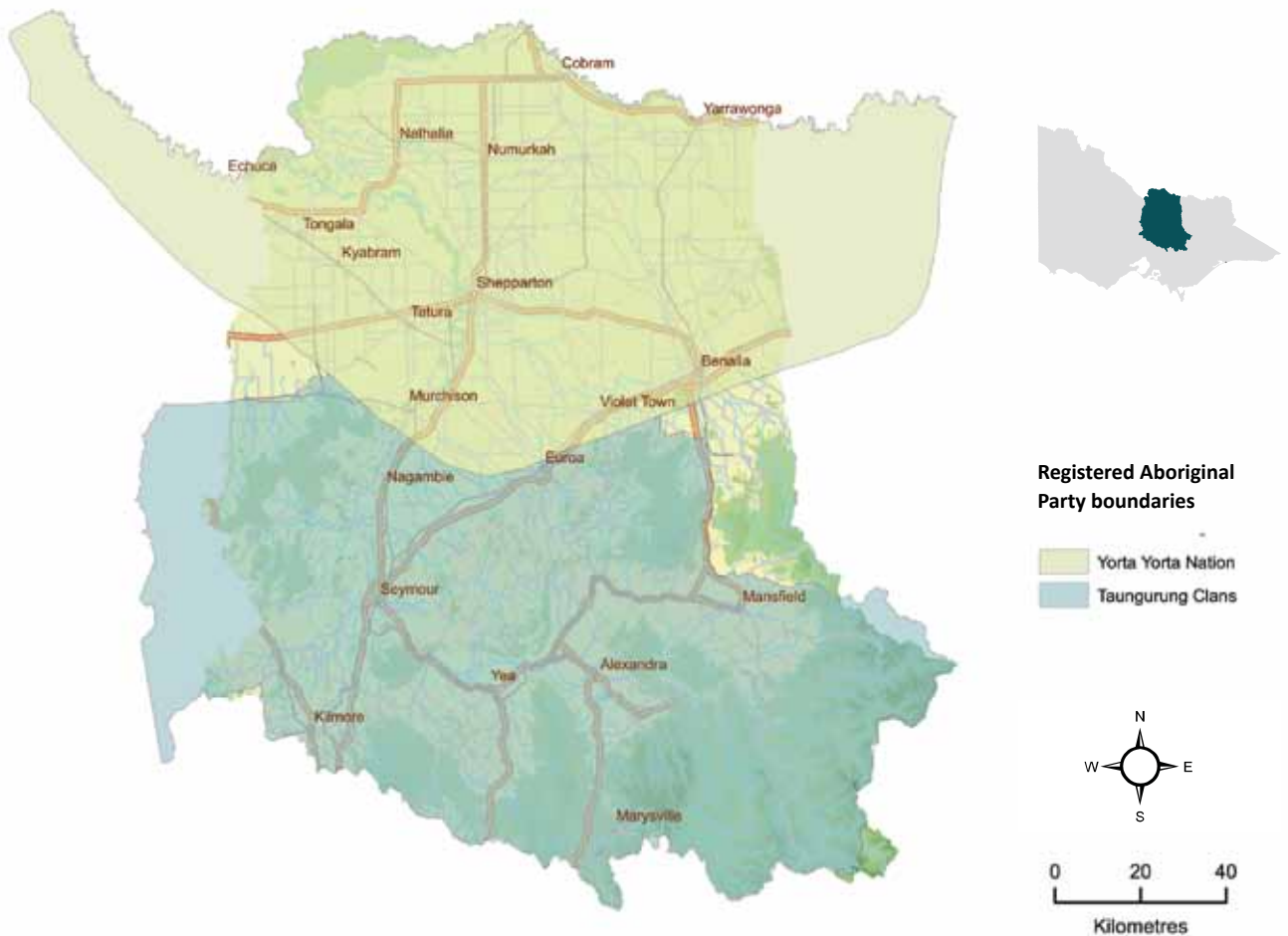


Figure 2: Registered Aboriginal Party boundaries across the Goulburn Broken Catchment



Approximately 10 per cent of the Catchment population was born overseas. Migrants mainly from the British Isles took up landholdings in the 1800s. Since World War II there has been an influx of migrants from Italy, Greece, the Netherlands, Germany, New Zealand and Turkey and many other countries. Over 90 per cent of people reside in regional towns and centres with Shepparton/Mooroopna the largest population centre (Montecillo 2012).

Shepparton is home to a large culturally and linguistically diverse community, including newly arrived refugees from The Congo, Sudan, Afghanistan and Iraq. Other significant settlements include Seymour and Benalla (DPCD 2011).

The population is growing by about 1.23 per cent, or 2,600 people each year, which is slightly higher than average for regional Victoria, and is expected to reach around 255,500 in 2026 (Montecillo 2012).

Natural resource-based industries underpin the Catchment's economy. Livestock, dairy, fruit, vegetable, grape and other food production and processing contribute to the

\$15.9 billion gross regional output (2009 figures) with a gross value of agriculture production in the Catchment in 2009–10 of \$1.16 billion. Primary production and manufacturing account for about 30 per cent of the 77,000 or more jobs in the economy (Montecillo 2012).

Other industries include construction and trade, tourism, utilities, transport and communications. Nature-based and cultural heritage tourism and recreation are also important employers (Montecillo 2012).

Involvement by the community in catchment management is broad based. It is estimated that for every \$1 spent by government in catchment management, at least another \$1.50 (and as high as \$4) is spent by the Catchment community (GB CMA 2012b). In addition to the effort undertaken by individual landholders on private land across the Catchment, a variety of networks and groups achieve catchment outcomes on public and private land. The Catchment also boasts a strong history of community leadership in responding to important catchment threats and issues, such as salinity.

## Current Catchment condition

The condition of the Goulburn Broken Catchment is summarised in this section. Further details are supplied in the supplement *Assets of the Goulburn Broken Catchment*. Catchment condition is also reported in Goulburn Broken CMA's Annual Report (GB CMA 2012b).

### BIODIVERSITY

The general rating of biodiversity condition across the Catchment is poor (Table 1), which is based on comparison with pre-European settlement condition and considers vegetation quality and extent, threatened species population trends, water regimes of environmental features, and the management systems in place (GB CMA 2012b). At a finer scale, biodiversity condition varies from poor to good condition (VCMC 2007), with some aspects improving and some declining (GB CMA 2010b).

Native vegetation extent, including diversity, is particularly important because it underpins most of the Catchment's species diversity. Variation in biodiversity condition across the Catchment is usually related to past activities, especially the clearing of vast tracts of native vegetation for agriculture in the plains and valleys.

Most remaining native vegetation is on public land, which covers one-third of the Catchment and is largely sloping or prone to flooding, although it is mainly regrowth following land uses such as mining and timber harvesting.

About 10 per cent of native vegetation remains on private land (GB CMA 2010c).

Progress against long-term targets listed in Goulburn Broken CMA strategies is on target (Table 1).

## LAND

Because land is used and valued in many ways (and often in ways that are not complementary) and there is no precise description of what is needed from soils in the future, it is extremely difficult, perhaps even futile, to assess the overall condition of land: good condition for one purpose might be poor condition for another purpose.

It is known that human activity has caused soil-loss rates to increase by a factor of several hundred times since European settlement, however there is no benchmark against which to assess the risk of continued degradation (Feehan 2012).

The capability of land and soils to sustainably support different uses depends on the type of use, the soil (depth, texture, acidity, stoniness, etc.) and the land (slope, aspect and geology) (Feehan 2012).

Some key components of land condition that relate to existing defined uses and values and which are amenable to management have been rated in Table 1.

Investment area	Long-term strategy progress	Catchment condition		
		1990	2012	Trend
Shepparton Irrigation Region salinity	On target	Poor	Good	▼
Environmental flows	On target	Poor	Good	▲
Riparian and instream habitat and channel form	Below target	Poor	Satisfactory	▲
Water quality (nutrients) in rivers and streams	Exceeding target	Very poor	Satisfactory	▲
Floodplain management	Exceeding target	Very poor	Poor	▲
Biodiversity	On target	Poor	Poor	•
Land health including dryland salinity	Below target	Poor	Satisfactory	▲
Invasive plants and animals	Below target	Poor	Poor	•
Collaborations and communities	On target	Poor	Satisfactory	▲

*Table 1: Long-term strategy implementation progress and Catchment condition*

### Notes:

Long term strategy implementation progress considers evidence of outputs completed against targets, including onground works and actions that improve management systems.

Catchment condition ratings consider evidence of environmental condition, social and economic health and management systems. Appendix 1 of the Goulburn Broken CMA Annual Report (2012) describes the ratings method.

The rating of Catchment condition in 1990 was determined using a 2012 understanding of the 1990 situation. It is a useful reference year because 1990 was the start of integrated catchment management and sufficient time has passed to ask meaningful questions of long-term change.

Trend dots indicate that current condition is static; arrows indicate that condition is improving (up arrow) or declining (down arrow).

The threat from high watertables, with associated salinity and waterlogging, is one land condition that applies to most uses and values, including agriculture, roads, housing, biodiversity and wetland health.

The condition of land related to irrigation salinity in the Shepparton Irrigation Region (SIR) improved from poor in 1990 to good in 2012, although the return of high rainfalls in 2010-2012 has recharged the soil profile. Improvements in salinity management since 1990, including infrastructure, will be severely tested if rainfall continues.

The story of land health, including dryland salinity condition, is similar, although the condition is expected to be more rainfall dependent because there has not been an equivalent installation of infrastructure to manage salinity.

The condition of land related to invasive plants and animals is considered to remain poor, with terrestrial and aquatic environments continuing to be vulnerable to new and emerging weeds and animal species, as well as long-established species, such as Paterson's Curse and foxes.





## WATER

The condition of water has been rated by separating its components according to how it is managed. For the purposes of this RCS, assessment of water condition includes environmental flows, water quality, riparian and instream habitat and channel form, and floodplain management, which includes protection of infrastructure (Table 1). In addition, stream salinity is assessed with irrigation and dryland salinity because its causes and management have to be considered simultaneously. Land-use change has resulted in flooding and high and saline watertables, threatening livelihoods and property.

Condition assessments considers both the benefits from water resources and the risks they present.

The condition of riparian and instream habitat and channel form and water quality are satisfactory (Table 1).

Stream regulation and degraded soils from changed land uses and natural events such as fire have caused the health of river reaches (related to instream and channel condition and water quality and supply) to decline.

The 2004 assessment of selected river reaches in the Goulburn and Broken basins indicated the following conditions: 5 per cent of reaches were excellent, 11 per cent were good, 55 per cent were moderate, 23 per cent were poor, and 6 per cent were very poor (DSE 2005).

Since European settlement the extent of some wetland types has declined by 20 to 60 per cent. 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. Assessment of 116 wetlands since 2009 indicated the following conditions: 6 per cent were in excellent condition, 38 per cent were good, 39 per cent were moderate, 15 per cent were poor, and less than 2 per cent were very poor.

Many wetlands are still under threat and public land wetlands are generally in better condition than private land wetlands, although there are still examples of wetlands in good condition on private land.

Floodplain flood management involves balancing provision of flood patterns for natural assets with reduced flooding impacts on built environments. Pre-development planning and flood response systems have improved significantly since 1990, although large opportunities for aligning floodplain flood management with the Environmental Water Reserve program, such as the lower Goulburn River floodplain, remain uncaptured. Flood protection is rated poor, although condition states for both measures have improved over time (Table 1). The condition of the Catchment related to environmental flows has improved significantly, consistent with greater government emphasis since 1990 on providing water for natural assets (Table 1).

## PEOPLE

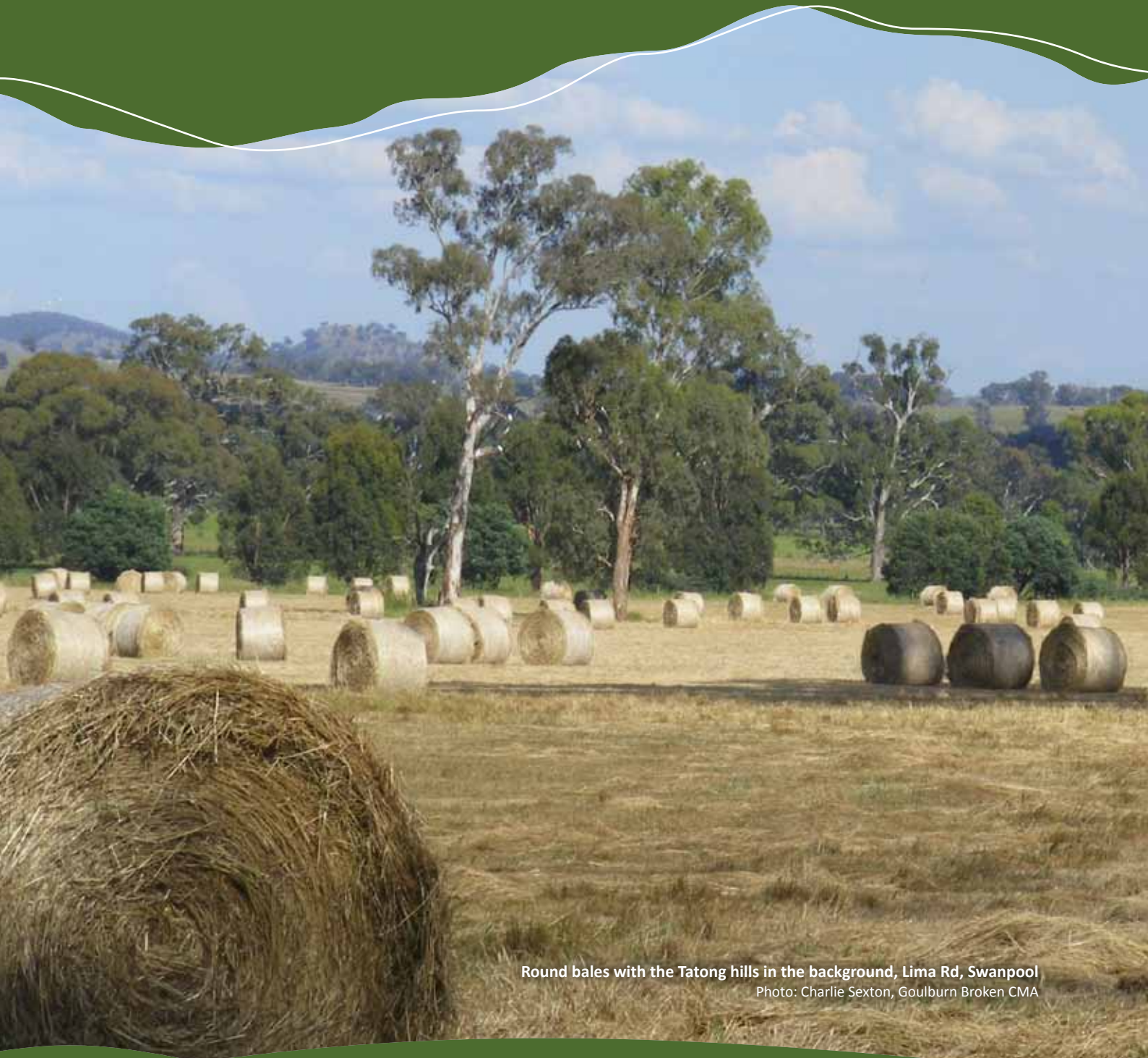
For every dollar invested by government, regional communities, including landholders, contribute more than one dollar, despite continuing challenges (GB CMA 2012b). This commitment, coupled with local leadership, has led to significant investment by Victorian and Australian Governments in major initiatives such as the Farm Water Program.

Because successful catchment management depends on individual land managers and groups to implement most of the changes, understanding their capabilities and motivations helps when developing 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 indicate how Landcare groups see themselves. In 2010-2011, the average network health self-rating was 4.5 out of 6, while the average group health self-rating was 3.5 (GB CMA 2012c). 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 other agencies, have been critical to successful catchment management in the Catchment for more than two decades. The overall condition of people involvement, as indicated by the “collaborations and communities” rating is satisfactory (Table 1).

## CHAPTER TWO

# The strategic framework



Round bales with the Tatong hills in the background, Lima Rd, Swanpool  
Photo: Charlie Sexton, Goulburn Broken CMA

Chapter two describes the resilience approach to RCS development and implementation, emphasising how individuals, communities and organisations need to be involved in decisions in an ever-changing world.

Key drivers of change are described and priorities are listed to address them.

This Chapter also outlines the RCS strategic framework, which focuses on two scales of decision:

- whole-of-Catchment (detailed in this chapter)
- sub-Catchment (detailed in Chapter three).

## The resilience approach

This RCS builds on the significant history of Catchment management described in the introduction.

Resilience is the ability of the Catchment's people and environment to absorb stress while continuing to function in a desired way.

A series of major events in recent years, from bushfires, droughts and floods to the global financial crisis, has severely tested the Catchment's communities and ecosystems, catalysing an emphasis on developing resilience in preparing this RCS.

The resilience approach to catchment management focuses on the connections between people and nature, how these connections change, and what can be done to achieve desired, balanced goals for resilience.

Consistent systems of people and nature are called **social-ecological systems** (SESs), which include elements such as land form, vegetation types, land uses, and social structure and dynamics. Figure 3 illustrates connections between such elements.

SESs exist at a range of connected scales, from site to the whole-of-Catchment. The scale chosen for decision making considers the balance between being small enough to understand the details sufficiently, while being large enough to allocate resources efficiently.

Two scales of SES are detailed in this RCS: the whole-of-Catchment and six sub-Catchment areas.

The six sub-Catchment SESs are referred to in this RCS as the 'SESs'. Chapter three includes background details for each SES and priorities for management.

Thresholds of resilience define the tipping point beyond which the characteristics of an SES change so much that the SES is no longer the same. Such changes, which are the result of slow disturbances or unexpected events, can result in changes to ecosystem services that are not desirable. The resilience approach includes identifying thresholds to guide efforts within each SES. Appendix one details resilience thinking further.

## DRIVERS OF CHANGE AND STRATEGIC OBJECTIVES

The resilience approach recognises the need for adapting to drivers of change by countering risks and capturing opportunities they present. The four main drivers of change identified in this RCS, through consultation with the community and technical experts, have been prominent for well over a decade, although how they impact has shifted. Their impacts also vary between SESs. Strategic objectives, described in detail in the following sections, guide decisions in adapting to these four highly connected drivers of change, namely:

- Water policy reform
- Land-use change
- Climate variability
- Increased farm production.



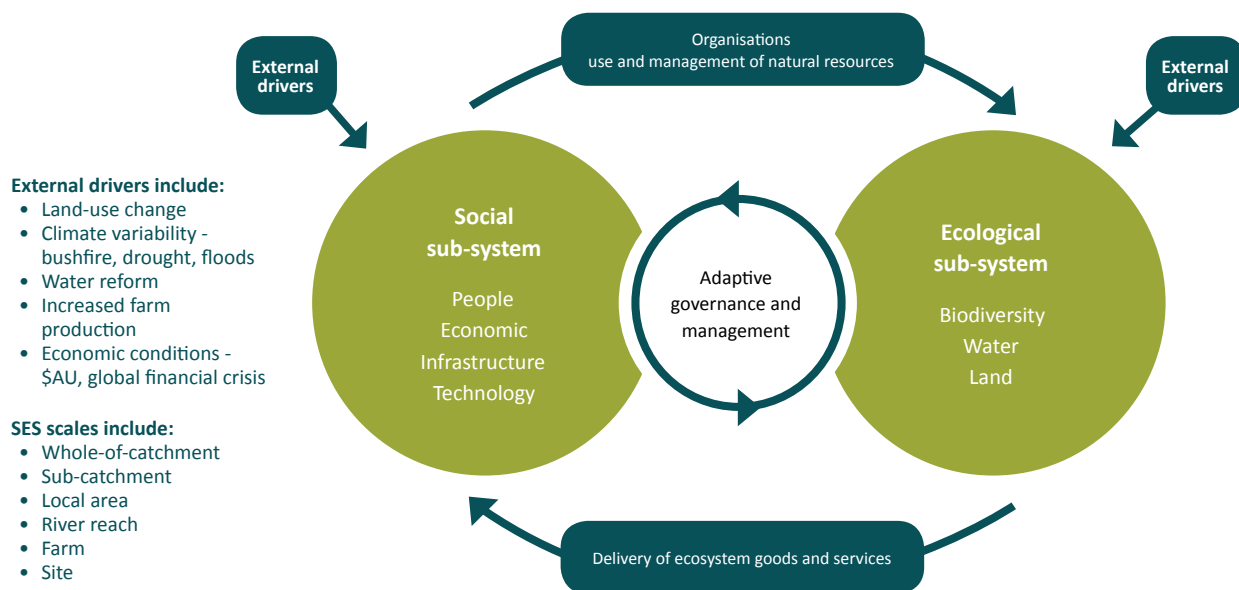


Figure 3: The social-ecological system model

Two additional strategic objectives, also described in detail in the following sections, to further guide development of a resilience approach over the next six years:

- To embed resilience
- To strengthen partnerships.

The importance of people in SESs is reflected by the heavy involvement of the community and partners in developing this RCS, which will continue as a feature of implementation.

Further details on the resilience approach are in Appendix one.

## The RCS structure

The RCS includes four distinct levels of detail in decision making that apply at either or both whole-of-Catchment and sub-Catchment SES scales, as shown in Figure 4. These inform decisions on funding and action, which usually happens annually. Four of six strategic objectives are framed around the drivers of change.

Level 1 is the **50-year vision**, which provides a general sense of what the community would like the Catchment to be:

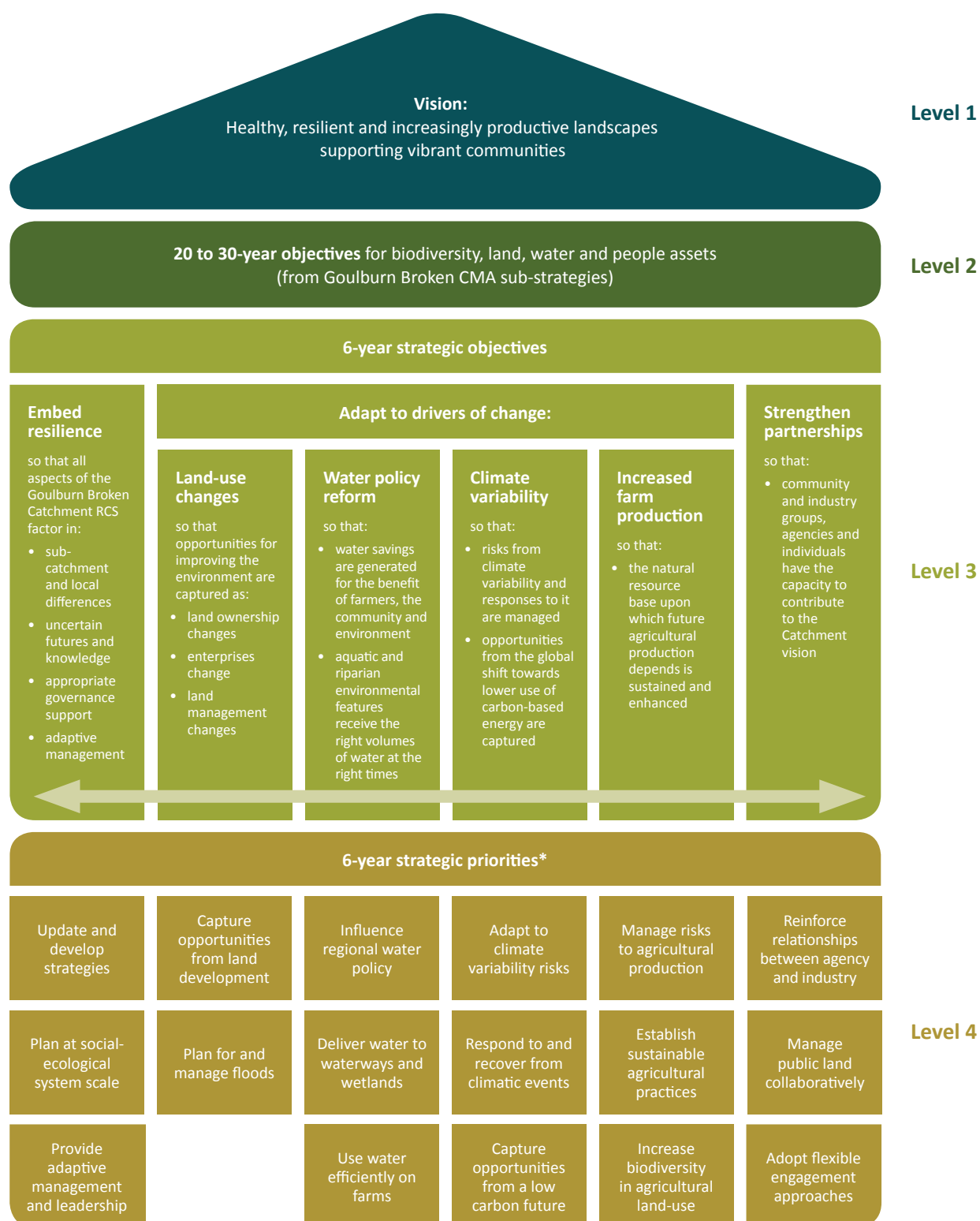
*Healthy, resilient and increasingly productive landscapes supporting vibrant communities*

This vision reflects the important relationship between protection and use of the Catchment's natural assets, which generate environmental, economic and social benefits.

Level 2 holds the **long-term 20 to 30-year biodiversity, land, water and people objectives**, listed and detailed later in this chapter. They guide efforts by defining what is to be achieved within the different asset classes of biodiversity, land, water and people; it is assumed that achieving these objectives will position the Catchment community on the path to achieving the vision. These objectives are drawn from a suite of detailed sub-strategies (Appendix two).

Level 3 is made up of **6-year strategic objectives** that help communicate the emphasis for management; it is assumed that achieving these objectives will enable progress towards 20 to 30-year biodiversity, land, water and people objectives.

Level 4 includes **6-year strategic priorities**, which describe the focus for bundles of management measures needed to address the drivers of change; it is assumed that achieving these strategic priorities will indicate achievement of strategic objectives. Management measures generally describe the tasks to be undertaken over the next six years.



\* Strategic priorities describe the focus for bundles of management measures

Figure 4: The Goulburn Broken Regional Catchment Strategy 2013-2019 objectives hierarchy

# Whole-of-Catchment scale decisions

Many significant natural resource management problems are similar across much of the Catchment, leading to the most efficient and effective decisions being made at the whole-of-Catchment scale. This section describes the RCS' strong emphasis on whole-of-Catchment scale issues through sub-strategies, which support decisions made at smaller geographic scales.

## RCS sub-strategies and 20 to 30-year objectives - Level 2

Sub-strategies have been critical in Goulburn Broken Catchment decision making for over two decades. Sub-strategies are usually whole-of-Catchment scale, focusing on assets, threats or supporting themes (Figure 5).

Because the context behind each sub-strategy varies and is continuously changing, sub-strategies are renewed according to their own context, independent of the over-arching RCS renewal cycle. Sub-strategies are developed in consultation with government and community organisations and individuals, providing details for investment plans and priorities. Appendix two summarises how each sub-strategy has evolved.

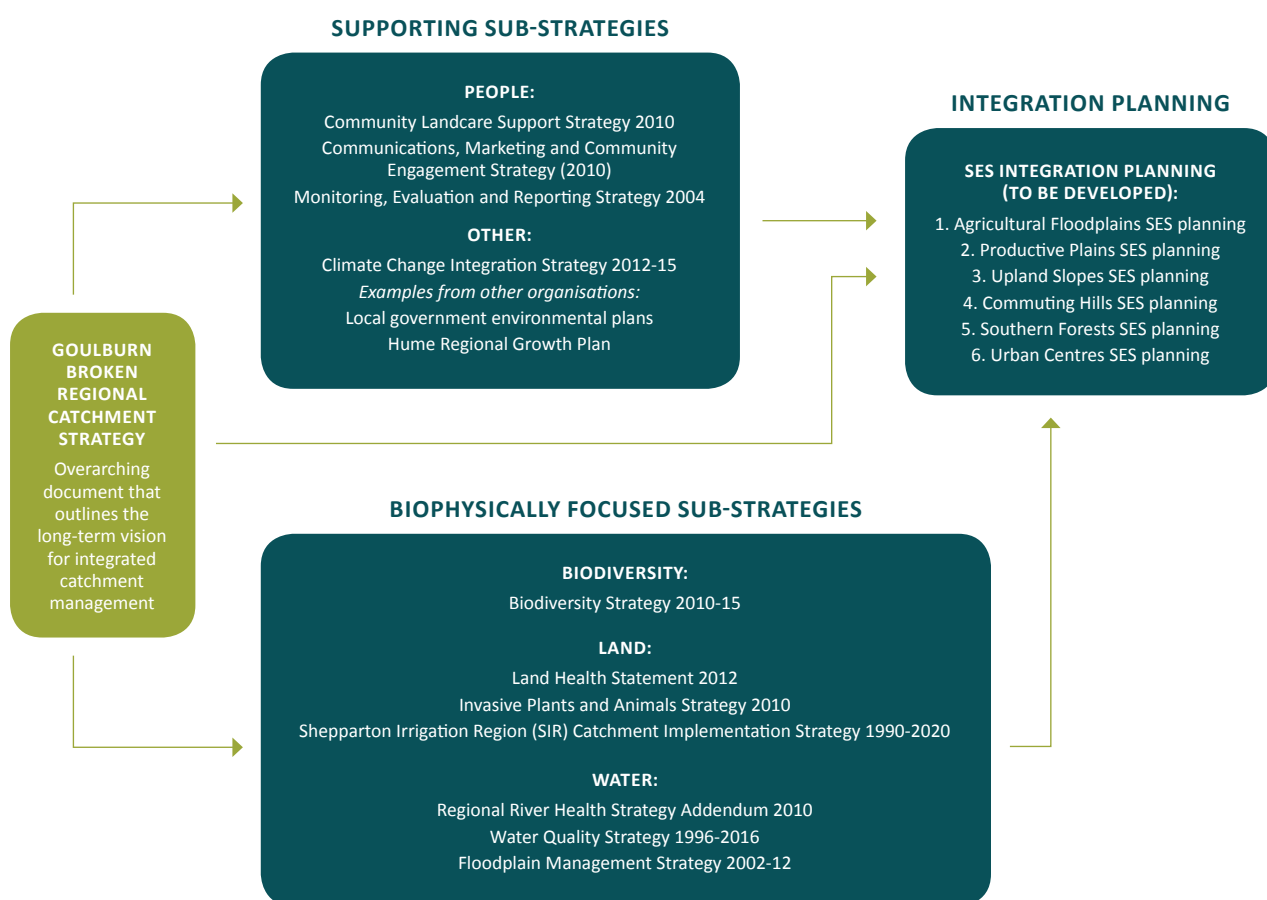


Figure 5: The relationship between the RCS, sub-strategies and SES planning



The RCS provides the strategic framework for aligning sub-strategy implementation by listing the sub-strategies' 20 to 30-year objectives for biodiversity, land, water and people and providing an overview of assets, threats and priorities at whole-of-Catchment and SES scales.

Each sub-strategy has evolved its own way of defining long-term objectives, often guided by Victorian or Australian Government processes. These objectives are listed. Updating the sub-strategies will include testing how these objectives align with resilience thresholds and how they relate in each SES.

## BIODIVERSITY OBJECTIVES

The Biodiversity Strategy for the Goulburn Broken Catchment, Victoria 2010-2015 (GB CMA 2010c) outlines a series of management measures for how long and short-term biodiversity objectives will be met, and prioritises geographic areas for two main actions: 1) protecting ecosystem services and 2) enhancing existing remnant vegetation through corridors and linkages.

The Biodiversity Strategy considers Victorian and Australian Government policies and strategies, such as those that guide the identification and protection of threatened species and communities: the *Victorian Flora and Fauna Guarantee (FFG) Act 1988*, the *Commonwealth Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* and the Victorian Native Vegetation Framework 2002.

### The Biodiversity Strategy contains 20 to 30-year objectives covering the extent, quality and connectivity of native vegetation:

- Maintain extent and quality of all native habitat at 2005 levels in keeping with the goal of 'net gain' listed in Victoria's Biodiversity Strategy 1997
- Increase the extent of native vegetation in fragmented landscapes by 70,000 hectares by 2030 to restore threatened Ecological Vegetation Classes (EVC) and to improve landscape connectivity
- Improve the quality of 90 per cent of existing (2005) native vegetation by 10 per cent by 2030.

### ► RCS IN ACTION



## Important assets to wildlife and production

The Land and Biodiversity Team have worked over many years to increase the extent and resilience of the grassy woodlands that dominate the Catchment.

This has included projects such as Bush Returns and more recently Woodland Tender, where landowners are paid to allow natural regeneration and protection of high quality grassy woodland areas. Land and soil care projects in the Yea Hills have also been very successful.

The team continues to support community-driven revegetation projects such as: the Grey-crowned Babbler in the Longwood Plains, Superb Parrot in the north of the Catchment; and Regent Honeyeater in the Lurg Hills. Further work will build on past projects with an aim of ensuring that the unique and threatened grassy woodlands can continue to thrive into the future.



## WATER OBJECTIVES

The Goulburn Broken Regional River Health Strategy (GB CMA 2002b), the Goulburn Broken Water Quality Strategy Review (GB CMA 2002c), the Goulburn Broken Regional Floodplain Management Strategy (GB CMA 2002d) provide a basis for action on waterways, wetlands and floodplains. Shallow watertable and salinity management in the SIR is delivered through the Shepparton Irrigation Region Catchment Implementation Strategy (GB CMA 2010b). Groundwater management plans or water supply protection areas have been developed to manage extraction of water from deep lead groundwater aquifers.

A suite of treaties, conventions, initiatives, legislation, policies and strategies direct the management of rivers, floodplains and wetlands, especially the *Commonwealth Water Act 2007* and *EPBC Act 1999*, *State Water Act 1989* and the *Northern Region Sustainable Water Strategy (NRSWS)* (DSE 2009). Appendices three and four provide a full listing.

Important international treaties, conventions and initiatives include:

- 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
- Convention on Wetlands of International Importance (Ramsar Convention) 1971.

### The 20 to 30-year objectives for water, derived from the relevant sub-strategies, are:

#### River health

Long-term objectives include:

- 350 kilometres of river maintained in excellent or good condition
- Ecological flow objectives met in high value reaches
- Nutrient loads reduced or improved
- Riparian condition protected or enhanced along 550 kilometres of river
- In-stream habitat enhanced or reinstated along 140 kilometres of river.

#### Wetlands

- The maintenance and improvement of significant wetlands feature in Shepparton Irrigation Region groundwater and salt management planning (Oppy 2010).

#### Water quality

The resource condition target is to reduce potential phosphorus loads by 65 per cent by 2016 (GB CMA 1996). This will be achieved by reducing phosphorus loads from:

- Irrigation drains by 50 per cent
- Dryland and diffuse sources by 20 per cent
- Wastewater management facilities by 80 per cent
- Urban storm water
- Intensive agricultural industries and local water quality issues.

#### Floodplains

- Reduce the impact of flooding on the built environment
- Provide ecosystems with natural flooding patterns where appropriate.

#### Salinity

- Manage shallow groundwater for salinity control within the SIR by improved irrigation management on farms, improved surface water management within drainage catchments and consistently pumping groundwater with appropriate reuse over 216,000 hectares
- Keep increases to salinity levels of the River Murray at Morgan at or below 8.9 EC (electrical conductivity units)
- Ensure no net increase in stream salinity in the Goulburn River upstream of Goulburn Weir.

## LAND OBJECTIVES

The Goulburn Broken Dryland Landscape Strategy (GB CMA 2009b), Shepparton Irrigation Region Catchment Implementation Strategy (GB CMA 2010b), Goulburn Broken Invasive Plants and Animals Strategy 2010-2015 (GB CMA 2010a), 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 relevant to land are the Soil Health Strategy (DSE 2012d), 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 2010).

### The 20 to 30-year objectives for land in the Goulburn Broken Catchment are:

#### Soil health

- Protect the environmental values and ecosystem services provided by healthy soils on public and private land, and productive values on private land
- Build soil health to complement productive values on private land
- Reduce the impact of threats from inappropriately managed land on natural and built public and private land
- Promote sustainable farming practices to ensure the improved productivity from irrigated and dryland agricultural level
- Prioritise protection of foothills and river valleys of highland areas from salinisation threatening significant terrestrial and aquatic assets.

#### Invasive plants and animals

- Prevent the establishment of new and emerging weeds
- Invasive species in high value asset areas treated to protect assets
- Manage the impact of established pest animals such as foxes and rabbits.

## PEOPLE OBJECTIVES

Objectives for involving people in catchment management are guided by the Victorian Landcare Program Strategic Plan (DSE 2012e). Relevant Goulburn Broken CMA sub-strategies include the Goulburn Broken CMA Community Landcare Support Strategy (GB CMA 2010d) and the Goulburn Broken CMA Communication and Marketing Strategy 2010-2011 (GB CMA 2010f).

### The 20 to 30-year objectives for people are:

- Develop and support functioning and enthusiastic community groups to enable them to play an active part in catchment management
- Support community leaders taking up leadership positions in catchment management
- Develop and support improved knowledge in the community of new and emerging catchment threats and thresholds
- Facilitate the adoption of best management practices by land managers to support the achievement of long-term Catchment objectives.



## ► RCS IN ACTION



## Farm Water Program

Mooroopna North dairy farmers Murray and Sharon Pivac successfully applied for Round 1 funding from the Farm Water Program.

The couple's on-farm project involved filling in channels and installing 5 kilometres of pipe and 53 risers on 103 hectares of the 300 hectare property.

Murray says he applied for the funding because he realised it was the "best chance he'd have to do works that would otherwise take a lifetime to complete".

Murray says the works have saved him labour and time: instead of waiting for six hours to get water on to a paddock it's almost instant.

Automating irrigation risers means he can now use timers rather than getting up a couple of times a night to change water.

The work saved 121 megalitres of water with 60 megalitres transferred to the Victorian Government for environmental purposes.

Murray believes the Farm Water Program is a "win-win" for the environment and irrigators and the best way to ensure good outcomes for both.

He reckons he is using the same amount of water but over a bigger area – he waters far more quickly and is seeing big improvements in pasture growth and productivity.

## 6-year priorities at whole-of-Catchment scale - Levels 3 and 4

This RCS includes 6-year strategic objectives and priorities that have been developed specifically to achieve the long-term vision and 20 to 30-year objectives for the Catchment.

Strategic objectives emphasise building resilience, with aims to embed a resilience approach generally, including strengthening of partnerships and adapting to four, often connected, drivers of change (water policy reform, land-use changes, climate variability and increased farm production).

These four drivers of change pose risks to, and offer opportunities for, the Catchment's biodiversity, land, water and people.

Strategic objectives and priorities that apply at the whole-of-Catchment scale are described in this chapter. Chapter three describes how strategic objectives and priorities apply in each of the sub-Catchment SESS.



## STRATEGIC OBJECTIVE: TO EMBED THE RESILIENCE APPROACH

**What this will mean:** *Goulburn Broken CMA and partner plans factor in sub-catchment and local differences, uncertain futures and knowledge, appropriate governance support, and adaptive management.*

Catchment partners have been thinking about the resilience approach to catchment management for over a decade, stemming back to pioneering work with CSIRO on ecosystem services (CSIRO 2001; CSIRO 2003). Holistic thinking and management, which the resilience approach promotes, has become increasingly valued within the Catchment over this time (Walker *et al*, 2009). With the embedding of a resilience approach as a strategic objective over the next six years, this RCS represents a commitment to ensure the resilience approach becomes central to decision making, emphasising ‘the links between social, economic and biophysical domains and the links across scales’ (Possingham & Biggs 2012).

Embedding resilience in developing and implementing the RCS is a significant step in helping individuals, communities and organisations achieve their goals in the face of ongoing change (Table 2).

Context	Management measure
As described previously in this chapter, existing sub-strategies are important in guiding the management of natural assets. Reviewing 20 to 30-year objectives for biodiversity, land, water and people listed in these sub-strategies against resilience thresholds and at whole-of-Catchment and SES scales will be important in ensuring management is guided by a resilience approach.	<b>Strategic priority: Update and develop strategies</b>
	Review and update existing strategic documents and sub-strategies and create new ones according to need
The resilience approach encourages progress towards long-term objectives by fostering integrated management of assets at the scale of six SESs across the Catchment. Although the drivers of change are significant across most of the Catchment, the way they impact in different parts varies considerably and is subject to ongoing change, requiring communities and organisations to develop locally tailored and readily updated responses.	See management measures listed in Chapter four
	<b>Strategic priority: Plan at a social ecological system scale</b>
Key partners need to work with each other and provide leadership in catchment management on behalf of the Catchment’s communities. Adaptive management requires partners to always have the best available understanding and the resources that enable them to contribute. Submission of integrated partnership projects to government and non-government funders is a priority.	Develop an adaptive planning process for social-ecological systems to build and enhance their resilience
	<b>Strategic priority: Provide adaptive management and leadership</b>
	Build community and agency capacity to respond together to drivers of change
	Research resilience knowledge gaps to inform decision making based on thresholds and tipping points

*Table 2: Whole-of-Catchment scale strategic priorities and management measures to embed the resilience approach*



## STRATEGIC OBJECTIVE: TO STRENGTHEN PARTNERSHIPS

**What this will mean:** *Community and industry groups, agencies and individuals have the capacity to contribute to the Catchment vision.*

The Catchment's environmental features and systems are influenced and managed by almost as many individuals, communities and organisations, which means that most of the work required to achieve the Catchment vision will be undertaken by parties other than the Goulburn Broken CMA. Strong relationships between partners are therefore critical in firstly agreeing on the management desired and then undertaking the work.

While the issues described in Table 3 require a whole-of-Catchment scale approach, many SESs require individually tailored partnerships and these are described in Chapter three. For example, it is appropriate for local government to lead strategic planning and implementation in some projects, such as Greater Shepparton City Council's RiverConnect, while industry groups might be best placed to develop and implement others, such as Murray Dairy leading a farm nutrient management project.

Partners' roles in catchment management (listed in Appendix five) will be fulfilled through addressing the following strategic priorities (Table 3).

Context	Management measure
Public land, which covers one-third of the Catchment, has retained most of its native vegetation because its soils or topography are not suitable for agriculture. Large blocks and long streamside corridors of public land therefore provide the foundation for building biodiversity and water quality resilience. Balanced decisions around planned burns, emergency response and recovery, land development, cultural heritage, and invasive plants and animals require effective relationships between public land managers and surrounding landholders.	<b>Strategic priority: Reinforce relationships between agencies and industry</b>  Define roles and relationships with regional delivery partners
In all parts of the Catchment, working with landholders who manage Crown Land frontage is particularly important because of the large total area involved and many benefits derived from good management.  Traditional Owners provide significant benefits as part of joint projects, helping to factor in their knowledge of culture and natural assets.	<b>Strategic priority: Manage public land collaboratively</b>  Undertake works on public land and crown land frontages to improve waterways and wetlands  Collaborate with Traditional Owners in catchment management
The Goulburn Broken CMA plays a lead role in communicating environmental needs and in supporting or coordinating partners to address them, especially on private land. For example, the Land and Biodiversity Implementation Forum, involving relevant community and government groups, provides opportunities for collaboration. The Sustainable Irrigation Program Advisory Group (SIPAG) met for the first time in 2012, replacing the Shepparton Irrigation Region Implementation Committee that had been in place since the early 1990s. SIPAG includes multiple organisation stakeholders. The Goulburn Broken CMA-led Farm Water Program Consortium includes industry, government organisation and community organisation representatives.  Strong partnerships with neighbouring CMAs are also needed to address cross-boundary issues.	<b>Strategic priority: Adopt flexible engagement approaches</b>  Build capacity in existing and new conservation groups to deliver catchment management productivity projects  Develop an engagement approach that matches landholder motivations with catchment management outcomes  Partner research organisations in developing understanding of social capital and community connectivity  Continue to build online awareness or and engagement in catchment management

Table 3: Whole-of-Catchment scale priorities to strengthen partnerships



## STRATEGIC OBJECTIVE: TO ADAPT TO LAND-USE CHANGES

**What this will mean:** *Opportunities for improving the environment are captured as land ownership changes, enterprises change and land management changes.*

Land-use changes continue across the Catchment, including changes from irrigated to dryland farming, from low intensity to high intensity production, from large farms to small lifestyle properties and clearing of native vegetation for infrastructure expansion. These changes will continue in response to short and long-term pressures.

Short-term pressures include events such as drought, fire, flood and the global financial crisis. Long-term pressures include ageing farmers, gender imbalance and increasing competition for land and other resources, both within the farming sector and between the farming sector, and other parts of the economy, including between farming and lifestyle land use.

Ongoing population growth and migration into and within the Catchment will continue to drive demand for land resources to meet urban housing and lifestyle living needs, which also requires expanded infrastructure such as transport and communication networks. Strategic planning efforts, such as the Hume Regional Growth Plan (DPCD 2012), address this change. Local government is also developing planning schemes in recognition of the change and

Context	Management measure
The significant challenge of balancing environmental, social and economic needs in the face of short and long-term land-use change pressures continues. Research, investment and planning in new land uses are also needed so that natural assets are impacted positively as economic and social benefits are captured.	<b>Strategic priority: Capture opportunities from land development</b>  <i>The approach varies significantly across the Catchment. Refer to management measures listed in SES sections of Chapter three</i>
Sensitive management of land-use changes is needed to minimise the impact of flooding on built environments, including infrastructure, and to maximise benefits of flooding on natural assets.	<b>Strategic priority: Plan for and manage floods</b>  Provide floodplain decisions and advice in land-use planning  Understand more about the nature of flooding to manage its impact on natural and built environments

*Table 4: Whole-of-Catchment scale strategic priorities and management measures to adapt to land-use changes*

agencies such as Goulburn Valley Water are responding appropriately to emerging issues.

The large current and anticipated investment in irrigation infrastructure (see under 'To adapt to water policy reform') presents significant risks and opportunities as land is redeveloped across broad areas to align with changing water use.

Non-traditional productive land-uses and practices are also emerging as we adapt to future shortages of non-renewable energy resources and fertilisers.

Opportunities include carbon sequestration activities and energy production via biofuels and wind farms. The Catchment will also continue to be explored for energy and mineral reserves.



The challenge continues to be how to best balance environmental, social and economic needs in the face of ongoing land-use change, a priority for this RCS (Table 4).



## STRATEGIC OBJECTIVE: TO ADAPT TO WATER POLICY REFORM

**What this will mean:** *Water savings are generated for the benefit of farmers, the community and environment, and waterways and wetlands receive the right volumes of water at the right times.*

Water's many uses, including irrigated agriculture, urban consumption, recreation and manufacturing, generate significant economic and social benefits to the Catchment. Waterways and wetlands are important in their own right and for underpinning a healthy water supply system. Water is becoming more valued as demand increases in response to a growing population and as watering needs of waterways and wetlands are recognised.

Water conservation and distribution and stream management have significant environmental, economic and cultural consequences, with delivery of environmental water contributing to the condition of natural assets within and beyond the Catchment.

The unprecedented drought of 1997-2009, which created conditions that were more severe than the worst case scenarios considered in developing the Victorian Government's Northern Region Sustainable Water Strategy (NRSWS) (DSE 2009), further sharpened attention on long-term, sustainable use of water. There is significant uncertainty about meeting all demands in a long-term climate that is expected to be hotter and drier (DSE 2012b).

Context	Management measure
Water policy impacts on natural assets across all SESs, demanding a whole-of-Catchment scale response, particularly in regulated streams and areas of groundwater extraction. All Catchment partners, including community leaders, have an important role in communicating their needs and priorities to inform water policy at local, Catchment and broader scales.	<b>Strategic priority: Influence regional water policy</b>  Influence water policy development and implementation to secure water for improving natural asset condition and social and economic wellbeing  <i>The Agricultural Floodplains SES is especially sensitive to water policy shifts</i>
Commonwealth and State Environmental Water Holders and delivery agencies are responsible for ensuring water is used to restore river and wetland health, providing the necessary volumes at the appropriate times to priority assets. This will be done considering impacts to agricultural and recreational users of water resources, including how these users may be at risk from increased environmental flow regimes.	<b>Strategic priority: Deliver water to waterways and wetlands</b>  Plan, deliver and monitor environmental water delivery to improve the condition of priority waterways and wetlands  <i>This management measure is contexted in detail where it has special relevance, namely the Agricultural Floodplains and Upland Slopes SESs of Chapter three</i>
There are opportunities for large-scale, multiple-benefit, water savings projects in the Agricultural Floodplains SES.	<b>Strategic priority: Use water efficiently on farms</b>  <i>Refer to context and description of management measure in the Agricultural Floodplains SES section of Chapter three</i>

*Table 5: Whole-of-Catchment scale strategic priorities and management measures to adapt to water policy reform*

The NRSWS aims to secure the Catchment's water over the next 50 years, seeking to retain reliable water supplies and protect environmental values in a future with less water (DSE 2009).

Urban, agricultural and environmental water use continues to be high on the political agenda. The Murray-Darling Basin Plan seeks to set new conditions for managing and allocating water, with a focus on finding ways to maximise environmental outcomes while minimising negative impacts on communities (Burke 2012).

Large-scale salinity and nutrient management projects have been successfully implemented in the Goulburn Broken Catchment for well over two decades, consistent with broader Murray-Darling Basin strategies.

Australian and Victorian Government investments in projects such as the Goulburn-Murray Water (G-MW) Connections Program (formerly known as the Northern Victoria Irrigation Renewal Project) and the Goulburn Broken CMA Farm Water Program are resulting in water being used and delivered more efficiently in irrigated agriculture, which in turn makes significantly more water, and better quality water, available for production and improving natural assets. These investments build on previous projects that emphasise 'producing more with less'.

The Connections Program and the Farm Water Program are large enough to fundamentally change the nature of individual farm enterprises and the way local communities function.

Water policy reform is wide-reaching, having significant implications for what land is used for and how it is managed, which reinforces the need for the strategic priorities listed under 'To adapt to land-use changes' to be considered simultaneously with those listed in this section.

The roles of partners in managing environmental water are expected to increase as much larger volumes become available, requiring joint approaches to identify fund sources and priority natural assets, while minimising risks to agricultural and recreational uses, landholders and towns.

Balancing the needs of all water users is a priority for this RCS, requiring Catchment partners, including communities, organisations and individuals, to contribute to project design and implementation (Table 5).

## ► RCS IN ACTION



### RiverConnect

More and more Shepparton and Mooroopna residents are enjoying their stunning riverine environment because of the RiverConnect project.

RiverConnect links the goodwill and energy of many and varied groups and individuals, enhancing existing activities and creating the opportunity to develop bigger, whole of community projects.

People from vastly different backgrounds are interacting through educational, recreational, artistic, cultural heritage and environmental activities.

RiverConnect resulted from a ground swell in understanding that the time had come to embrace the Goulburn and Broken Rivers and the opportunities they present. The RiverConnect vision is for the riverine environment to be the heart and soul of Shepparton and Mooroopna.

Working Groups of RiverConnect involve more people in implementing detailed actions listed in the RiverConnect Strategic Plan, which was prepared in 2011 after extensive community consultation.

Eighteen of the nineteen schools in the RiverConnect area have adopted-a-reach and thousands of students participate in activities on the banks of the Goulburn and Broken Rivers each year.

## STRATEGIC OBJECTIVE: TO ADAPT TO CLIMATE VARIABILITY

**What this will mean:** *Risks from climate variability and responses to it are managed and opportunities from the global shift towards lower use of carbon-based energy are captured.*

The climate of the Goulburn Broken Catchment is expected to become hotter and drier in the long term, with the greatest reductions of rainfall in spring (DSE 2012b). Greater climate variability is expected in the short-term, with increased numbers of hot days, reduced numbers of frosts, and changes in daily rainfall patterns. The unprecedented conditions of the 1997-2009 drought were worse than the worst climate change scenario considered in developing the NRSWS (DSE 2009).

These changes affect all natural assets. Habitat for terrestrial and aquatic species will alter, impacting on species distributions. Threats such as weed and pest animal invasions will also change, causing the likely extinction of some species (CSIRO 2012). Higher water temperatures and reduced stream flows could affect water quality, habitat values for aquatic and riparian species, and productive and recreational uses of water. Drought is likely to exacerbate erosion and sedimentation and increase extreme bushfire events.

Climate-related issues are a major consideration of water policy reform (see Strategic Objective: To adapt to water reform policy). Climate-driven pressures are also likely to result in land-use changes, such as fewer people living in bushfire-prone areas and different agricultural enterprises.

Context	Management measure
The Goulburn Broken CMA will help disseminate climate projection data that has implications for management of natural assets so that it can be factored into Goulburn Broken CMA and partner organisation planning.	<b>Strategic priority: Adapt to climate variability risks</b>
	Factor risks of climate variability and identify adaptation strategies in Goulburn Broken CMA and partner plans
	Factor risks to natural assets into public land fire management plans
Record breaking climate-induced events over the last decade highlight the importance of well-planned and coordinated emergency response and recovery.	<b>Strategic priority: Respond to and recover from climatic events</b>
	Plan and implement flood, fire and drought response and recovery
Emerging policies that are likely to influence new land-use practices, such as carbon sequestration planting and opportunistic planting regimes, need to consider positive and negative impacts on natural assets, including biodiversity and water yields. These types of planting might provide biodiversity habitat as well as income diversification in some areas.	<b>Strategic priority: Capture opportunities from a low carbon future</b>
	Identify where carbon sequestration activities provide environmental, economic and social benefits
	Develop mechanisms to ensure carbon sequestration activities do not threaten natural assets

*Table 6: Whole-of-Catchment scale strategic priorities and management measures to adapt to climate variability*



Sub-strategy design and implementation needs to include likely impacts of climate variability and consider risks and opportunities presented by the emerging move to a low carbon future (Table 6)(GB CMA 2012a).

## STRATEGIC OBJECTIVE: TO ADAPT TO INCREASED FARM PRODUCTION

**What this will mean:** *The natural resource base upon which future agricultural production depends is sustained and enhanced.*

Food production and processing are significant contributors to the Catchment's economy and are important employers. These sectors face many challenges, including domestic and global pressures 'to produce more with less', whilst remaining profitable in the face of emerging scarcities of many inputs needed to produce good food: water, land, nutrients, oil, technology, skills, finance and stable climates. The Catchment is losing about one per cent of its farmland every year to other land uses (Cribbs 2012).

Only one-fifth of Victorian farms are considered large enough to fund the level of farm investment required for productivity growth and to provide an average standard of living for a full-time farming family (Barr 2012). The demand for increased production in the face of variable trade and climatic conditions will continue to put pressure on future farm investment. Options are needed in response to the likely significant changes in the farming landscape. For example, new opportunities for increased production or different products that consider the trend towards reliance on off-farm income could be explored. This includes opportunities from changes in the types of farm ownership (towards part-time farming, absentee and lifestyle-driven ownership).

Context	Management measure
Soils in the Shepparton Irrigation Region are threatened by water logging and soil salinisation (as described in the Agricultural Floodplains SES section of Chapter three).	<p><b>Strategic priority: Manage risks to agricultural production</b></p> <p>Deliver surface and sub-surface drainage works across a modernised irrigation delivery system, including adaptive shallow groundwater management</p>
Agricultural practices that increase productivity while not degrading natural assets are needed. This requires increased understanding of soil biology and chemistry, crop science, invasive plants and animals, nutrient recycling, and soil, water, energy and carbon conservation in the context of sustainability and resilience.	<p><b>Strategic priority: Establish sustainable agricultural practices</b></p> <p>Management measures related to sustainable agricultural practices are described in Agricultural Floodplains, Productive Plains and Upland Slopes SESs sections of Chapter three</p>
Native vegetation found on soils suited for agriculture has been extensively cleared and is generally threatened. Remaining patches of native vegetation provide significant habitat and other ecosystem services and need to be protected and enhanced.	<p><b>Strategic priority: Adopt flexible engagement approaches</b></p> <p>Management measures related to biodiversity are described in Agricultural Floodplains, Productive Plains and Upland Slopes SESs sections of Chapter three</p>

*Table 7: Whole-of-Catchment scale strategic priorities and management measures to adapt to increased farm production*

Potential impacts on natural assets from the drive to increase farm production are exacerbated by pressures generated by the other drivers and responses described earlier in this chapter. For example, water and food security and quality policies and responses, soil improvement, invasive plant and animal control, fire and flood management and continued habitat loss and degradation all put pressure on farm productivity and sustainability.

Rainfall in 2010-2012 resulted in the re-emergence of high watertables across intensively irrigated areas of the Catchment, confirming the ongoing threat of salinity.

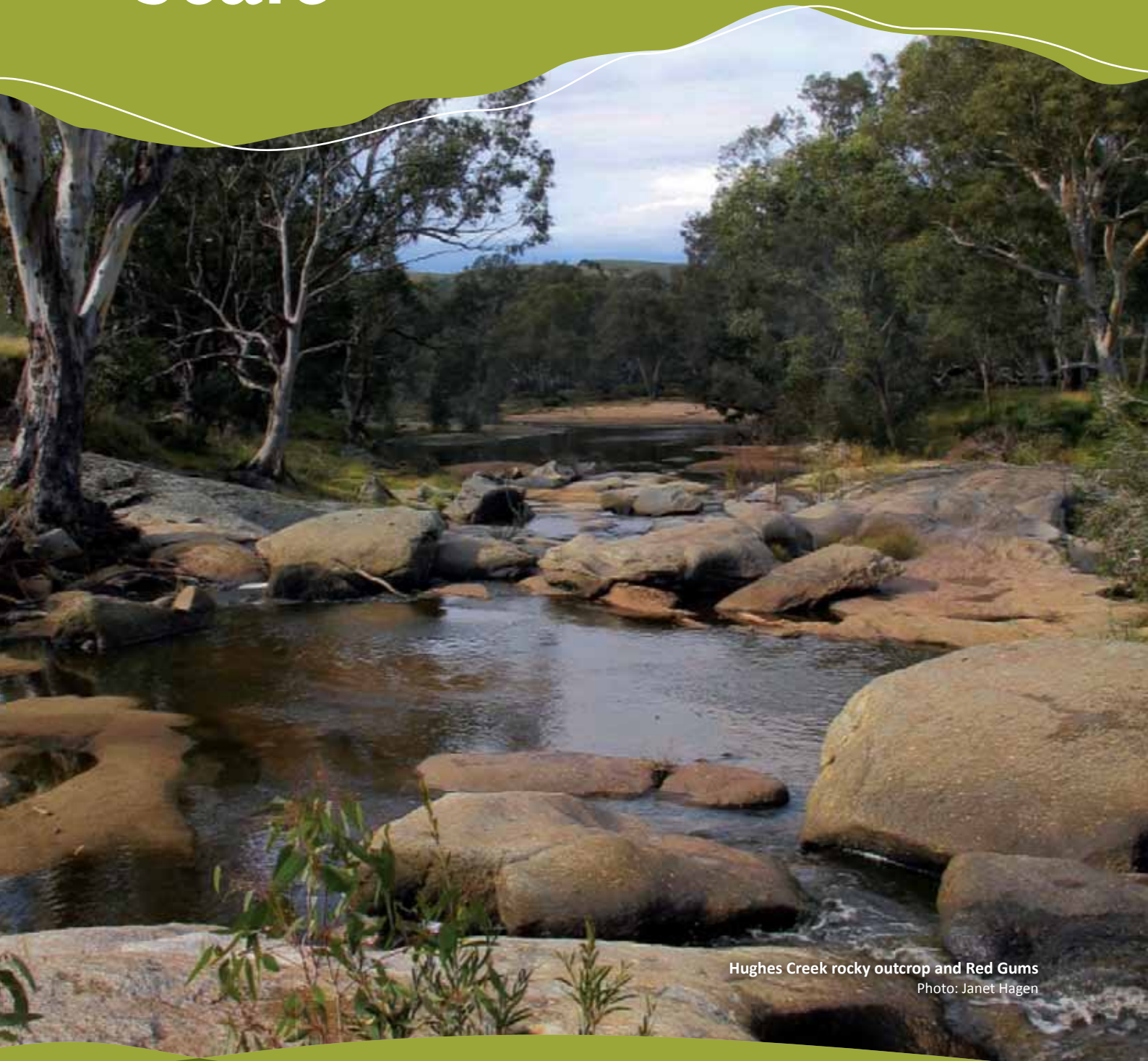
Sustainable growth in agricultural production that balances economic and environmental needs is an RCS priority (Table 7).





## CHAPTER THREE

# Decision making at the sub-Catchment scale



Hughes Creek rocky outcrop and Red Gums  
Photo: Janet Hagen

Following the description of whole-of-Catchment priorities in Chapter two, this chapter describes six sub-Catchment SESs, drawing heavily on input from community, individuals and technical experts.

Each sub-Catchment SES is described; its characteristics, landscapes, land uses and social systems, including what is valued. Priorities that are expected to be the basis for more detailed planning over the next six years are also listed, contextualised by how the four connected drivers of change described in Chapter two impact on each sub-Catchment SES. While significant variation in planning between SESs is encouraged as communities respond to their differing needs, efforts will also be directed towards achieving an appropriate level of whole-of-Catchment consistency.

It is acknowledged that significant planning has already been undertaken in several sub-Catchment SESs and catchment governance and engagement processes are in place, such as those associated with the SIPAG with a focus in the Agricultural Floodplains SES.

Sub-Catchment SESs, introduced in Chapter two, are generally, although not exclusively, consistent systems of people and nature (or social and ecological characteristics) including land form, vegetation type, land uses and social structure and dynamics. SESs don't have sharp boundaries, as shown in Figure 6.

Why are these SESs such a prominent feature of this RCS? The six sub-Catchment SESs 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.

An early task in sub-Catchment SES planning will be to consider thresholds of resilience (listed in Appendix six) so that Catchment management partners can agree on desired levels of intervention.



# A summary of sub-Catchment social-ecological systems

The following descriptions provide a snapshot of the key features and threats to the six sub-Catchment SESs (Figure 6). These descriptions were identified in consultation with the Catchment community and using technical input during the development of the RCS.

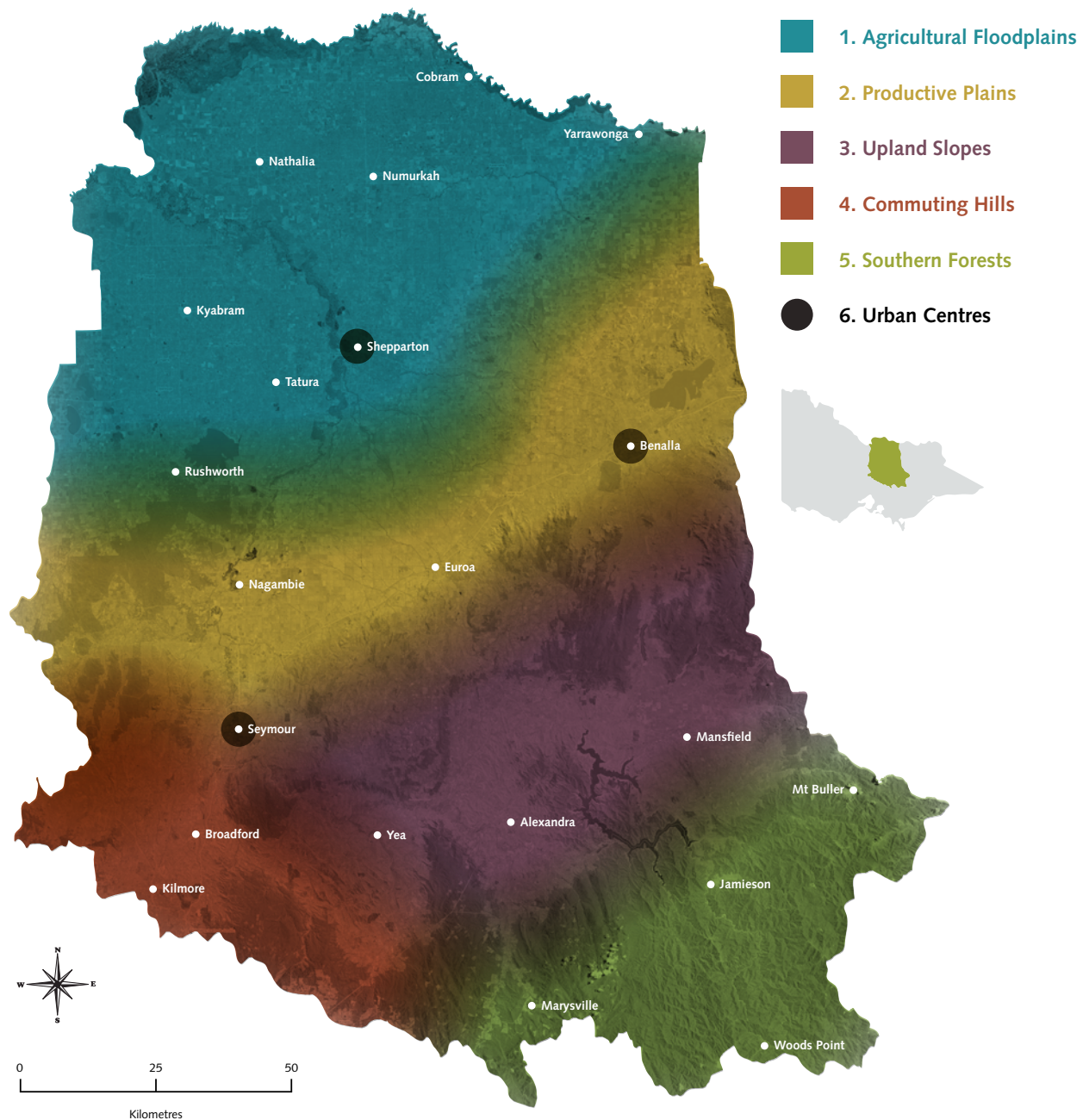


Figure 6: Sub-Catchment Social-ecological systems (SESs) of the Goulburn Broken Catchment

## 1. Agricultural Floodplains

### Northern floodplains with Murray River along boundary with NSW

- Landscape highly modified for agriculture with remaining vegetation fragmented and found mainly on waterways, wetlands and roadsides
- Irrigation supports dairy, horticulture and cropping and a large food processing sector with major investment in on and off-farm irrigation infrastructure recently
- Barmah National Park highly valued (Ramsar listed) internationally important breeding site for many bird species
- Long history of community leadership in managing land and water problems
- Further loss and decline of vegetation, salinity, poor natural drainage, future farming options, and floods continue to threaten production and river health

## 2. Productive Plains

### Foothills and floodplains towards the north of the Catchment

- Habitat provided by vegetation along waterways, roadsides, ranges and spring soak wetlands
- Dryland farming includes cattle, sheep, cropping and viticulture and many farms remain in same families for generations with average farming populations ageing
- Rivers and creeks in moderate condition and wetlands in moderate to good condition.
- Landcare and conservation management networks establish sustainable farming practices and protect threatened species
- More habitat loss, ageing farming populations and declining social connection are threats to biodiversity and farming futures

## 3. Upland Slopes

### Includes the slopes and valleys towards the south of the Catchment

- Grazing and other agricultural enterprises occur in cleared valleys surrounded by partially forested hills and vegetation along waterways
- Lake Eildon provides water for agricultural production, recreation, tourism, and river health all the way down the Catchment and beyond the boundary
- Generational farmers live alongside increasing numbers of lifestyle properties and absentee landholders
- Erosion, weeds and fires are among the threats to the amount and quality of highly valued water, used for many purposes

## 4. Commuting Hills

### Includes the mountainous southern and south western urban fringe

- Public and private forests support many plant and animals including the Golden Sun Moth
- Land use also supports a range of agricultural industries and lifestyle communities
- Waterways remain largely healthy because of the extent of remaining vegetation
- People drawn to area for natural beauty and lifestyle and commute to Melbourne for work
- Fire remains a major threat to safety and properties, along with native vegetation loss through population pressures and development

## 5. Southern Forests

### South-east mountains, waterways and snow covered alps

- Unique alpine vegetation supports endangered mountain Pygmy Possum
- Most of the area is public land managed for conservation, but also for recreation and timber production
- Waterways are in good condition with recreation and tourism highly valued
- People live in small and seasonal communities and travel to and from this area
- The interface between private and public land is important for management
- Waterway health threatened by erosion along with threats to vegetation including fire, weeds and pest animals

## 6. Urban Centres

### Major urban centres of Shepparton, Seymour and Benalla

- Biodiversity is poor but urban people value the rivers and remaining vegetation for recreation
- Provide employment, housing, schools and services surrounded by farming and lifestyle properties on Goulburn and Broken River floodplains
- Water is pumped from the rivers for domestic use and runs off into rivers following storms
- Large diverse populations
- Pollution, land development and aquatic weeds threaten river health, including water quality and floods are an on-going threat to properties and safety



# 1. Agricultural Floodplains

Broken Creek between Nathalia and Barmah. Photo: Keith Ward, Goulburn Broken CMA



The Agricultural Floodplains SES encompasses the Shepparton Irrigation Region (SIR) and northern parts of the Catchment to the River Murray. It includes the towns of Cobram, Nathalia Yarrawonga, Tatura, Kyabram, Tongala and Numurkah.

Yorta Yorta Clans were the first people of the Agricultural Floodplains SES which has been significantly shaped since by natural events such as flooding and drought, and more recently by post-war soldier settlements in the irrigated lands, and the post-1950 agriculture technology boom. Landcare and the salinity pilot programs were formed to protect the landscape and more recently, water policy and reform has been important, particularly the current technological irrigation improvements including the Connections Program and improved on-farm systems.

## Values, products, goods and services of this system

Agricultural production and processing industries are highly valued for the economic value they provide to this SES. River ecosystems and wetlands are highly valued for the ecological and economic services they provide. The Barmah and Lower Goulburn National Parks are valued for their biodiversity and recreational assets. The health of these areas is essential to Traditional Owners' cultural and spiritual connections to the land, evidenced by the large number of Aboriginal cultural heritage sites located in this area.

The resilience of the Agricultural Floodplains is about this system's ability to stay in a state that provides these values in the face of change. This state underpins the future aspiration for the Agricultural Floodplains: *An area that is highly productive in ways that maintain and enhance its natural and cultural features.*

## Biodiversity

Since European settlement, this SES has been highly modified from its original state, which was open grassy woodlands, dominated by River Red Gum forests, with Grey Box, and Yellow Box among other species over a sparse understory of wattles, peas and herbs. The Barmah and Lower Goulburn National Parks are the closest representations of the original riverine forests. There are few remaining examples of other types of vegetation communities, such as those dominated by Grey Box, Black Box, Murray Pine and Buloke.

The current condition of biodiversity in this SES is poor, with remaining native vegetation scarce and highly fragmented, mostly occurring as single scattered paddock trees and small remnant patches. Understory species are rare except in larger patches or through revegetation activities. Generally, there is one to three per cent native vegetation cover on private land and this SES is considered 'relictual' (generally defined as less than 10 per cent native vegetation cover).

Therefore, protecting the existing remnants and large old trees is critical in conserving biodiversity, while considering future potential for restoration.

**Terrestrial habitat** for this SES are box, red gum, murray pine and buloke woodlands all of which are associated with the Broken, Boosey, Murray and Goulburn River systems, and are critical to the long-term viability of the River Red Gum communities along the major waterways.

**Threatened species and communities** include Superb Parrot and Grassy Woodlands with all EVCs on private land are threatened with extinction, and Box Gum Grassy Woodlands are Federally listed in the *EPBC Act 1999* as threatened.

The greatest threats to biodiversity in this area are the continuing incremental loss of scattered paddock trees, and the decline in quality and extent of remnants, particularly those associated with major waterways. Threats include clearing through land-use changes, grazing, pest plant and animal invasion and loss of large old trees (natural death and direct removal) on private land and roadsides. The same threats exist on public land with additional threats from tourism and recreation use and timber and firewood removal.

## Land

Agricultural production is the dominant land-use in this SES. It is supported by the provision of water harvesting, storage and delivery and drainage infrastructure, and soils suitable for a range of farm production enterprise including dairy, horticulture and cropping. Dryland agricultural production in this SES includes cropping and grazing enterprises.

Erosion, organic matter decline, soil acidification, contamination, compaction, salinisation, sodicity, waterlogging and biodiversity decline are all threats in this SES related to agricultural land-uses. Pest plant and animal invasion also threatens land-use in this SES, including Paterson's Curse, Fleabane, foxes and rabbits. New and emerging weeds such as Chilean Needle Grass and African Love Grass are also considered significant threats to the Agricultural Floodplains.

Poor natural drainage is an inherent feature of the intensively irrigated floodplains, and from the 1950s to the 1980s salinisation emerged as a major issue across the area. Salinity continues to be the major threat in this SES with soil salinisation linked to the salinity of, and depth of shallow watertables. Watertable depth, combined with poor drainage, also contributes to soil waterlogging in the SIR. Significant land and soil assets have been identified where watertable depths are approaching zones that can negatively impact upon their condition.

## Irrigated agriculture

The hydrological cycle in the SIR has undergone massive change since European settlement due to clearing of native vegetation and the introduction of irrigation. The result has been about nine per cent of land in the Agricultural Floodplains SES adversely affected by shallow, saline watertables. Deep lead aquifers are considered to be in good condition, although water yield was affected during the 1997-2009 drought.

The condition of agricultural land-use is heavily influenced by the efficient delivery and use of water on farms. Long-term average historical water losses were estimated to be more than 800 gigalitres a year in the Goulburn Murray Irrigation District (up to 2004-2005), which encompasses the SIR (G-MW 2009). Losses in any individual year will vary depending on customer deliveries in that year. For example, in a drought year with lower customer deliveries, losses will be less. These losses were in part attributed to ageing and inefficient irrigation infrastructure. The Connections Program was initiated to reduce these losses through modernisation of the public irrigation delivery system.



## ► RCS IN ACTION



## Irrigation upgrades improve water-use efficiency

Stanhope dairy farmer Graeme Nurse is adamant that upgrading his farm irrigation system has been a great move.

"It was badly set up and very hard to irrigate," Mr Nurse said.

"We've gone from more than 100 bays to about 35 and use one outlet rather than three. Instead of taking days to irrigate it takes hours.

"There's no doubt we're more efficient - we're using less water and saving time and labour.

Mr Nurse successfully applied for funding from Round 1 of the Farm Water Program to upgrade 40.6 hectares of his 323 hectare property.

A channel that cut the farm almost in half was removed, lasering carried out, new bays constructed and outlets installed.

The works saved 102 megalitres of water with 51 megalitres transferred to the Victorian Government for environmental purposes.

Mr Nurse said he was now feeling far more optimistic about the future of farming in the region.

Efficient water use on-farm helps to minimise salinity, waterlogging and nutrient impacts by reducing surface run off and seepage to the watertable. 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. While improved irrigation efficiency helps reduce adverse impacts of irrigation, other than in severe drought, accessions to the watertable will exceed deep drainage resulting in high watertables and salinity.

## Water

The Agricultural Floodplains SES is mostly low lying floodplain, with some sandhills near the Murray and Goulburn Rivers. The river ecosystems are a dominant feature across the landscape.

Regulation, and the associated timing and volume of flow in rivers and across the floodplain is the greatest threat to waterways, which are typically highly modified from their original state. Most waterways are currently in poor condition.

The health of rivers is also strongly influenced by the management and condition of upstream catchments and waterway systems.

Priority waterway assets include:

**Goulburn River:** A Heritage River associated with wetlands of national significance supporting threatened species including Murray Cod, Silver Perch and Macquarie Perch. It features many cultural heritage sites and provides water for agriculture, urban and recreational use.

**Seven Creeks:** Supports the threatened Trout Cod and Macquarie Perch.

**Gobarup Creek:** Associated with wetlands of national significance.

**Broken River:** Associated with wetlands of national significance and supports the threatened Murray Cod, Macquarie Perch and Silver Perch.

**Broken Creek:** Supports the threatened Murray Cod and is associated with wetlands of international significance.



## People

The SIR creates agricultural products worth an estimated \$1.38 billion (Monticello 2012). This highlights the dependency of the Agricultural Floodplain SES on agriculture and food manufacturing for employment, as well as the range of services that supports this production. There are many threats to the agricultural capacity needed to support local processing in the future.

The area has a history of community leadership and involvement in Catchment management, particularly in relation to irrigation when faced with threats such as salinity. The Salinity Pilot Program Advisory Council broke new ground in the 1980s in its approach to engaging the community to manage the threat associated with rising watertables. Landcare networks and groups, the Goulburn Valley Environment Group (GVEG) and Catchment Management Networks (CMNs) are active in this SES, playing a key role in production-focused and environmental advocacy and ongrounds works programs. However, volunteer burnout is considered a threat to the way people manage natural resources, as well as the ongoing group leadership and contribution to Catchment management.

Wetlands form a critical part of the river ecosystems of the Agricultural Floodplains. Current wetland condition is generally moderate to good. Wetlands on public land are in better condition than private land, where they are considered to be in generally poor condition. The biggest threats to wetlands are river regulation, drainage and landforming. Priority wetlands assets include:

**Barmah Forest:** Along with the adjoining Millewa forest in NSW, it forms the largest River Red Gum forest in the world. It is one of Victoria's largest waterbird breeding areas and protects 38 rare or threatened plant species.

**Kanyapella Basin:** Mixed River Red Gum forest and Black Box woodland which protects the nationally threatened River Swamp Wallaby Grass and provides flood retardation.

**Muckatah Depression:** A long 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.

**Gaynor Swamp:** A large red gum lignum swamp that supports tens of thousands of water birds.

**Wanalta Wetland Complex:** Four hydrologically connected wetlands valued for their size, rarity, species diversity and waterbird habitat.

**Kinnairds Swamp:** 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.

**Black Swamp:** A small red gum swamp that protects the nationally threatened River Swamp Wallaby Grass and Australasian Bittern.

**Carlands Swamp:** A private wetland with the most eastern Victorian area of tangled lignum swamp.





## Developing resilience of the Agricultural Floodplains SES

Table 8 details what is needed to develop resilience in the Agricultural Floodplains SES, building on needs best addressed at the whole-of-Catchment scale, which were listed in Chapter two.

Context	Management measure	Possible specific action (examples)
<p>The greatest threat to ecological health of the abundant waterways and wetlands in the Agricultural Floodplains is management of upstream waterway systems, including regulation of flows. Timing and volume of flows are being adjusted as part of significant <b>water policy reforms</b> which aim to balance delivery of water (within thresholds) for:</p> <ul style="list-style-type: none"> <li>biodiversity habitat (within and downstream of the Catchment, including wetlands outside of riparian areas)</li> <li>irrigation and associated processing industries</li> <li>domestic consumption.</li> </ul> <p>Catchment partners, including community leaders, communicate Agricultural Floodplains SES priorities to Catchment and broader scale water policy bodies.</p> <p>Over the last 20 years, significant investment in initiatives such as water treatment plants, water reuse, and dairy shed effluent management has helped reduce nutrients to the Water Quality Strategy's target levels. The Catchment's water quality has improved, although isolated problems remain.</p>	<b>Strategic priority: Influence regional water policy</b>	
	Influence water policy development and implementation to secure water for improving natural asset condition and social and economic wellbeing	Continued community, DEPI, Goulburn Broken CMA, industry and water authority partnerships to provide balanced and informed input into policy development
	Create opportunities for community leaders to contribute to water policy	Involve industry body representatives in Farm Water Program design
	<b>Strategic priority: Deliver water to waterways and wetlands</b>	
	Plan, deliver and monitor environmental water delivery to improve the condition of priority waterways and wetlands	Meet Ramsar obligations for Barmah National Park including provision of natural flooding patterns
	Prioritise protection of waterway and wetlands within the modernised irrigation delivery system	Consider in the development of the 2013 Waterway Management Strategy
<p>The dry extreme of <b>climate variability</b>, which resulted in the 1997-2009 drought, meant that limited water was available to share. Resilience thresholds might have been crossed, with accelerated restructuring of dairying and horticultural enterprises (many individuals left the industries) and associated closures of major food processing factories. Past droughts continue to alter the identity and functioning of several townships.</p> <p>Water, energy and labour efficiency programs through <b>water policy reform</b> are helping the Agricultural Floodplains retain its food production function, although there is likely to be a threshold around the minimum area of irrigated land needed for a viable industry that retains processors locally. Water savings are being shared between the environment, irrigators and other users.</p> <p>Increased water efficiencies also help make soils and environmental features more resilient by reducing accessions to watertables: watertable depth and salinity level thresholds are critical objectives for management. The recent wet end of the <b>climate variability</b> range, which resulted in repeated extreme rainfall events, is leading to rapid recharge of watertables.</p> <p>Fire regime risks in public land such as Barmah are exacerbated when there are extended dry periods, which are part of <b>climate variability</b>, placing biodiversity habitat at risk.</p>	<b>Strategic priority: Use water efficiently on farms</b>	
	Modernise water delivery on irrigated land to provide ecological and productivity benefits	Continue to implement the Farm Water Program
	<b>Strategic priority: Adapt to climate variability risks</b>	
	Factor risks of climate variability and identify adaptation strategies in Goulburn Broken CMA and partner plans	Develop addendum for Biodiversity Strategy
	Factor risks to natural assets into public land fire management plans	Input into a strategic approach to planned burning in Barmah that considers ecological values

Context	Management measure	Possible specific action (examples)
<p>Irrigated water delivery and management changes from modernisation drive the need for changes in drainage and shallow groundwater management.</p> <p><b>Land-use changes</b> due to irrigation modernisation and the demand for <b>increased farm production</b> introduces threats to biodiversity, soils, wetlands, cultural heritage and groundwater, including off-site threats of water use. Farm production is constrained by several aspects of soil health related to salinity, such as soil sodicity.</p> <p>Also, farms outside the irrigation infrastructure modernisation footprint could become less viable and may undergo significant <b>land-use change</b>, providing a different suite of challenges.</p>	<b>Strategic priority: Capture opportunities from land development</b>	
	Deliver farm planning to integrate ecological and agricultural productivity benefits	Whole farm or total property management planning
	Promote land-use capability assessments and implementation, including use and management of water	Streamline new Irrigation Development Guidelines linked to whole farm planning and supported by planning schemes
	<b>Strategic priority: Manage risks to agricultural production</b>	
	Deliver surface and sub-surface drainage works across a modernised irrigation delivery system, including adaptive shallow groundwater management	Renewed investment in a drainage works program to support investment in irrigation infrastructure modernisation
	<b>Strategic priority: Establish sustainable agricultural practices</b>	
<p>Streamside native vegetation widths and connections to terrestrial remnant vegetation are important considerations in maintaining the viability of public land reserves and threatened species populations. This in turn provides a range of ecosystem services to <b>increased agricultural productions</b> and lifestyles, and needs to be considered in relation to future <b>climate variability</b>.</p>	Create awareness and acceptance of sustainable management practices to improve land and soil condition	Research costs and benefits of new options for farm production, such as energy
	<b>Strategic priority: Increase biodiversity in agricultural land-use</b>	
	Create awareness and acceptance of land management practices to enhance and protect terrestrial and aquatic habitat	Research to understand more about the productive benefits associated with habitat protection and enhancement, such as vegetation corridors and the retention of large, old trees
	Identify environmental stewardship opportunities for land managers	Community-led projects like the Superb Parrot Project
<p>Extreme <b>climate variability</b> has resulted in extreme drought, bushfires and floods over the last decade, impacting on the people in this SES long after the event.</p>	Work with landholders to protect and improve biodiversity on farms and build understanding of its contribution to sustainable and profitable farming	Education campaigns to target high value assets
	<b>Strategic priority: Respond to and recover from climatic events</b>	
	Plan and implement flood, fire and drought response and recovery	Delivery of support to affected communities

**Note:**

The table (and descriptions on the previous page) will be part of background information for consultative planning and implementation over the next few years, which will include decisions on how to keep the SES from crossing undesirable thresholds.

Significant uncertainties in setting desirable SES thresholds and measuring progress elevate the need for close collaboration between SES stakeholders when setting priorities. Some key threshold parameters to be considered when making decisions are listed in the table. Appendix six includes a more complete list across all SESs, with some quantitative targets.

**Table 8: Adapting to drivers of change in the Agricultural Floodplains SES**

## 2. Productive Plains

Canola in the Dookie Hills. Photo: Charlie Sexton, Goulburn Broken CMA



The Productive Plains SES is located across the lower slopes and plains of the central Goulburn Broken Catchment and includes the towns of Nagambie, Euroa, Violet Town, Dookie and Tungamah.

Yorta Yorta and Taungurung Clans first utilised the productive plains area which were abundant in food, water and cultural sites. Since European settlement, land-use change has included clearing for farming, gold rushes, the post-1930s farm mechanisation boom and the wool boom of the 1950s.

### Values, products, goods and services of this system

Agricultural land-use is highly valued in this area for the economic and social services it provides. There is also high value placed on the remaining native vegetation, on land and along waterways for the ecosystem and social services it contributes to. The social capital in the community is highly valued for the activity and support it generates.

The resilience of the Productive Plains is about this system's ability to stay in a state that provides these values in the face of change. This state underpins the future aspiration for the Productive Plains: *To balance productive capacity with vegetation extent and maintain social networks.*

### Biodiversity

Before extensive clearing for agriculture and the introduction of exotic pasture grasses, this area was dominated by open Box Ironbark forests and Box Gum Grassy Woodlands. Wetlands were common and varied in diversity and structure. The current area of terrestrial and aquatic habitat is generally small, particularly on the more fertile plains, with the less fertile stony hills and rises containing relatively large forest blocks (such as the Whroo Rushworth forests). In this SES, conservation reserves are too few and small to sustain wildlife in the plains (Bennett 1998). However, this area can be considered fragmented (generally a native vegetation cover of between 10 and 30 per cent), with potential for revegetation and connection of remnant patches with an aim of making the wildlife more resilient in the future.

The major threats to biodiversity in this SES are continued fragmentation and loss of species diversity resulting in a shift from a fragmented (10-30 per cent extent) to a relictual ecosystem (less than 10 per cent extent).

**Terrestrial habitat:** High value assets in this SES, identified through NaturePrint and local knowledge, including Warby Ranges, Reef Hills State Park, Dookie Hills and Chesney Hills.

**Threatened species and communities:** Focus species include the threatened woodland bird community, Bush Stone-curlew, Grey-crowned Babbler, Swift Parrot and Regent Honeyeater, and flora such as the Euroa Guinea flower, orchids and species associated with grasslands. Focus communities include Box Grassy Woodlands, and creek line Grassy Woodlands in the Goldfields Bioregion.

## Land

Agriculture continues to be the dominant land-use in the Productive Plains. Nature conservation is interspersed across the SES generally as public forests and parks. Land-use varies in relation to soil type and climatic conditions.

Ideally, soils support a range of land-uses, however erosion, organic matter decline, soil acidification, contamination, compaction, salinisation and biodiversity decline are all threats to soil in this SES. Pest plant and animal invasion also threatens land-use, in particular agricultural production. Chilean Needle Grass is a recently introduced Weed of National Significance (WONS) into this SES and is one example of an emerging weed that threatens both production and biodiversity values. Foxes are an issue for landowners in the area, and control programs should also simultaneously target rabbits.

Dryland salinity has been considered a significant threat to land and water condition in this SES since the 1980s. Land and soil health to support agricultural production continues to be a priority.

### ► RCS IN ACTION



## Beyond Soilcare

Soil health is something many people are interested in and this is borne out by farmers' response to the Beyond SoilCare project funded by the Commonwealth Government's Caring for Our Country Program. Long-term soil health underpins the condition of the natural assets in the Catchment. Whether it is soil stability, reduced acidity, increased soil biodiversity or storage of soil carbon, a healthy catchment requires continuous building of soil health now and into the future.

Over 180 landholders have completed 470 soil tests, covering an estimated 36,000 hectares, and attended six soil test interpretation days. Farmers attending the workshops have responded to the strong partnership with industry in program delivery that has included resellers, consultants and contractors. They have all provided their specialised knowledge to assist farmers to grapple with the challenges of managing soil to maintain its health as well as generating income in the short and long-term.





## Water

Waterways in this area come from the Strathbogie Ranges and other surrounding hills, where they begin to meander across the plains. They are largely unregulated, except for the Goulburn River. Generally these waterways are considered to be in moderate condition. Major threats to waterways in this SES are European Carp, which muddy water, outcompete and predate on native fish and frogs. Reduction in quality of riparian habitat through set-stock grazing impacts on rates of erosion, increasing nutrient loads to waterways. Priority waterway assets are:

**Goulburn River:** A Heritage River associated with wetlands of national significance which supports threatened species including Murray Cod, Silver Perch and Macquarie Perch. It contains cultural heritage sites and provides water for agriculture, urban centres and recreational use.

**Gobarup Creek:** Associated with wetlands of national significance.

**Hughes Creek:** Supports the threatened Macquarie Perch and Murray Cod.

**Broken River:** Associated with wetlands of national significance and supports the threatened Murray Cod, Macquarie Perch and Silver Perch.

**Holland Creek:** Supports the threatened Macquarie Perch.

**Ryans Creek:** Contains an ecologically healthy reach.

Wetlands of the Productive Plains are generally in a moderate to good condition. Priority wetland assets include:

**Doctors Swamp:** One of the most intact River Red Gum swamps in Victoria which supports a diverse number of species including 73 wetland flora species and 44 wetland fauna species. It can receive environmental water via irrigation infrastructure.

**Winton Wetlands:** 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 Latham's Snipe and protects seven nationally threatened flora species.

**Tahbilk Lagoon:** A large billabong connected to the Goulburn River. The wetland is a biological hot spot that protects a number of threatened species including the Broad-shelled Turtle, the most southerly remnant freshwater Catfish population and the largest known Watershield (native waterlily) population in Victoria.

**Moodies Swamp:** 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.

Larger aquifers support agricultural pursuits, as well as stock and domestic supply. Climate variability and reduced recharge and over extraction are threats to these larger groundwater aquifer assets. The deep lead aquifer asset in this area is the Mid-Goulburn deep lead aquifer system associated with the Goulburn River.



## People

Land ownership in this SES is relatively stable with properties changing hands less frequently compared to the rest of the Catchment. This long-term ownership often creates a strong sense of land and water stewardship among land owners.

The current condition of communities in the Productive Plains is considered by people who were interviewed to be good but declining. The effects of the recent drought are long-lasting and the average age of farmers in this SES is increasing, which is driving changes in land management, such as leasing.

Landcare Networks and CMNs are well established in this SES and are key delivery partners of onground works. They play a pivotal role in identifying relevant projects that consider both the productive needs of this SES whilst enhancing natural assets.

## Developing resilience of the Productive Plains SES

The Productive Plains SES's relative stability presents an opportunity to address incremental threats and to develop general resilience in advance of an uncertain future. Table 9 details what is needed to develop resilience in the Productive Plains SES, building on needs best addressed at whole-of-Catchment scale, which were listed in Chapter two.

Context	Management measure	Possible specific action (examples)
<p>The ageing demographic suggests there could be significant land ownership or management changes over the next decades, although it is very uncertain what <b>land-use changes</b> will result. Social capital, in the form of the community-based workforce, might also decline as long-term community members leave the SES or are no longer able to contribute.</p> <p>There is significant opportunity in many areas to:</p> <ul style="list-style-type: none"> <li>prevent the decline in native vegetation from fragmented (10-30 per cent cover) to relictual status (less than 10 per cent cover)</li> <li>revegetate and connect remnant patches.</li> </ul> <p>This landscape change also offers ecosystem services to <b>increased farm production</b>.</p>	<b>Strategic priority: Increase biodiversity as part of agricultural land-use</b>	
	Create awareness and acceptance of land management practices to protect and improve terrestrial and aquatic habitat	Provide education opportunities through conservation groups such as Landcare and CMNs
	Identify environmental stewardship opportunities for land managers	Support projects like the Grey-crown Babbler and Regent Honeyeater projects
	Work with landholders to protect and improve biodiversity on private land and build understanding of its contribution to sustainable and profitable farming	Implement a biodiversity incentives project that protects and enhances habitat, such as Blackberry control
<p>Significant <b>land-use changes</b> are mostly in the south-western part of this SES, in areas around Nagambie and across to the Strathbogie Ranges, where broadacre mixed farming properties are making way for more intensive enterprises such as thoroughbred horse studs. Such enterprises present significant risks and opportunities for catchment management.</p> <p>Although <b>water policy reforms</b> are considering the suite of ecosystem services provided by waterways, regulation of the waterways for multiple purposes, especially downstream supply, limits operation of the waterways in terms of water quality and ecological benefits.</p>	<b>Strategic priority: Capture opportunities from land development</b>	
	Deliver farm planning to integrate ecological and agricultural productivity benefits	Environmental Best Management Practice courses by Gecko CLaN
	Promote land-use capability assessments and implementation, including use and management of water	Sustainable agriculture practice research and extension e.g. Gecko CLaN's Pasture Cropping and Sustainable farming education and Strathbogie Tablelands Landcare Alternative Fertiliser Trials
	<b>Strategic priority: Deliver water to waterways and wetlands</b>	
<p>Short-term agricultural production objectives and long-term native biodiversity objectives on the one piece of land are usually not well aligned in this SES: if <b>climate variability</b> and <b>increased farm production</b> drivers stimulate more or different agricultural production, such as more cereal crops, biodiversity may be further threatened and agricultural soils will be pushed to produce more. These changes may also introduce new or increased threats to land and soil health, such as invasive pest species.</p> <p>Fire risks in public land such as the Whroo Rushworth Forest are exacerbated when there are extended dry periods, which are part of <b>climate variability</b>, placing biodiversity habitat at risk.</p> <p>Droughts stemming from climate variability highlight the need for research into new crops, or modification of existing crops, and their management.</p>	<b>Strategic priority: Establish sustainable agricultural practices</b>	
	Create awareness and acceptance of sustainable management practices to improve land and soil condition	Engagement with farming groups on benefits of changed management practice e.g.; Gecko CLaN's Pasture Cropping project - farmers teaching farmers
	<b>Strategic priority: Adapt to climate variability risks</b>	
	Factor risks of climate variability and identify adaptation strategies in Goulburn Broken CMA and partner plans	Sustainable Agriculture Practices such as Gecko CLaN's Soil Carbon activities. Education of landholders to adapt to climate variability
<p><b>Climate variability</b> has resulted in extreme drought and floods over the last decade, impacting on this SES long after the event, exacerbating the burden on rural communities.</p>	Factor risks to natural assets into public land fire management plans	Partner agencies involvement in fire management strategy development
	<b>Strategic priority: Respond to and from climatic events</b>	
	Plan and implement flood, fire and drought response and recovery	Delivery of support to affected communities

### Note:

The table (and descriptions on the previous page) will be part of background information for consultative planning and implementation over the next few years, which will include decisions on how to keep the SES from crossing undesirable thresholds. Significant uncertainties in setting desirable SES thresholds and measuring progress elevate the need for close collaboration between SES stakeholders when setting priorities. Some key threshold parameters to be considered when making decisions are listed in the table. Appendix six includes a more complete list across all SESs, with some quantitative targets.

**Table 9: Adapting to drivers of change in the Productive Plains SES**

### 3. Upland Slopes

Delatite River Valley, with Mt Buller in the background. Photo: Mark Turner, Goulburn Broken CMA



The Upland Slopes SES extends across the southern hills and valleys of the Goulburn Broken Catchment. The landscape is typified by large old scattered trees within winding valleys, meandering between often forested hillsides. This SES includes the towns of Yea, Mansfield, Alexandra and Jamieson.

The Taungurung were the first people of the rivers, valleys and mountains in this region. Before European settlement, this SES was covered in forests in the hills and open grassy woodlands in the valleys. More recently, this area has been dominated by agricultural land and has had natural events, such as drought and fire shape the landscape.

#### Values, products, goods and services of this system

Many waterways yield good quality water, which provides economic (agriculture and tourism), ecological (water quality and quantity) and social (lifestyle and recreational (boating, fishing)) services. The remaining native vegetation (terrestrial and riparian vegetation on both public and private land) is valued for the ecosystem services as well as economic (tourism, forestry) and social (recreation and lifestyle) values it provides. Agricultural production is valued, but the lifestyle opportunities of this SES are increasingly appreciated by full-time and occasional residents.

The resilience of the Upland Slopes is about this system's ability to stay in a state that provides these values in the face of change. This state underpins the future aspiration for the Upland Slopes: *An area of inspired and diverse community participating widely in sustainable agriculture and lifestyle land-use, for conservation, production and tourism outcomes.*



## Biodiversity

Prior to European settlement, this SES would have consisted of grassy valleys, scattered with large old trees, more heavily wooded hills, but also some grassy hills with few trees.

The current state of biodiversity is considered to be good in terms of extent, although fragmented and disconnected. Many large, old trees and native pastures occur on private land, while public land supports large forest blocks. Common vegetation types are herb-rich forest EVC, which is classified as 'least concern' or 'depleted' and Valley Grassy Forests which are considered vulnerable to extinction.

Major threats to biodiversity in this SES are the lack of linkages between forest blocks; and the continued decline in the quality and extent of grassy woodlands and forests due to changes in land-use; and the quality of large forest blocks due to the effects of changes in fire regimes.

**Terrestrial habitat:** Significant terrestrial habitat assets for this SES include spring-soak wetlands and rocky outcrops of the Strathbogie Ranges and the grassy woodland steep hills that fringe the valleys to the south of the Strathbogie Ranges.

**Threatened species and communities:** Significant species and communities include the Legless Lizard, Golden Sun Moth, and Valley Grassy Forest EVCs.

## Land

Land-use across the Upland Slopes SES is a mixture of native forests, parks and production forestry on public land and dryland agriculture in the cleared valleys and slopes. This takes the form of grazing with some intensive agriculture such as viticulture and irrigated agriculture along waterways. Land-use in this SES is changing and traditional agricultural land is now interspersed with new production-types and lifestyle-focused properties. Soils here are shallow and finely structured.

The current condition of land and soils in this SES varies in relation to its use and management on private land. On public land it is considered in good condition, however, the 2006 and 2009 bushfires have impacted on soil health, in particular erosion.

Erosion is a major threat, although organic matter decline, soil acidification, contamination, compaction, salinisation and biodiversity decline are all also threats in this SES. Pest plant and animal invasion is a further threat. Major invasive species that affect the land in this SES are rabbits, which cause erosion and prevent regeneration of native species. A major plant threat is Blackberry, which clogs waterways, overtakes agricultural land and provides harbour for rabbits.

### ► RCS IN ACTION



### Working on Country with Taungurung

The Taungurung Weeds of National Significance (WONS) Caring for Our Country project is a joint program between Taungurung Clans Aboriginal Corporation and Goulburn Broken CMA for the control of WONS in high priority wetlands. The project also captures and exchanges Traditional Ecological Knowledge across Taungurung country.

Within the Strathbogie Ranges the innovative project is building cross-cultural relationships with Taungurung and local landholders through local Landcare facilitators. The project whilst protecting rare wetlands is also facilitating the sharing of cultural information held by landholders for generations. The project has given Taungurung people an instrument to create a cultural map of their Traditional lands utilised by their ancestors.



## Water

This SES generates a large proportion of the Catchment's total water yield. Lake Eildon, which regulates the Goulburn River, is an important feature and contributes to agriculture and lifestyles in this area. The Goulburn River also delivers a regulated supply of high quality water down the Catchment. Waterways vary in their condition, with the Goulburn River considered to be in a poor state, largely due to regulation.

Major threats to water quality in this SES are from erosion run-off (bushfire impacts) and diffuse sources of pollution (not directly associated with the waterway, e.g. animal faeces, township and lifestyle development). Changes to flow and flood regimes that regulate rivers threaten native fish populations and floodplain-dependent plant species. Priority waterway assets are:

**Goulburn River:** A Heritage River that supports threatened species. It contains important cultural heritage sites, provides water for agriculture and urban centres in and downstream of the basin, and supports recreational activities such as fishing and boating.

**Hughes Creek:** Supports the threatened Macquarie Perch and Murray Cod.

**King Parrot Creek:** Supports the threatened Macquarie Perch.

**Yea River:** Supports the threatened Macquarie Perch.

**Acheron River:** Environmental site of significance.

**Delatite River:** High economic values and supports the threatened Murray Cod.



Wetlands here are considered to be generally in a moderate state. Maintaining and enhancing wetland connectivity is important in the valleys. Priority wetland assets are:

**Central Highlands Peatlands:** Five separate sphagnum moss dominated bogs located along rivers and gullies in the Central Highlands.

**Yea Wetlands:** Protects the nationally and internationally threatened *Hemiphysalis* Damselfly (living fossil) which extend for approximately 10 kilometres upstream of Yea and a further 8-10 kilometres downstream to the Yea River's confluence with the Goulburn River.

**Horseshoe Lagoon:** A billabong on the mid-Goulburn River which is one of only a few wetlands in the region in excellent condition.

This part of the Catchment has relatively fresh, but low yielding fractured rock groundwater aquifers used mainly for domestic and stock use. Some small scale agricultural production is also supported by groundwater. The greatest threat to these aquifer assets is climate related changes to rainfall patterns and distribution, affecting their recharge. The future availability of groundwater is also put under pressure from water demand threats, particularly pressure from development.

## People

Taungurung people still live on country today and are active in the protection and preservation of their culture and land. Farmers and lifestyleers also characterise the community in this SES.

Some of this area is within daily commutable distance to Melbourne but has proved highly attractive for weekenders beyond this daily commute. Just under 50 per cent of Mansfield ratepayers are now absentee landholders. The area provides a range of recreational and tourism opportunities. Accordingly, the service industry is a large employer.

The community has a strong connection to the land, and as one landholder put it, 'I view the river as my river and I'm looking after it'. There is, at times, disconnect between different land-users and managers.



## Developing resilience of the Upland Slopes SES

Table 10 details what is needed to develop resilience in the Upland Slopes SES, building on needs best addressed at the whole-of-Catchment scale, which were listed in Chapter two.

Context	Management measure	Possible specific action (examples)
<p>Several intersecting drivers of change on top of existing land and water uses threaten to result in the crossing of water yield and quality thresholds in this SES.</p> <p><b>Climate variability</b> led to unprecedented bushfires in 2006 and 2009, increasing the vulnerability of soils to erosion. Nutrient laden run-off from diffuse sources, including agricultural land and emergent lifestyle developments (as <b>land-use changes</b>), is also significant. Although <b>water policy reforms</b> are considering the suite of ecosystem services provided by waterways, regulation of the waterways for multiple purposes, especially downstream supply, limits operation of the waterways in terms of water quality and ecological benefits.</p> <p>Changes to flow regimes to provide ecological benefits may create perceived risks to landholders along regulated waterways.</p> <p><b>Climate variability</b> and continued demand is threatening Groundwater yield and quality in upper parts.</p> <p>Although the Upland Slopes SES has large areas of native vegetation, especially on public land, agricultural practices and <b>land-use changes</b>, including subdivision, on private land (described above) is threatening to result in the crossing of several biodiversity habitat thresholds, especially fragmentation, connectivity and fire frequency, and riparian width thresholds (for cleaning water).</p>	<b>Strategic priority: Influence regional water policy</b>	
	Influence water policy development and implementation to secure water for improving natural asset condition and social and economic wellbeing	Continued community, DEPI, Goulburn Broken CMA, industry and water authority partnerships to provide balanced and informed input into policy development
	<b>Strategic priority: Deliver water to waterways and wetlands</b>	
	Plan, deliver and monitor environmental water delivery to improve the condition of priority waterways and wetlands	Consider in the development of the 2013 Waterway Management Strategy
	<b>Strategic priority: Capture opportunities from land development</b>	
	Plan land-use to minimise loss of biodiversity	Identify high value assets and potential biodiversity corridors in lifestyle areas and assist local government in the development of appropriate tools to include biodiversity in planning decisions
	Manage public land to minimise loss of biodiversity	Partner agencies to become more involved in meetings that are making land management decisions
	<b>Strategic priority: Adapt to climate variability risks</b>	
	Factor risks to natural assets into public land management and fire plans	Identify where agencies and community can have influence and build partnerships with public land managers
	<b>Strategic priority: Increase biodiversity in agricultural land-use</b>	
	Create awareness and acceptance of land management practices to protect and improve terrestrial and aquatic habitat	Develop an education campaign that focuses on increasing knowledge and acceptance of the need for biodiversity conservation
	Work with landholders to protect and improve biodiversity on private land and build understanding of its contribution to sustainable and profitable farming	Provide landholders with incentives to improve the condition of terrestrial, riparian and wetland habitat

Context	Management measure	Possible specific action (examples)
The capacity of individuals and community organisations to address the legacy of the 2006 and 2009 bushfires as well future challenges is of significant concern, and populations of many native species of flora and fauna also remain vulnerable as a result of the bushfires. Fires, floods and drought all remain <b>climate variability</b> threats.	<b>Strategic priority: Adapt to climate variability risks</b>	
	Factor risks of climate variability and identify adaptation strategies in Goulburn Broken CMA and partner plans	Undertake risk assessment for specific biodiversity assets to determine priorities for investment
	Plan and implement flood, fire and drought response and recovery	Contribute to the Hume Regional Emergency Management Committee
Land-use changes and the make-up of the population, including absentee landownership of near 50 per cent in some local government areas, threaten connections between the people who largely manage the system.	<b>Strategic priority: Capture opportunities from land development</b>	
	Promote broader community awareness and acceptance of practices to protect and improve the condition of natural assets	Partner Landcare in the promotion of biodiversity and incentives to act on knowledge and acceptance
	Promote land-use capability assessments and implementation that includes management of water	Work with local shire planners to develop planning overlays that consider land capability
Short-term agricultural production objectives and long-term native biodiversity objectives on the one piece of land are usually not well aligned in this SES: if <b>climate variability</b> and <b>increased farm production</b> drivers stimulate more agricultural production, such as cereal crop, biodiversity may be further threatened and agricultural soils will be pushed to produce more.	<b>Strategic priority: Establish sustainable agricultural practices</b>	
	Create awareness and acceptance of sustainable management practices to improve land and soil condition	Partner in invasive pest plant and animal program delivery

**Note:**

The table (and descriptions on the previous page) will be part of background information for consultative planning and implementation over the next few years, which will include decisions on how to keep the SES from breaching undesirable thresholds.

Significant uncertainties in setting desirable SES thresholds and measuring progress elevate the need for close collaboration between SES stakeholders when setting priorities. Some key threshold parameters to be considered when making decisions are listed in the table (Appendix six includes a more complete list across all SESs, with some quantitative targets).

*Table 10: Adapting to drivers of change in the Upland Slopes SES*



## 4. Commuting Hills

Mt Piper in the mist. Photo: Abbey Green



The Commuting Hills SES features the mountainous urban fringe of the southern and south-eastern Goulburn Broken Catchment. Large tracts of public land and small privately owned forested land remain over much of this area. Towns include Kilmore, Broadford, Kinglake and Marysville.

Traditional Owners shaped the land of the Commuting Hills SES. Since then, the Commuting Hills SES has been cleared for agriculture and gold rushes and rail and road infrastructure.

### Values, products, goods and services of this system

Ecologically this area is highly valued for the extent and connectivity of remaining unique forests and the rich diversity of species. Forests are also highly valued for the lifestyle they offer to people who live here, as well as the economic value created through agriculture, forestry and recreation.

These areas are of significant cultural value, with many Aboriginal sites remaining in these largely undisturbed landscapes. Waterways are highly valued for their pristine condition and the important service they provide; fresh clean water throughout the Catchment. Communities here are diverse, vibrant and energetic.

The resilience of the Commuting Hills is about this system's ability to maintain a state that provides these values in the face of change. This state underpins the future aspiration for the Commuting Hills: *An area that safely retains its natural appeal and value for those living, farming, working and visiting.*



## ► RCS IN ACTION



## Golden Sun Moth

The Golden Sun Moth (*Synemon plana*) is an endangered species of the native grasslands and grassy woodlands. The Golden Sun Moth lives most of its life underground (between 1-3 years) feeding on the roots of native grasses.

There are 43 species of Sun Moths found only in Australia. Unlike other moths they fly during the day and not at night. The Golden Sun Moth is also extraordinary as the females cannot fly.

The loss or disturbance of habitat is the major threat to the Golden Sun Moth. Remaining areas of habitat are under threat from urban development as cities and towns grow and farming methods change from grazing to cropping. Pesticides and fertilisers are also a threat.

Populations of Golden Sun Moths are now separated by large distances. This makes them very vulnerable as the males only fly short distances.

Groups such as the BEAM Mitchell Environment Group and the Friends of Mt Piper are working to raise the awareness of the Golden Sun Moth to protect it from extinction.

## Biodiversity

The large areas of publicly and privately owned forests are irreplaceable and rare. In this SES, vegetation clearing and timber harvesting has occurred since European settlement. However, the classification of state parks in parts of this SES in the early 20th century have protected large forest areas and these contribute to its current biodiversity classification of good condition. The major threat to this condition comes from intensive residential development in and around these forests and their existing and potential linkages. Pest plant and animal invasion and loss of understorey are threats to biodiversity here through invasion and degradation of the forest blocks. Predominant EVCs include Grassy Dry Forest and Shrubby Dry Forest. These EVCs are considered endangered or vulnerable and contain significant biodiversity assets.

**Terrestrial habitat:** There are several important reserves, one of which is Mount Piper Education Area, which contains five species of Wallaby Grasses, among other significant flora and fauna species.

**Threatened species and communities:** This SES is important for populations of the nationally threatened large and small Ant-blue Butterfly and Golden Sun Moth, and Crimson Spider Orchid (endangered

in Victoria and vulnerable in Australia). Other threatened species include Western Rat-Tailed Grass, Yellow Star, Slender Bitter Cress, Creeping Grevillea, Matted Flax Lily, Barking Owl, Powerful Owl, Diamond Firetail and Speckled Warbler.

## Land

Land-use on public land includes extensive native forests, parks and production forestry. Lifestyle, intensive agriculture such as berry farming and aquaculture along waterways, with some grazing on cleared valleys and slopes are typical private land-uses. Soils here are shallow and finely structured with high organic matter.

The current condition of land and soils in this SES is considered good because of the extent of native forests; however, the 2006 and 2009 bushfires have impacted on soil health, in particular erosion. Land clearing is also a threatening process here. A decline in organic matter and acidification are also threatening processes. Pest plant and animal invasion is a threat to all land-uses; particularly at the public and private land interface. Examples of invasive species include Serrated Tussock, Gorse, Blackberry and Paterson's Curse, foxes, dogs and cats.

## Water

The remaining extent of forest contributes to healthy river ecosystems, which ideally provide constant yields of filtered high-quality water down the Catchment. Threats to waterways here relate largely to run off and water quality. Waterways are classified generally in good condition, however, as with soil health, fires affect water yield and quality. Water quality is under threat in this SES from invasive species in waterways, including European Carp. Priority waterway assets are:

**King Parrot Creek:** Supports the threatened Macquarie Perch.

**Yea River:** Supports the threatened Macquarie Perch.

**Acheron River:** Environmental site of significance.

**Taggerty River:** Contains ecologically healthy and representative reaches and supports the threatened Barred Galaxias.

Groundwater in the Commuting Hills SES is used primarily for stock and domestic supply, in some cases for community/urban water supply (e.g. Kinglake). Climate change and variability, droughts and floods are key threats to water availability from aquifers, affecting recharge processes and baseflows to waterways and water quality.

This is particularly the case in the Commuting Hills which (like the other 'upland' type systems) contain aquifer systems which respond over short timeframes to reduced rainfall recharge. Groundwater availability is also put under pressure from water demand threats, particularly pressure from development in the Commuting Hills.

## People

Lifestylers, in commuting distance to Melbourne-based jobs and services, characterise much of the community of this SES. People are drawn to the area for its lifestyle and visual appeal, its commuting potential, and in some cases, for cheaper land prices relative to the Melbourne real estate market. Employment in this area is largely in the service sector. It will take a long time for many communities in this SES to recover from the impacts of the 2009 bushfires.

Many of the people living in this SES may associate more with southern landscapes, beyond the boundary of the Goulburn Broken Catchment. This may create challenges in getting the broader community involved in natural resource issues associated with overall catchment health. This may also mean a disconnect at times with the long established farming community still remaining in the SES.

## Developing resilience of the Commuting Hills SES

Table 11 details what is needed to develop resilience in the Commuting Hills SES, building on needs best addressed at the whole-of-Catchment scale, which were listed in Chapter two.

Context	Management measure	Possible specific action (examples)
<p>Although the Commuting Hills SES has large areas of native vegetation, <b>land-use changes</b> on private and public land (described above) are threatening to result in the crossing of several thresholds. Native vegetation ecosystem services (and threshold parameters to be managed) are the provision of:</p> <ul style="list-style-type: none"> <li>biodiversity habitat (quality, patch sizes and corridor widths)</li> <li>clean water (riparian buffer widths)</li> <li>natural amenity (patterns of native vegetation).</li> </ul> <p>Extreme <b>climate variability</b> has resulted in drought, fires and floods over the last decade, impacting on this SES long after the event. This is exacerbating the impacts of <b>land-use change</b> and is placing an additional burden on rural communities, several of which have been stretched to breaking point.</p> <p>Increased frequency of bushfires and drought, resulting from extreme <b>climate variability</b>, and planned fires are significant additional threats to aquatic biodiversity habitat and water quality (through increased soil erosion) and to terrestrial biodiversity habitat (loss of structural diversity).</p> <p>The new buildings and infrastructure proliferating as part of <b>land-use changes</b> also need to be designed in the context of bushfires and floods so that economic and social values are not significantly impacted.</p>	<b>Strategic priority: Capture opportunities from land development</b>	
	Manage land-use to minimise loss of biodiversity	Working with Murrindindi and Mitchell Shires to identify high value habitat assets and connectivity pathways to inform planning
	Promote land-use capability assessments and implementation that includes management of water	Mitchell Shire distributes information on biodiversity, native vegetation, weeds and sustainability through the Rural Landholders Kit and New Residents Kit. The Kit is sent biannually to all new landholders >2ha.
	Promote broader community awareness and acceptance of practices to protect and improve the condition of natural assets	Mitchell Shire Land Management Policy addresses land degradation problems; pest plants and animals, salinity, erosion, and loss of native flora and fauna. Eligible landholders receive rate reductions for land management practices that arrests land degradation that has off-site and downstream effects
	Manage public land to minimise loss of biodiversity	Work with Parks Victoria and landholders adjacent to parks to better manage the public/private land interface
	<b>Strategic priority: Respond to and recover from climatic events</b>	
	Plan and implement flood, fire and drought response and recovery	Contribute to the Hume Regional Emergency Management Committee
	<b>Strategic priority: Adapt to climate variability risks</b>	
	Factor risks of climate variability and identify adaptation strategies in Goulburn Broken CMA and partner plans	Identify areas of drought refugia, and work with research institutions to better understand the influence of fire regimes on various biota
	Factor risks to natural assets into public land fire management plans	Input into a strategic approach to planned burning that considers ecological values

**Note:**

The table (and descriptions on the previous page) will be part of background information for consultative planning and implementation over the next few years, which will include decisions on how to keep the SES from breaching undesirable thresholds.

Significant uncertainties in setting desirable SES thresholds and measuring progress elevate the need for close collaboration between SES stakeholders when setting priorities. Some key threshold parameters to be considered when making decisions are listed in the table (Appendix six includes a more complete list across all SESs, with some quantitative targets.)

*Table 11: Adapting to drivers of change in the Commuting Hills SES*

## 5. Southern Forests

Upper Goulburn River Valley around Kevington. Photo: Mark Turner, Goulburn Broken CMA



The Southern Forests SES to the south and south-east of the Goulburn Broken Catchment includes seasonally snow-covered alps, moist montane and sclerophyll forests. The Southern Forests occur on public land which is managed as State Forest, alpine resorts and national or state parks by Parks Victoria, Department of Environment and Primary Industries (DEPI), the Alpine Resorts Co-ordinating Council and Alpine Resort Management Boards. These are the largest intact native vegetation areas in the Catchment.

Over the past 100 years, the Southern Forests SES has been significantly shaped by natural events such as the 1939 and more recent fires, gold rushes and the post-war timber and tourism boom. More recently, the concentration of timber mills has slowly been reducing and tourism demands have increased.

### Values, products, goods and services of this system

The forest landscapes are highly valued for their ecological extent and diversity, cultural significance and economic importance generated through recreation and tourism, and plantation and native forest timber harvesting. The ecosystem services provided by the Southern Forests include high quality and reliable water which then provide environmental, economic and social values across and beyond the Catchment.

The resilience of the Southern Forests is about this system's ability to stay in a state that provides these values in the face of change. This state underpins the future aspiration for the Southern Forest as: *A protected ecosystem that balances ecological, economic and recreational needs.*





## ► RCS IN ACTION



## Holly removal in Marysville and Narbethong

Holly is a weed affecting the Southern Forests of the Goulburn Broken Catchment. As with most weeds, Holly is a garden plant that escaped into the forest through birds eating the berries and dispersing the seeds into the surrounding bushland.

As the majority of the forested land in this area is public land, Holly removal has been a partnership project involving VicRoads, DEPI, Goulburn Broken CMA, PV, Murrindindi Shire Council, Landcare, Friends of the Marysville Walks, Conservation Volunteers and the local community.

Significant funding by the agencies listed above and much effort (both paid and unpaid) has contributed to eradicating this weed on private and public land. The program began in April 2007 and to date has eradicated Holly from approximately 900 hectares and is ongoing.

The objective of the program and future vision for the Southern Forests is 'No Holly at Narbethong, Marysville and Buxton'.

## Biodiversity

Travelling along a gradient from the valleys to the mountains, old growth damp and wet forests, interspersed with rainforests, give way to mixed species forest of Peppermints and Box trees. High on the slopes, Snow Gum Woodlands dominate a herb-rich ground layer. Above the snowline, unique fens and bogs are alive with frogs and water nymphs.

The large forests of this SES still contain unique vegetation communities including Alpine Sphagnum Bogs, fens and habitat such as boulder fields, although all of these are affected by people. However, generally the current condition of biodiversity in this SES is considered good. Major threats to this state are recreational activities (such as four-wheel driving on steep and erodible sites), cattle grazing and pest plant, disease and animal invasion (e.g. fox predation and the Chytrid Fungus).

**Terrestrial habitat:** The unique vegetation, fauna communities and species of this SES include the Alpine Frog, groundwater dependent ecosystems, peat bogs and wetlands. EVC groups include Sub-alpine and Montane grasslands, shrublands or woodlands, with rare EVCs including Alpine Rocky Outcrops and Sub Alpine Dry Shrubland.

### Threatened species and communities:

Focus species are the Mountain Pygmy Possum and frogs such as Dendy's Toadlet, Spotted Tree Frog (critically endangered, endangered nationally) Growling Grass Frog, Brown Toadlet (endangered in Victoria) and Alpine Tree Frog (critically endangered, vulnerable nationally). Cool temperate Rainforest EVC is endangered.

## Land

Land in the Southern Forests SES is used for forest reserve, recreation, tourism and production forestry (native forests and plantation). These land-uses require supporting infrastructure, including roads and telecommunications. Soils are fragile on often steep slopes. The current condition of land and soils in this SES is considered good because of the extent of native forests, however, the 2006-2009 bushfires have impacted on soil health, in particular erosion.

Erosion is a threat to these fragile soils. All invasive and introduced plants and animals are a major threat to this area, as they reduce the natural values, for all ecosystems. In particular, Holly and Blackberry spread easily in damp forests. Pigs, cattle and deer cause erosion and major disturbance to damp and wet forests. Foxes and feral cats kill native species that keep the forest system healthy, such as Bandicoots that spread fungus, vital for maintaining soil structure.

## Water

The Southern Forests SES contribute to healthy river ecosystems, providing constant yields of filtered high quality water. Waterways in this SES are considered to be in a good to excellent state.

There are several significant native fish species in this area and barriers to fish movements are a threat. Increasing numbers of tracks for timber extraction and recreational activities intensifies erosion, resulting in reduced water quality. This leads to increased sedimentation of waterways, destruction of fish habitat and changes to stream conditions, such as temperature and turbidity. Priority waterways assets are:

**Goulburn River:** A Heritage River that is an ecologically healthy reach. It supports many threatened species including the Barred Galaxias, Spotted Tree Frog and Alpine Bent.

**Rubicon River:** A priority river with near “Ecologically Healthy” status, supports Barred Galaxias in tributary streams – Keppel Hut Creek, Pheasant Creek, Perkins Creek, Taggerty River, Torbreck River and Stanleys Creek.

**Big River:** A Heritage River containing ecologically healthy and representative reaches that supports the threatened Spotted Tree Frog.

**Howqua River:** A Heritage River that has high economic values in the form of tourism and recreation.



The current condition of wetlands in this SES is considered to be good. The major threats to wetlands are pest plant and animal invasion and soil erosion. Priority wetland assets include:

**Alpine bogs:** Areas that protect the nationally endangered Alpine Sphagnum Bogs and associated fens ecological community.

**Central Highlands Peatlands:** Five separate sphagnum moss dominated bogs located along rivers and gullies in the Central Highlands.

## People

People enjoy this SES throughout the year, pursuing a range of recreational activities, including skiing in winter, bush walking, driving, cycling and camping. Recreation and tourism contribute economic wealth to the SES. Some small communities are permanent, but seasonal communities commonly service the recreation and tourism industries or forest harvesting activities and maintenance of infrastructure that supports both. Hence, people are often not well connected with each other or the surrounding environment.

Threats include bushfires and policies that affect tourism and forestry activities. The current state of communities in or around the Southern Forests could be considered variable, although this assessment is largely unsupported. Communities are still suffering the devastating effects of bushfires. Forest harvesting has been declining. Anecdotally, recreational use of the forests is increasing.

## Developing resilience of the Southern Forests SES

Table 12 details what is needed to develop resilience in the Southern Forests SES, building on needs best addressed at the whole-of-Catchment scale, which were listed in Chapter two.

Context	Management measure	Possible specific action (examples)
<p>Although the natural environment is relatively intact in the Southern Forests SES, several native vegetation thresholds may be approached, with threats from current land uses and possible <b>land-use changes</b> compounding the legacy of major natural events and historic land-uses. This is particularly important at the public/private land interface.</p> <p>Retaining diversity of native vegetation is critical to these forests' long-term viability. Native vegetation ecosystem services (and thresholds to be managed) include the provision of:</p> <ul style="list-style-type: none"> <li>• Terrestrial biodiversity habitat for several species (quality and diversity)</li> <li>• Clean water for consumption, aquatic biodiversity and recreation (cover to prevent erosion)</li> <li>• Natural amenity (patterns of native vegetation in the landscape).</li> </ul>	<b>Strategic priority: Create opportunities from land development</b>	
	Plan land-use to minimise loss of biodiversity	The Mitchell Shire Environment Committee provides: <ul style="list-style-type: none"> <li>• Advice and makes recommendations concerning management of the natural environment</li> <li>• A mechanism for community representatives, Councillors and staff to discuss, develop and contribute to environmental issues</li> <li>• A source of expertise to support development and review of plans and strategies</li> </ul>
<p>Increased frequency of unplanned bushfires and drought, resulting from extreme <b>climate variability</b>, and planned fires are significant additional threats to aquatic biodiversity habitat and water quality (through increased soil erosion) and to terrestrial biodiversity habitat (through loss of structural diversity).</p>	Manage public land to minimise loss of biodiversity	The Holly removal project in the case study demonstrates a management project at the public-private interface
	<b>Strategic priority: Adapt to climate variability risks</b>	
<p>Extreme <b>climate variability</b> has resulted in extreme drought and fires over the last decade, impacting on this SES long after the event.</p>	Factor risks of climate variability and identify adaptation strategies in Goulburn Broken CMA and partner plans	Identify areas of drought and fire refugia and manage for protection
	Factor risks to natural assets into public land fire management plans	A range of agencies to be included in discussions by DEPI and PV to have input into land management decisions
	<b>Strategic priority: Respond to and recover from climatic events</b>	
	Plan and implement flood, fire and drought response and recovery	Identify risks to drought refuge areas and develop mitigation plans

### Note:

The table (and descriptions on the previous page) will be part of background information for consultative planning and implementation over the next few years, which will include decisions on how to keep the SES from breaching undesirable thresholds.

Significant uncertainties in setting desirable SES thresholds and measuring progress elevate the need for close collaboration between SES stakeholders when setting priorities. Some key threshold parameters to be considered when making decisions are listed in the table. Appendix six includes a more complete list across all SESs, with some quantitative targets.

Table 12: Adapting to drivers of change in the Southern Forests SES



## 6. Urban Centres

Artwork by Dianna Budd from RiverConnect exhibition 2012



Urban Centres are the smallest sub-Catchment systems by area, but contain the largest populations in the Goulburn Broken Catchment. These areas are defined by a concentration and diversity of people, services and industries. Major urban centres are Shepparton, Seymour and Benalla.

Major urban centres have typically grown from settlement on rivers and floodplains, where waterways supported growth and development of these centres and surrounding agriculture. These waterways and their remaining native vegetation have been highly modified based on past use and are now in a degraded state. Built structures and supporting infrastructure are the main features of these landscapes.

### Values, products, goods and services of this system

These centres are valued for the range of services and employment opportunities they provide. River and water features are valued for their aesthetic appeal and recreation and economic services provided. Communities are valued for their rich diversity.

The resilience of the Urban Centres is about this system's ability to stay in a state that provides these values in the face of change. This state underpins the future aspiration for the Urban Centres as: *Centres that offer employment and support facilities for residents and service surrounding rural areas while valuing the natural environment.*

### Biodiversity

Urban centres have major waterways and associated riparian and terrestrial habitat, such as large old hollow bearing trees. The waterways provide native vegetation corridors through towns which can act to reduce the fragmentation effect of surrounding agricultural land by providing important links between remnants.

Urban centres contain many threats to biodiversity through high density housing and the associated infrastructure, cats and dogs, invasive species (rats, Indian Mynas, sparrows), removal of indigenous vegetation and pollution. Native vegetation is scarce and highly fragmented, occurring mainly along the waterways. It is highly modified and generally in poor condition ecologically, managed more for recreational purposes, by DEPI, PV or local government.

Areas of high conservation value are the local parks, waterways and wetlands, which can be home to wildlife such as the threatened Squirrel Glider.



## ► RCS IN ACTION



## Nest box building with Bunnings Warehouse

The sound of hammers could be heard from the DIY Workshop in Shepparton Bunnings as Year 10 and 11 students from Shepparton High School built nest boxes for Landcare in support of threatened species.

Shepparton Bunnings and Shepparton High School have supported Landcare by building nest boxes for the Dhurringile and District Landcare group and the Upper Goulburn Landcare Network.

Shepparton High School and Shepparton Bunnings were recognised for their great work when they were awarded the 2011 Goulburn Broken Region Landcare Education Award for raising awareness and understanding of the Landcare ethic amongst students and/or the community, and for implementing Landcare.

Community members also had an opportunity to build boxes as part of an event held in the car park of Shepparton Bunnings. About 30 people attended the day to build nest boxes for bush fire affected mammals and birds enabling them to find new homes.

## Land

Land-use in the Urban Centres is intensively built with houses, facilities and supporting infrastructure. These centres are typically surrounded by agricultural land-use and have some public parks and forests, particularly along waterways.

Soils are threatened by erosion, organic matter decline, soil acidification, contamination, compaction, salinisation, sodicity and biodiversity decline related to land-use. Many people enjoy the more natural areas of their urban centres, but some are unaware of their effect on land when they dump garden waste, which spreads weeds not only to the immediate area but potentially out in the rural landscape (Paterson's Curse was initially a garden escapee). Foxes thrive in urban centres, as do feral cats, preying on native species and consuming garbage. The current condition of land and soil health in this SES is poor.

## Water

Waterways and wetlands in Urban Centres have been highly modified to accommodate development and built infrastructure. Water is extracted from the rivers for consumptive use, and waste and stormwater is also discharged. Wastewater is treated prior to discharge, but often stormwater is not.

Waterways and wetlands are a major feature of the Urban Centres SESs but are under stress from numerous threats associated with high density living, such as gross and diffuse pollutants, flood mitigation

works that change flows, aquatic weeds and European Carp, which all reduce water quality. Pollutants change the chemistry of water which in turn effects fish and the food on which they rely. The floodplains have also been highly modified. Priority waterway assets and wetlands are:

**Goulburn River:** A Heritage River associated with wetlands of national significance supporting threatened species including Murray Cod, Silver Perch and Macquarie Perch. It contains many cultural heritage sites and provides water for agriculture, urban and recreational use.

**Broken River:** Associated with wetlands of national significance and supports the threatened Murray Cod, Macquarie Perch and Silver Perch.

**Reedy Swamp:** A significant breeding area for colonial nesting waterbirds including the threatened Royal Spoonbill. It provides important drought refuge.

## People

People from Urban Centres are very diverse. They live in Urban Centres for the services they provide, including employment, schools, support facilities, infrastructure, retail, health care and sporting opportunities. Urban communities are connected through employment, sporting and social groups but may not be strongly connected to the natural environment. This connection has changed over time with more modern developments (such as Benalla Art Gallery) now capitalising on river views and building communities' appreciation of waterways and wetlands.

## Developing resilience of the Urban Centres SES

Most areas within the Urban Centres SES are so ecologically degraded that they provide few ecosystem services beyond providing land upon which to place infrastructure for living, working or driving.

All three urban communities are increasingly embracing the significant riverine assets that run through them, especially for aesthetic and recreational reasons. The many agencies that have responsibilities for managing these assets are capitalising on this shift in interest, with increasing efforts to restore the ecological functioning of riverine reaches to higher thresholds, including structural diversity of riparian habitat.

Urban Centres SESs' inhabitants need some understanding of broader Catchment needs in order to support management measures, especially those implemented by local government. Fostering the connection between urban inhabitants and their natural environment is likely to improve appreciation of rural environmental issues, resulting in benefits that extend beyond the Urban Centre SES.

Table 13 details what is needed to develop resilience in the Urban Centres SES, building on needs best addressed at the whole-of-Catchment scale, which were listed in Chapter two.

Context	Management measure	Possible specific action (examples)
<p><b>Land-use changes</b> on the edge of Urban Centres, usually from agriculture to industrial enterprises or housing, present significant local impacts but little risk to the crossing of systemic thresholds, with long-established local government planning processes addressing flood threats and risks to biodiversity. Significant actions to manage stormwater run-off, including retrofitting stormwater pipes in long-established areas, have been underway for almost two decades, helping to keep the waterways and adjacent environment clean.</p> <p>Improving riparian vegetation along waterways also improve biodiversity and water quality.</p> <p><b>Climate variability</b> has conditioned the community to be well prepared in responding to, and recovering from inevitable floods, but improvements to flooding warnings continue.</p>	<b>Strategic priority: Capture opportunities from land development</b>	
	Plan land-use to minimise loss of biodiversity	Influence development and implementation of the Hume Regional Growth Plan
	Manage wastewater treatment and stormwater runoff to minimise pollutants to urban waterways and wetlands	Creation of projects such as a wastewater wetland proposed by the South Yarrowonga Landcare Group
	Manage public land to minimise loss of biodiversity	Consider how Shepparton and Mooroopna's multi-partner RiverConnect model might be adapted to other urban centres
	Promote broader community awareness and acceptance of practices to protect and improve the condition of natural assets	Continued implementation of programs such as Waterwatch
	<b>Strategic priority: Respond to recover from climatic events</b>	
	Plan and implement flood, fire and drought response and recovery	Contribute to the Hume Regional Emergency Management Committee

**Note:**

The table (and descriptions on the previous page) will be part of background information for consultative planning and implementation over the next few years, which will include decisions on how to keep the SES from breaching undesirable thresholds.

Significant uncertainties in setting desirable SES thresholds and measuring progress elevate the need for close collaboration between SES stakeholders when setting priorities. Some key threshold parameters to be considered when making decisions are listed in the table. Appendix six includes a more complete list across all SESs, with some quantitative targets.

*Table 13: Adapting to drivers of change in the Urban Centres SES*

# Actioning sub-Catchment social-ecological system priorities

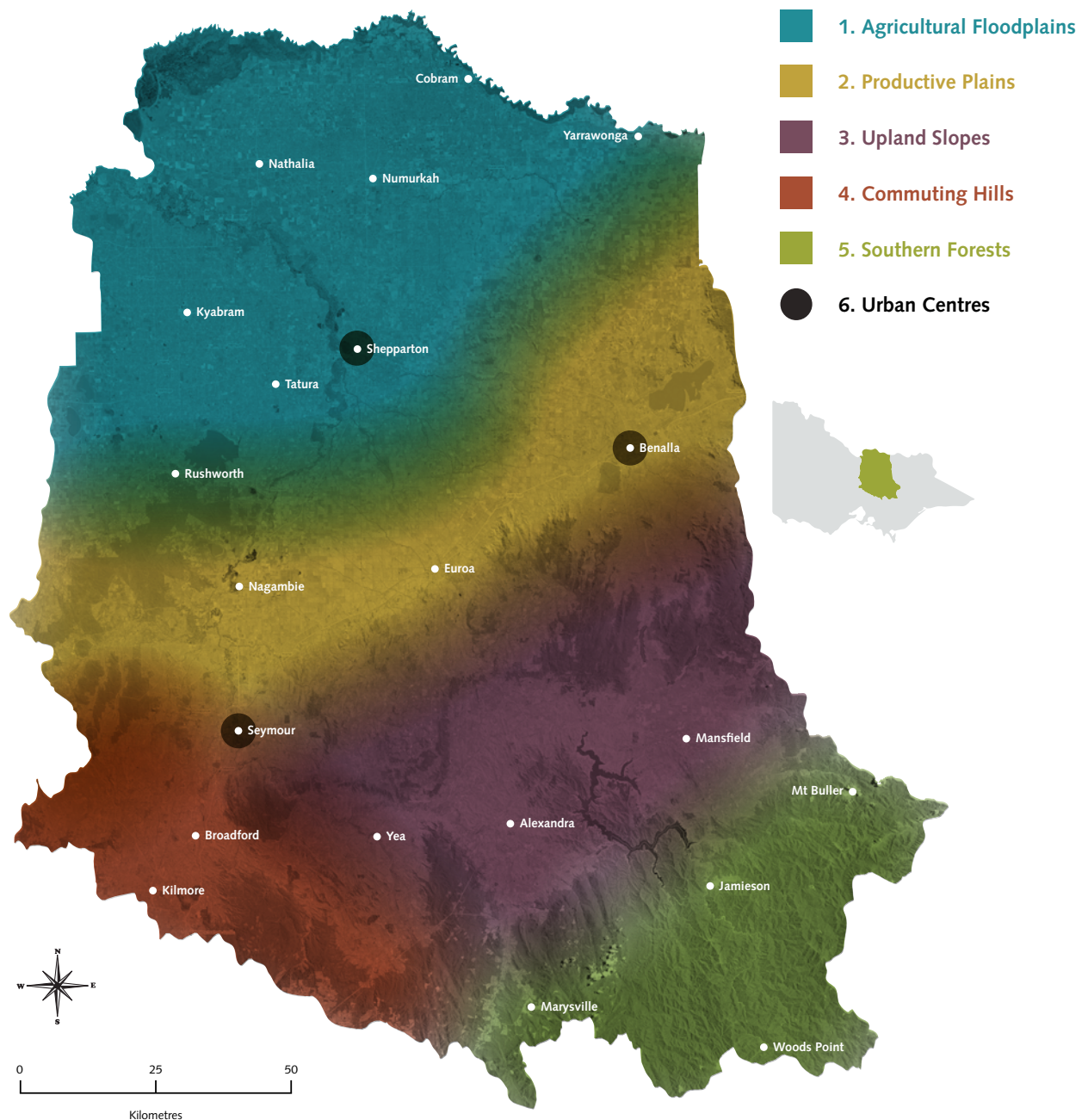


Figure 7: Sub-Catchment Social-ecological systems (SESs) of the Goulburn Broken Catchment

The following summary provides the focus for each SES (Figure 7) over the life of the RCS, based on current knowledge of SESs across the Catchment, drivers of change and resilience issues and priorities. It draws information from previously discussed long-term objectives, thresholds, assets and threats associated with making SESs resilient. Detail on how an assets based approach has been used to contribute to the areas of focus can be found in the supplement *Assets of the Goulburn Broken Catchment*.

### 1. Agricultural Floodplains

- Connect native vegetation on private land to the Goulburn and Broken Rivers, Barmah Forest and Broken Creek
- Keep shallow watertables below plant root zones and coordinate disposal of saline water
- Protect the unique character of Barmah Forest and key rivers, such as the Lower Goulburn River and Broken Creek and wetlands through delivery of environmental water and land management
- Integrate efficient water use with other environmental features into farm design
- Identify new ways to farm sustainably in variable climatic conditions
- Influence water policy to protect and secure water for farmers and the environment through community leadership

### 4. Commuting Hills

- Retain native vegetation extent in the face of development pressure to prevent loss of vegetation and subsequent biodiversity loss, erosion and water quality decline
- Identify and protect highest value vegetation corridors
- Nurture partnerships between land managers where private and public meet

### 2. Productive Plains

- Increase native vegetation areas and connections to Goulburn and Broken Rivers, Holland and Hughes Creek and Winton Wetland
- Integrate environmental features into farm design
- Sustain highly-valued waterways and wetlands through river protection and expanding river corridors
- Deliver community initiatives and partnerships to sustain habitat for threatened species and farm production, such as weed control

### 5. Southern Forests

- Maintain diversity of large extents of native vegetation on public land for habitat, clean water and natural amenity
- Protect populations of threatened Barred Galaxias
- Nurture partnerships between land managers where private and public meet

### 3. Upland Slopes

- Maintain native vegetation on public land, and enhance through strategic linkages to the Goulburn River and other key waterways
- Protect and improve the values of Lake Eildon and the Heritage listed Goulburn River
- Deliver environmental flows down the Goulburn River considering land use and development along the floodplain
- Deliver partnership approaches to sustainable land management practices

### 6. Urban Centres

- Retain native vegetation extent in the face of development pressure around urban centres
- Improve quality of riparian vegetation on public land along Goulburn and Broken Rivers
- Reduce flooding impacts to Seymour, Shepparton and Benalla
- Identify common interests with broader community that benefit the environment



CHAPTER FOUR

# Implementation and evaluation



Hamish Crawford enjoys his new groundwater pump at Harston

This chapter describes how the management measures listed in this RCS will lead to real changes.

It shows at a glance:

- how priorities vary between different SESs
- the partners needed to implement different management measures.

The chapter also describes how decisions will continually improve through evaluation and adaptation.

## RCS implementation

### PARTNER INVOLVEMENT AT ALL SCALES

RCS implementation depends on partnerships of many types and scales (see Chapter two, Appendix five and Figure 8).

The Goulburn Broken CMA facilitates these partnerships by helping to match decision making processes, including governance arrangements, with the issue being addressed. It encourages the making of decisions at a scale that is as close to the action as possible, consistent with *“the predominant view... ..that a devolved institutional design benefited agency performance and, if farmers had influence, benefited them also”* (Keeble *et al* 2012).

This RCS includes management measures that the Goulburn Broken CMA has a significant role in resourcing and implementing. While similar management measures have been emphasised previously at whole-of-Catchment scale, this RCS increases the focus on stakeholder involvement at the sub-Catchment SES scale. Goulburn Broken Catchment organisations also sometimes have a role in decisions that transcend the Catchment’s borders, such as water reform policy.

The emphasis of management measures listed in this RCS is on keeping different SESs in desirable states: away from undesirable thresholds. Other management measures having less impact on SES resilience are not listed in this RCS, although they are likely to be listed in separate sub-strategies if they are important.

More specific actions that expand upon the higher level RCS management measures are listed in sub-strategies or will be developed as part of SES or implementation planning and the annual funding cycle.

Case studies and examples of specific actions in this RCS are indicative of the onground changes that ultimately result from decisions at whole-of-Catchment and sub-Catchment SES scales.

Successful implementation of this RCS also depends on investment levels that partners can gain from Victorian and Commonwealth governments and other sources.

The timing and extent of sub-Catchment SES planning will depend on available funding and the commitment of Catchment partners, especially SES communities.



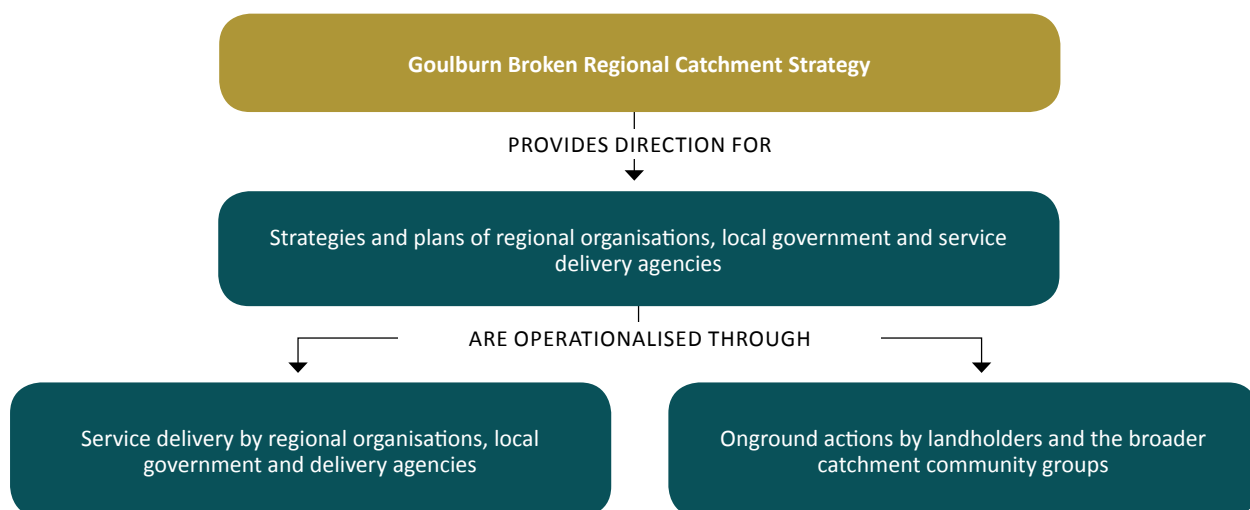


Figure 8: Overview of how the RCS will be implemented

## SHORT-TERM PRIORITIES

While management measures listed in Chapters two and three and in the evaluation section of this chapter will guide partners in developing and implementing projects over the next six years, priorities in the short-term include:

- establishing an RCS implementation plan (based on management measures collated in Table 14 and as described in the evaluation section of this chapter)
- identifying opportunities for projects, especially those involving partners, given the immediate context (including the funding environment)
- building projects stemming from this RCS into business planning processes.

## Priorities list and partner involvement

Table 14 on the following page lists management measures to be undertaken within each sub-Catchment SESs or at whole-of-Catchment scales to achieve desired levels of resilience. (These have been collated from Chapters two and three.) The table also provides the basis of an RCS implementation plan, including likely involvement of partners.

The numbered SESs in the table correspond to the SESs described in Chapter three:

1. Agricultural Floodplains
2. Productive Plains
3. Upland Slopes
4. Commuting Hills
5. Southern Forests
6. Urban Centres

The shaded column indicates SESs targeted for delivery of management measures over the next six years (as listed for each SES in Chapter two). A management measure with shading in each SES column indicates a whole-of-Catchment scale measure. For management measures where shading does not appear against an SES it does not infer that the management measure will not be undertaken. Rather, this targeting process is using resilience as the first criteria for guiding implementation. However, there are other criteria that are considered, such as availability of resources.



Strategic objectives, strategic priorities and management measures	SES						Partners*
	1	2	3	4	5	6	
Strategic objective: To embed the resilience approach							
Strategic priority: Update and develop strategies							
Review and update existing strategic documents and sub-strategies and create new ones according to need							Many and varied
Strategic priority: Plan at social-ecological system scale							
Develop an adaptive planning process for social-ecological systems to build and enhance their resilience							Land managers, residents, community groups, local government, Parks Victoria, water authorities, DEPI, DTPLI, research organisations, industry, CFA
Strategic priority: Provide adaptive management and leadership							
Build community and agency capacity to respond together to drivers of change							Many and varied
Research resilience knowledge gaps to inform decision making based on thresholds and tipping points							Research organisations, G-MW, DEPI, community groups, CMAs
Strategic objective: To strengthen partnerships							
Strategic priority: Reinforce relationships between agencies and industry							
Define roles and relationships with regional delivery partners							DEPI, G-MW, GVW, local government, Parks Victoria, industry groups
Strategic priority: Manage public land collaboratively							
Undertake works on public land and Crown land frontages to improve waterways and wetlands							Landholders, DEPI, Parks Victoria, local government, reserve committees of management
Collaborate with Traditional Owners in catchment management							Traditional Owners, DEPI, Parks Victoria, landholders
Strategic priority: Adopt flexible engagement approaches							
Build capacity in existing and new conservation groups to deliver catchment management projects							Community groups, DEPI
Develop an engagement approach that matches landholder motivations with catchment management outcomes							Research organisations, landholders, community groups, local government, DEPI
Develop understanding of social capital and community connectivity							Research organisations, landholders, community groups
Continue to build online awareness of and engagement in catchment management							Information technology experts, community
Strategic objective: To adapt to land-use change							
Strategic priority: Capture opportunities from land development							
Deliver farm planning to integrate ecological and agricultural productivity benefits							Landholders, DEPI, CMAs, local government
Plan land-use to minimise loss of biodiversity							Local government, DTPLI, DEPI, Parks Victoria, G-MW
Manage wastewater treatment and stormwater runoff to minimise pollutants to urban waterways and wetlands							GVW, EPA, local government
Manage public land to minimise loss of biodiversity							DEPI, Parks Victoria, reserve committees of management
Promote broader community awareness and acceptance of practices to protect and improve the condition of natural assets							Landholders, residents, community groups, local government
Promote land-use capability assessments and implementation, including use and management of water							Landholders, DEPI, DTPLI, Australian Government, local government
Strategic priority: Plan for and manage floods							
Provide floodplain decisions and advice in land-use planning							Local government, G-MW
Understand more about the nature of flooding to manage its impact on the natural and built environments							G-MW, local government, GVW



Strategic objectives, strategic priorities and management measures	SES						Partners*
	1	2	3	4	5	6	
Strategic objective: To adapt to water policy reform							
Strategic priority: Influence regional water policy							
Influence water policy development and implementation to secure water for improving natural asset condition and social and economic wellbeing							MDBA, DEPI, G-MW, Yorta Yorta Nation, DTPLI
Create opportunities for community leaders to contribute to water policy							Community groups, community members, G-MW, DEPI
Strategic priority: Deliver water to waterways and wetlands							
Plan, deliver and monitor environmental water delivery to improve the condition of priority waterways and wetlands							Commonwealth and Victorian Environmental Water Holders, DEPI, CMAs, Parks Victoria, Yorta Yorta Nation, MDBA, G-MW
Prioritise protection of waterway and wetlands within the modernised irrigation delivery system							G-MW, Parks Victoria, DEPI
Strategic priority: Use water efficiently on farms							
Modernise water delivery on irrigated land to provide ecological and productivity benefits							Landholders, CMAs, DEPI, G-MW, Dairy Australia, Northern Victorian Irrigators, Murray Dairy, SEWPaC
Strategic objective: To adapt to climate variability							
Strategic priority: Adapt to climate variability risks							
Factor risks of climate variability and identify adaptation strategies in Goulburn Broken CMA and partner plans							Many and varied
Factor risks to natural assets into public land fire management plans							DEPI, Parks Victoria, Traditional Owners, CFA, local government, community, reserve committees of management
Strategic priority: Respond to and recover from climatic events							
Plan and implement flood, fire and drought response and recovery							DEPI, local government, water authorities, Parks Victoria, CFA, SES
Strategic priority: Capture opportunities from a low carbon future							
Identify where carbon sequestration activities provide environmental, economic and social benefits							Landholders, community groups, Australian Government, DEPI, industry, research organisations
Develop mechanisms to ensure carbon sequestration activities do not threaten natural assets							Landholders, community groups, industry, research organisations, Australian Government, DEPI
Strategic objective: To adapt to increased farm production							
Strategic priority: Manage risks to agricultural production							
Deliver surface and sub-surface drainage works across a modernised irrigation delivery system, including adaptive shallow groundwater management							DEPI, G-MW, landholders, local government
Strategic priority: Establish sustainable agricultural practices							
Create awareness and acceptance of sustainable management practices to improve land and soil condition							DEPI, G-MW, community groups, landholders
Strategic priority: Increase biodiversity in agricultural land-use							
Create awareness and acceptance of land management practices that protect and improve terrestrial and aquatic habitat							Community groups, landholders, local government, Trust for Nature, DEPI
Identify environmental stewardship opportunities for land managers							Community groups, Trust for Nature, local government, landholders, DEPI
Work with landholders to protect and improve biodiversity on private land and build understanding of its contribution to sustainable and profitable farming							DEPI, G-MW, landholders, community groups, Trust for Nature

\* Goulburn Broken CMA is a partner in implementing all management measures.

**Note:** Management measures related to evaluation and adaptation are listed later in this section.

*Table 14: Strategic priorities and management measures to improve and maintain SES resilience*

# Evaluation and adaptation

The Goulburn Broken CMA's approach to evaluation, which stretches back to the 1980s, ensures that emerging issues and lessons from the past are continually built into strategy development (see the RCS and sub-strategy evaluation and adaptation record). This approach, which was outlined in the Monitoring, Evaluation and Reporting Strategy for the Goulburn Broken Catchment (Garrett & McLennan 2004) and is further detailed in this section, is generally consistent with DEPI's Evaluation Framework (DSE 2012c).

Further alignment of details between Goulburn Broken CMA and DEPI evaluation approaches is expected during RCS implementation.

## EVALUATION, PLANNING LEVELS AND DECISION MAKING CYCLES

The RCS's three critical and connected levels of evaluation for strategic planning and implementation are:

1. Annual performance
2. Long-term strategy implementation progress
3. Catchment condition.

As shown in Table 15, each evaluation level requires different data (or evidence) because of the different questions asked.

## UNCERTAINTY OF CAUSE AND EFFECT

Significant uncertainties in measuring Catchment condition and understanding links between cause and effect have contributed to a non-standardised approach in catchment management reporting. Against this backdrop, the Goulburn Broken CMA has held critical evaluation processes constant, such as monitoring against benchmarks, which promotes understanding of long-term progress, including the impact on Catchment condition.

Evaluation level	Evaluation terminology	Key evaluation questions	Examples of data (or evidence) to inform evaluation
1	Annual performance	How did we go this year against what we said we would do?	Outputs (onground works and capacity building actions or tasks) achieved and funds spent against targets set in the Corporate Plan
2	Long-term strategy implementation progress	How have we gone against what we said we would do when we wrote the (various) strategies? How effective were the implemented measures?	Outputs and assumptions of their impact listed in strategies
3	Catchment condition change	What 'shape' is the issue we are managing in now? Was the original strategy appropriate? Have circumstances (such as new knowledge or different weather patterns) changed sufficiently to warrant a revised strategy? Does the investment mix need to be modified?	Resource condition and trends Tipping points Indicators of resilience, adaptation and transformation responses

**Note:** Further explanation of evaluation against these three levels is provided in Goulburn Broken CMA's Annual Report, Appendix 1: Understanding progress and ratings (GB CMA 2012b). Details of annual performance, long-term strategy implementation progress and Catchment condition change are also provided in the Annual Report. Chapter one of this RCS includes an abridged version of long-term progress.

Table 15: Three levels of evaluation and key evaluation questions

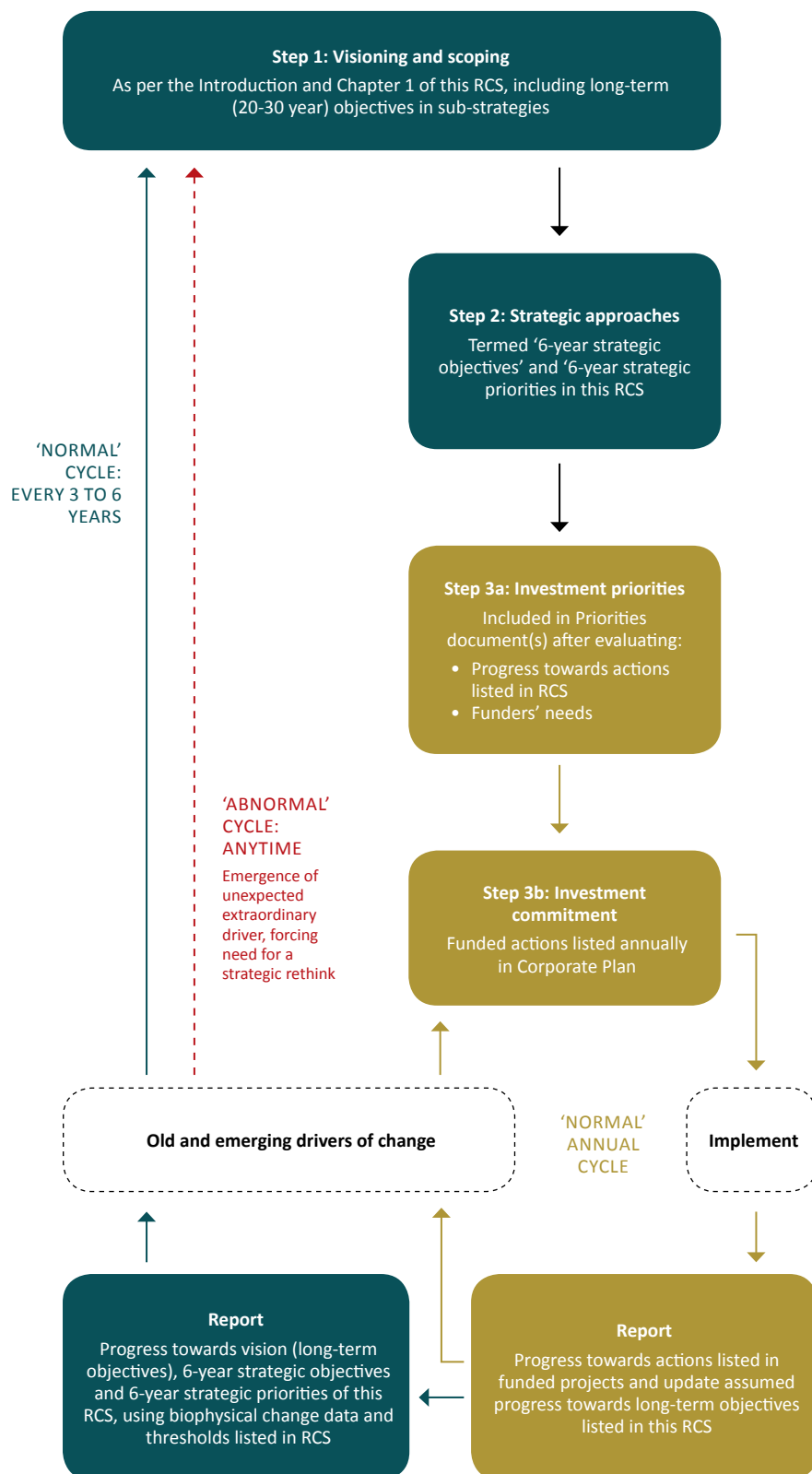


Figure 9: Goulburn Broken CMA planning cycles, showing how it is applied to this RCS

## EVALUATING AND ADAPTING THE OVER-ARCHING RCS

The RCS has formal annual, three-yearly and six-yearly decision making cycles, as shown in Figure 9. Each step in the cycles requires different levels of information, which align readily with the three levels of evaluation in Table 15.

In response to existing and emerging drivers of change, strategies are evaluated and adapted outside of the 'normal' cycle. This is shown in Figure 9 as an 'abnormal' cycle.

The structure of the 2003-2008 RCS made it difficult to prepare annual updates of progress. (The Introduction and Chapter one summarise what has been achieved). The structure of this RCS, as summarised in the objectives hierarchy of Chapter two and Table 14 of this chapter, supports annual reporting of progress, as shown in Table 16.

## EVALUATING AND ADAPTING SUB-STRATEGIES

The Goulburn Broken CMA has a relatively strong emphasis on long-term sub-strategies (see RCS sub-strategies in Chapter two).

The flowchart (Figure 9) is readily adapted and applied to all Catchment issues that are the focus of strategic planning.

Several sub-strategies, including their natural asset focus, have been evaluated for many years in accordance with detailed evaluation plans. Sub-strategies

usually undergo snapshot evaluations at least annually and major evaluations and adaptation every few years, including reviewed assumptions (see Appendix two). The Goulburn Broken CMA's Annual Report summarises sub-strategy progress in the three levels of evaluation listed in Table 15 and lists examples of evidence used to inform evaluation.

## EVALUATING AND ADAPTING THROUGH SOCIAL-ECOLOGICAL SYSTEMS

As described in earlier chapters, six SESs will become the focus for implementing the RCS and sub-strategies. The content and limits of SES planning will be determined as part of RCS implementation, involving extensive community and

agency consultation, which will impact significantly on evaluation and adaptation processes.

The process for evaluating and adapting approaches through these SESs will be part of SES planning.

## RESPONSIBILITIES FOR EVALUATION AND ADAPTATION

Catchment management happens at all geographical scales, from site to whole-of-Catchment to whole of Murray-Darling Basin, involving projects with vastly different timeframes, from daily to many years, and includes broad-ranging activities, from works to strategic planning and evaluation. Catchment management therefore involves a plethora of individuals and organisations, each with

different evaluation responsibilities. The Goulburn Broken CMA and partners determine evaluation responsibilities as needed. The Goulburn Broken CMA is responsible for evaluating implementation of this RCS.

**Strategic priority:** Plan at a social-ecological system scale (from Chapter two).

**Management measure:** Review sub-strategies' 20 to 30-year objectives using knowledge on thresholds and establish threshold objectives based on the six social-ecological-systems.

**Management measure:** Include evaluation and adaptation processes in SES planning.

RCS element	Evidence of progress	Management measures
Overall	Progress against all elements listed below	Conduct a mid-term review of the RCS in 2015 and a final review of the RCS in 2018
Vision and purpose	Progress towards long-term (20 to 30-year) objectives for biodiversity, land, water and people (drawn from sub-strategies)	Reconsider the appropriateness of the vision in detail every three years and rapidly check annually via sub-strategies and implementation programs, continue to: <ul style="list-style-type: none"> <li>• assign responsibilities for monitoring and evaluating progress</li> <li>• record onground interventions, such as fencing riparian vegetation, using standardised approach</li> <li>• update assumed impact of onground interventions, including from non-government funded sources</li> <li>• measure overall change in catchment condition resulting from all factors</li> </ul>
6-year strategic objectives and strategic priorities	Progress in implementing management measures listed under each strategic objective and strategic priority	Develop the RCS action plan and evaluate and update annually Include summaries of RCS and sub-strategy progress in Goulburn Broken CMA's Annual Report

**Note:** These management measures relate to the strategic priority "Update and develop strategies" (from Chapter two under the strategic objective "to embed the resilience approach").

Table 16: Management measures for monitoring, evaluating and reporting progress of the RCS



## CHAPTER FIVE

# Background details for developing the RCS



White Ibis and Royal Spoonbills nesting at Reedy Swamp  
Photo: Keith Ward, Goulburn Broken CMA

This chapter provides information supporting the RCS and its development. Detail on the Catchment's biodiversity, land, water and people assets can be found in the supplement *Assets of the Goulburn Broken Catchment*, with additional information in relevant sub-strategies.

## Scope of the RCS

Development of the RCS has been guided by the *Catchment and Land Protection Act 1994*, and the RCS development guidelines issued by the Victorian Catchment Management Council (VCMC 2011).

Other Commonwealth and State legislation and policies have also been considered, as detailed in Appendices three and four.

Community and agency consultation, expert advice and research have also contributed. These relationships are outlined in Figure 10.

The RCS outlines the Catchment vision and objectives for the next 20 to 30 years and describes drivers and management measures at a Catchment scale over the next 6 years. The RCS does not detail actions and budgets for onground activities.

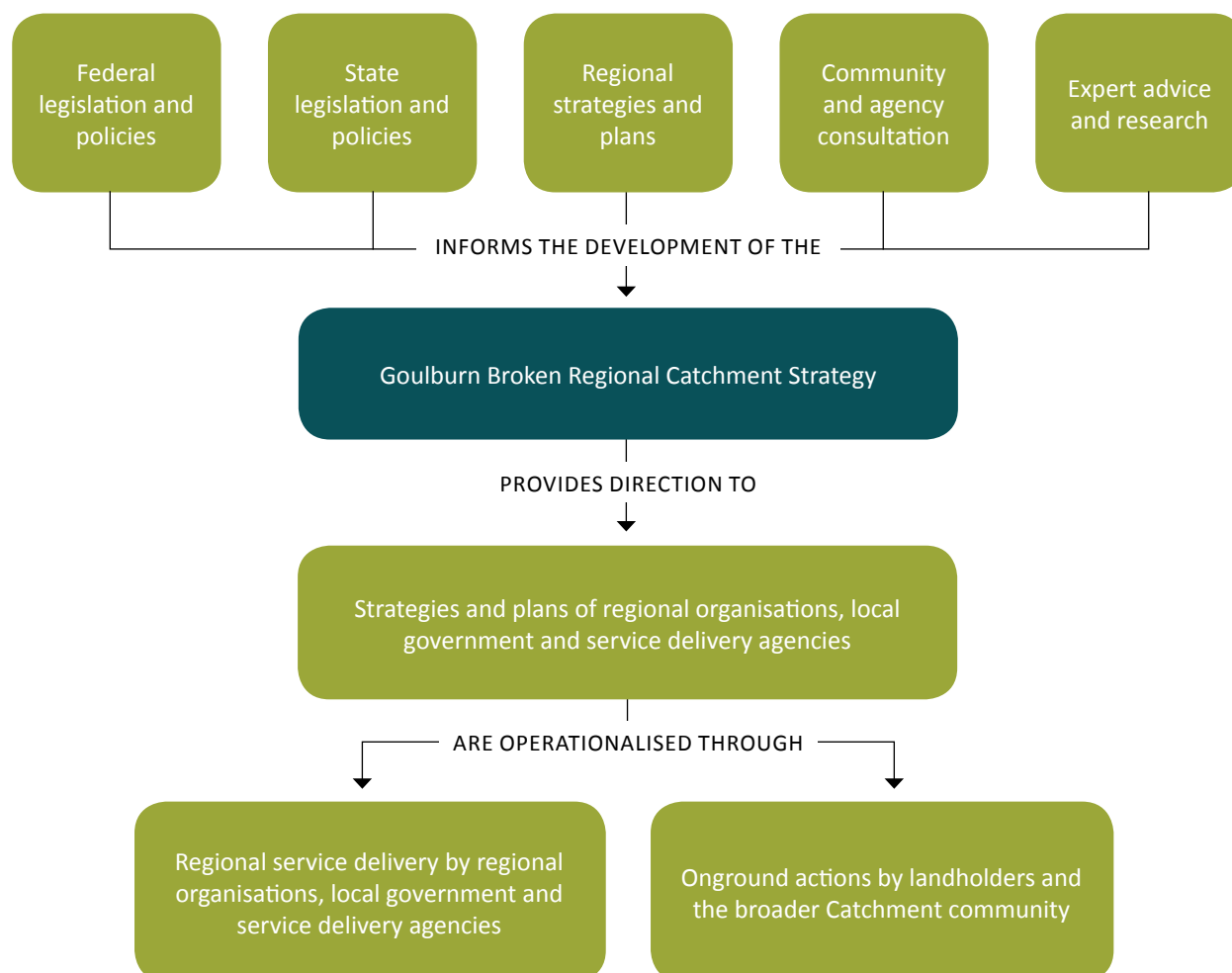


Figure 10: Relationships for development and implementation of the RCS

As well as relevant legislation, local government and regional policies, strategies and plans are also critical considerations.

Key legislation and policy highlighted in Appendix two include:

- *Aboriginal Heritage Act 2006*
- *Catchment and Land Protection (CaLP) Act 1994*
- *Climate Change Act 2010*
- *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*
- *Flora and Fauna Guarantee Act 1988*
- *Planning and Environment Act 1987*
- *Water Act 1989*



## Working across boundaries

Many features of the Goulburn Broken Catchment extend beyond its boundary, including the River Murray, the Goulburn Murray Irrigation District and terrestrial habitats including Box-ironbark and River Red Gum forests and Sand Hill Woodlands. The Goulburn Broken CMA has developed, supported, and is involved in many partnerships and joint projects to assist in the protection and management of these assets with neighbouring CMAs; North East CMA, North Central CMA, and the Murray CMA (NSW). Partnerships with other organisations have also been developed, for example icon site management for Barmah-Millewa Forest under the Living Murray Initiative is shared between the NSW National Parks and Wildlife Service and the Goulburn Broken CMA. For other projects, such as the Farm Water Program, the Goulburn Broken CMA is leading a consortium of

partners representing interests from across Northern Victoria. Consortium partners include Northern Victoria Irrigators; Murray Dairy; North Central CMA; North East CMA; G-MW and DEPI.

Climatic events that challenge the condition and resilience of the Catchment's biodiversity, land, water and people will also continue to impact across catchment boundaries. Drought, fires and floods all require the Goulburn Broken CMA and its partners to work across the Catchment boundaries with significant programs run in conjunction with a range of other Victorian CMAs and agencies.

Strong partnerships between Victorian and NSW CMAs and a range of government and non-government organisations enabling expertise and capability to be shared will be critical to meeting the ongoing challenges that stretch beyond the boundaries of the Goulburn Broken Catchment.





## Stages in developing the RCS

The RCS development was managed by the RCS Project Management Team, with input from the community and advice from recognised resilience experts. Figure 11 describes the Goulburn Broken RCS development process stages.

<b>1. Review of the 2003 RCS (2009) and progress against sub-strategies (annual)</b>
A review of the 2003 RCS was undertaken in 2009 with the review findings informing the development of this strategy. Progress in implementing sub-strategies and the condition of the Catchment are updated in Goulburn Broken CMA's Annual Report. This information also informs the development of this RCS.
<b>2. Trialling 'resilience' in the Goulburn Broken Catchment (from 2003)</b>
The Goulburn Broken Catchment was used as a case study for regional resilience assessment (Walker <i>et al</i> 2009), providing the foundation for this RCS to utilise a resilience-based approach for developing a plan for catchment management.
<b>3. Community interviews and workshops - issues, catchment dynamics and landscapes</b>
Interviews were undertaken with 65 landholders and community members from across the Catchment. Interview data was augmented with additional information gathered from workshops with five community groups. Data collected was on the issues (including threats), dynamics and how the community define the different landscapes/systems of the Catchment. (Note: interviews and workshops were ongoing through RCS development.)
<b>4. Facts and figures - development of issue papers</b>
DEPI was commissioned to develop two papers reporting on the economic and socio-economic factors impacting on the Catchment as key inputs into the development of the RCS. These were summarised and both the summaries and full reports were made publicly available through WeConnect for discussion on the website's blog or Facebook.
<b>5. Analysis of assets within the Catchment</b>
Significant assets with the Catchment were identified and analysed to understand threats, condition and significance (environmental, social and economic). The approach taken varied according to asset class.
<b>6. Identifying Social-ecological systems (SEs)</b>
Four panels of individuals with scientific, practitioner and/or community expertise were brought together to assess the data from steps 3-5. These workshops, one each around land, water, biodiversity and people sought to identify the sub-Catchment SEs of the Goulburn Broken Catchment, and started to describe their drivers, threats and thresholds where possible.
<b>7. Bringing it all together</b>
Utilising a small group of experts, the outcomes of each of the four panel sessions were used to develop objectives relating to the identified thresholds. This information was overlayed with the data from step 5 to provide a high level of strategy with long-term objectives and strategic priorities and management measures to enable progress against the RCS to be monitored.
<b>8. Drafting the Goulburn Broken Regional Catchment Management Strategy</b>
The online engagement tool WeConnect was used to draft the strategy and enabled (progressively) Goulburn Broken CMA staff, relevant agencies and organisations, and finally the public to view, edit and comment on the draft strategy prior to the formal consultation period.
<b>9. Formal consultation</b>
Formal period of consultation requirements as per the <i>CaLP Act 1994</i> included community meetings and face-to-face meeting with key stakeholders. During this time the ability to edit the strategy via WeConnect was not available to enable a static draft to be commented on.
<b>10. Responding to feedback</b>
Redrafting of the RCS required in response to feedback received during the consultation period.
<b>11. Endorsement and submission</b>
Endorsement by the Goulburn Broken CMA Board and presentation of RCS to Ministers.
<b>12. Implementation</b>
Implementation is an ongoing process that will involve continual refinement to ensure that the strategy informs sub-strategies. Adaptive management requires that the strategy and its implementation continues to be relevant and appropriate in a changing environment. Once approved, the RCS will be launched and made publicly available. Engagement on the RCS will continue with partners and the Catchment's communities through a range of mechanisms. Some of these are listed as management measures in the section 'Strengthening Partnerships' in Chapter two. Further engagement in implementing other management measures are outlined in Chapter four, under 'Management across SEs'.

Figure 11: Goulburn Broken RCS development process



## Involving community and agency partners in the RCS

The engagement objectives for developing this RCS were to provide the entire Catchment community with access to information and the opportunity to participate. This included:

### 1. Inter-agency Project

**Management Team** (monthly meetings) with representation from:

- Goulburn Broken CMA
- Department of Transport, Planning and Local Infrastructure
- Department of Environment and Primary Industries
- Goulburn-Murray Water
- Local government
- Parks Victoria.

Responsibilities included advice on community engagement, analysis of issue papers and interview findings, provision of expert opinion on assets, social-ecological systems, objectives and management measures and review of the draft strategy.

### 2. Interviews and workshops

were held with individuals, community representative groups and technical experts to inform development of RCS strategic priorities.

3. **Social media and an online engagement** was developed to engage staff, agencies and the Catchment communities in development of the RCS.
4. **Facebook** was used to publicise events and to stimulate discussion about the Catchment.
5. **WeConnect** was used to make publicly available the background information used to develop the strategy, to provide an opportunity for community input via the RCS 'blog' and to enable collective drafting of the RCS draft strategy.
6. **Other forms of engagement** including:
  - Catchment forums
  - Face to face meetings with
    - all relevant local government mayors, CEOs and councillors
    - indigenous representatives
    - other stakeholder representatives
  - Presentations to a range of interested groups, for example U3A, Landcare and Rotary
  - Monthly written updates circulated to Catchment agencies and community groups.

More details about RCS engagement can be found in Appendix seven.

### ► RCS IN ACTION



## Fox baiting with Conservation Management Networks

Fox baiting is a win-win program for the environment and primary production in the Goulburn Broken Catchment.

Around 200 landholders across approximately 80,000 hectares within the Broken Boosey and Whroo Goldfields Conservation Management Networks have been fox baiting for the past six years. Foxes are the major predator of many of our threatened species, and therefore addressing the fox population is vital to our native fauna's survival.

This fox baiting program connects biodiversity protection with good farming practice, and reaches those landholders who may not normally prioritise biodiversity in carrying out their land management activities.

# Acronyms

**ABA:** Asset Based Approach  
**ARI:** Average Recurrence Interval  
**BOM:** Bureau of Meteorology  
**CaLP Act 1994:** Catchment and Land Protection Act 1994  
**CFA:** Country Fire Authority  
**CFoC:** Caring For our Country  
**CMA:** Catchment Management Authority  
**CSIRO:** Commonwealth Scientific and Industrial Research Organisation  
**DAFF:** Department of Agriculture, Fisheries and Forestry  
**DEPI:** Department of Environment and Primary Industries  
**DTPLI:** Department of Transport, Planning and Local Infrastructure  
**EPA:** Environment and Protection Authority  
**EPBC Act 1999:** Environment Protection and Biodiversity Conservation Act 1999  
**EVC:** Ecological Vegetation Classes  
**EWR:** Environmental Water Reserve  
**FFG Act 1988:** Flora and Fauna Guarantee Act 1988  
**G-MW:** Goulburn-Murray Water  
**Goulburn Broken CMA:** Goulburn Broken Catchment Management Authority  
**GVW:** Goulburn Valley Water  
**ISC:** Index of Stream Condition  
**IWC:** Index of Wetland Condition  
**LGA:** Local Government Area  
**MDB:** Murray-Darling Basin  
**MDBA:** Murray-Darling Basin Authority  
**MDBC:** Murray-Darling Basin Commission  
**MER:** Monitoring, Evaluation and Reporting  
**NRM:** Natural Resource Management  
**PV:** Parks Victoria  
**RCS:** Regional Catchment Strategy  
**RMF:** Regional Management Forum  
**SES:** Social-Ecological System  
**SEWPaC:** Department of Sustainability, Environment, Water, Population and Communities  
**SIR:** Shepparton Irrigation Region  
**TCAC:** Taungurung Clans Aboriginal Corporation  
**TfN:** Trust for Nature  
**TEK:** Traditional Ecological Knowledge  
**U3A:** University of the Third Age  
**VCMC:** Victorian Catchment Management Council  
**VPP:** Victorian Planning Provisions  
**VRoT:** Victorian Rare or Threatened Species  
**WONS:** Weeds of National Significance  
**YYNAC:** Yorta Yorta Nation Aboriginal Corporation

# Glossary

**Adaptive management:** A systematic process for continually adjusting policies and practices by learning from the outcome of previously used policies and practices. Each management action is viewed as a scientific experiment designed to test hypotheses and probe the system as a way of learning about the system.

**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.

**Bioregions:** Large, geographically distinct areas of land with common biophysical characteristics such as geology, landform patterns, climate and ecological features.

**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.

**Corridor:** A landscape element that connects two or more patches in a relatively unbroken (contiguous) line; thus, a form of structural connectivity.

**Disturbance:** A temporary change in average environmental conditions that causes a pronounced change in an ecosystem.

**Drivers:** External forces or conditions that influences the inputs into a system that may or may not cause a system to change.

**Ecological Vegetation Classes (EVC):** Are a mapped vegetation classification system, where vegetation communities are grouped based on similar floristic, structural, and ecological features.

**Ecosystem:** A diverse and changing set of living organism within a community, interacting with each other and with the physical elements of the environment in which they are found.

**Ecosystem services:** The goods and services provided by natural ecosystems that are valued because of the role they play in creating a healthy environment for human beings. This includes the provision of clean water; the maintenance of liveable climates; the pollination of crops and native vegetation; and the fulfilment of people's cultural, spiritual and intellectual needs.

**Fragmented:** In relation to habitat, refers to the reduction in the total area of habitat, isolation of one area of habitat from others, breaking up of one patch of habitat into smaller ones or decrease in patch sizes.

**Habitat:** The place being occupied by an organism, population or community.

**Identity:** The essential nature of a system (an individual, an ecosystem, a society) based on the way it functions and on its defining structural characteristics.

**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 specific strategic priorities. Management measures are found in the relevant sub-strategies and investment plans.

**RCS strategic objectives:** High level goals that outline key achievements for the next six years. The objectives respond to identified drivers of change that potentially tip into alternative states. Achieving strategic objectives contributes to maintaining or achieving desired states.

**RCS strategic priorities:** These are the areas of action currently considered most critical for the next six years. Strategic priorities for implementation for biodiversity, land, water and people can be found in relevant sub-strategies.

**Relictual:** Landscapes that are approximately 10 square kilometres that have less than ten per cent native vegetation cover, as seen from an aerial view.

**Resilience:** The capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.

**Social-ecological systems:** Linked and generally similar 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.

**System:** The set of variables and the interactions, processes and mechanisms that govern them.

**Thresholds:** A breakpoint between two states of a system that must be exceeded to begin to produce some sort of effect or response.

**Tipping points:** A point where a small change can have a large effect on the state of a system.

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



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## APPENDIX ONE:

# How resilience has been used in the development of this RCS

## What is resilience thinking?

Resilience thinking is a multidisciplinary approach for understanding and managing dynamic systems, such as regions or catchments.

*Resilience is defined as a system's (such as a region, catchment, ecosystem, farm or industries) capacity to absorb disturbance and continue to function in a desired way.*

Resilience thinking conceptualises regions as complex adaptive systems where the dynamics of the social (including economic) and ecological systems are intertwined, where changes in one will inevitably result in changes in the other. The dynamics are largely *self organising*, determined by the constant interplay between drivers, feedbacks and interactions rather than the actions of a single organisation, key driver or mechanism.

Attempts to 'fix' or hold one part of the system constant, so it delivers maximum benefits or outputs overtime for example, will inevitably result in unexpected consequences as the system changes around the part being held constant. Instead a resilience approach focuses on building the capacity to cope with change and on continually improving knowledge and understanding of the important dynamics through an adaptive management approach.

Building or maintaining the resilience of a region requires an understanding of how the system functions and its *limits to absorb disturbances*. Management interventions are then designed to avoid reaching those limits or getting back within those limits where they have already been reached. These management interventions are implemented in an *adaptive management framework* that continually tests the assumptions, learns from the interventions, and scans for changes to any of the key dynamics.

## How does resilience thinking differ from other approaches to managing natural resources?

The overall aim of resilience thinking is to maintain the maximum options for the future by avoiding crossing thresholds or tipping points that are difficult (expensive and/or time consuming) to recover from. It does this by focusing on;

- Maintaining and/or improving the capacity of the ecological system to withstand unnatural levels of disturbances
- Developing the capacity of the social system to manage adaptively so it can respond to changes in the dynamics of the system that might limit future options.

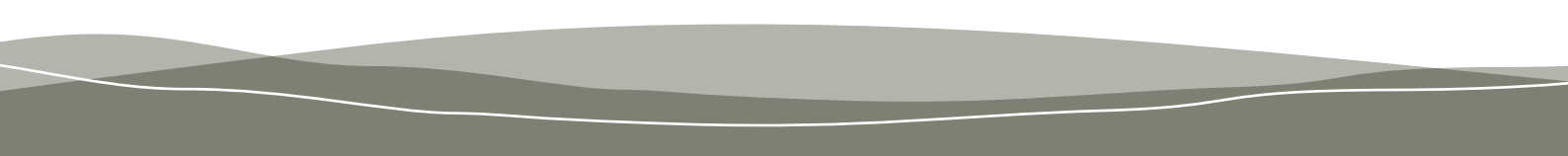
This approach differs somewhat from traditional approaches that attempt to define a sustainable state to aim for then try to manage and control the dynamics in order to reach the desired goal.



Attempts to intervene in social-ecological systems that try to control change and do not recognise the dynamics and connections between social and ecological systems usually fail to meet their stated aims and often cause unintended consequences. These failures can be traced back to the assumptions about how the system functions and how management interventions will 'fix' problems as they arise. Typically it is assumed that change is smooth, slow and incremental. In reality change is rarely smooth but rather abrupt and unexpected. Coping with this type of change requires new approaches built of flexibility and the capacity to respond in different ways, rather than any simple recipe for solving what are often very complex problems. Three key elements in the strategic planning process are critical to developing a resilience based approach:

- Project management that coordinates the collection and synthesis of information about the resilience of the system
- Technical input that provides expert social and ecological input at key times during the process
- Communication within and between these groups and with other stakeholders and the wider community.

In approaching a RCS using Resilience Thinking, minimal requirements are:

- Best available information/data about the social structure and dynamics (key outputs, drivers, trends, thresholds) at the appropriate scale, including emerging issues
  - Knowledge about the performance of the current RCS, and its strengths/weaknesses
  - Knowledge/links to other strategic plans and process so you can easily map governance, overlaps, synergies, conflict in governance etc.
- 

## APPENDIX TWO:

# Evolution of Goulburn Broken RCS and sub-strategies

A more detailed summary is available at [www.gbcma.vic.gov.au](http://www.gbcma.vic.gov.au) and an update on implementation of most strategies is provided in Goulburn Broken CMA's annual report.

### GOULBURN BROKEN RCS 2013-19

- First RCS coincided with start of Goulburn Broken Catchment Management Authority, 1 July 1997.
- Progress summarised in second RCS, 2003.
- Progress detailed in 2009 review and since 2004-05, in Goulburn Broken CMA annual reports.
- Progress summarised in introduction to this third RCS.
- Next major review expected 2019.

### SHEPPARTON IRRIGATION REGION CATCHMENT IMPLEMENTATION STRATEGY 1990-2020

- Prepared as Shepparton Irrigation Region Land and Water Salinity Management Plan 1989.
- Victorian Government endorsed it in 1990.
- Major reviews in 1995, 2000, 2003 and 2007 (not yet published) included sub-programs such as environment and surface water-management and programs.
- Progress reported in Goulburn Broken CMA annual reports.
- Major review 2013.

### GOULBURN BROKEN DRYLAND SALINITY MANAGEMENT PLAN (1990)

- First prepared 1989.
- Victorian Government endorsed it in 1990.
- Progress 1990-95 reviewed in 1996.
- Progress 1995-2001 reviewed; included in updated Plan (Draft c. 2002).
- Strategic approach updated as part of Dryland Landscape Strategy.
- Progress reported in Goulburn Broken CMA annual reports.

### GOULBURN BROKEN LAND HEALTH STATEMENT DRAFT (2012)

- Began as a Goulburn Broken Soil Health Strategy Draft 2003.
- Goulburn Broken Soil Health Action Plan (2006), which is annually reviewed, guides Strategy implementation.
- Benefits from efforts associated with Goulburn Broken Dryland Salinity Management Plan, which it supersedes.

### DRYLAND LANDSCAPE STRATEGY 2009-11

- Integrated biodiversity and salinity programs and catalysed integration with other CMA programs.
- Reviewed 2010.
- Being superseded by emphasis on systems of people linked with nature as per the resilience approach, as described in this RCS.

### GOULBURN BROKEN BIODIVERSITY STRATEGY 2010-15

- “Environment” programs an integrated part of salinity plan implementation in early 1990s (see above).
- Goulburn Broken Native Vegetation Management Strategy (NVMS) 2000, including addendum to significant 1999 draft following consultation. Annually reviewed.
- Became Goulburn Broken Native Vegetation Management Plan 2003, with NVMS bundled (as Volume 1) with Native Vegetation Retention Controls (as Volume 2), following state directive.
- Goulburn Broken Biodiversity Monitoring Action Plan 2006 details assumptions behind assessing progress against long-term biophysical targets.
- NVMS largely superseded by From the Fringe to Mainstream - A Strategic Plan for Integrating Native Biodiversity 2004-2007. Annually reviewed. Both strategies thoroughly reviewed 2008.
- Biodiversity Strategy progress included in Goulburn Broken CMA’s annual reports.

### GOULBURN BROKEN REGIONAL RIVER HEALTH STRATEGY (GB RRHS) 2005-15

- Until 2005, priorities guided by waterway plans prepared by waterway authorities, which preceded the CMA, and complementary whole-of-Catchment strategies, especially Goulburn Broken Water Quality Strategy (draft 1997, updated 2002) Goulburn Broken Regional Floodplain Management Strategy (2002-12) and draft Goulburn Broken Wetland Strategy (2003).
- GB RRHS reviewed 2010 and Addendum prepared 2010.
- Catchment-based staff are part of strong State and National networks measuring and evaluating progress.
- Major review 2013.

### GOULBURN BROKEN WATER QUALITY STRATEGY 1996-2016

- Significant draft released for public comment July 2006.
- Addendum prepared June 1997.
- Focused on algal blooms from nutrient inputs.
- Major review 2002.
- Reviewed as part of GB RRHS in 2013.

### GOULBURN BROKEN FLOODPLAIN MANAGEMENT STRATEGY 2002-12

- Progress documented in Goulburn Broken CMA’s annual reports.
- No review date set: strategy remains relevant.

### GOULBURN BROKEN INVASIVE PLANTS AND ANIMALS STRATEGY (IPAS) (2010)

- Goulburn Broken Rabbit Management Action Plan 2001-2005 (2000) and Goulburn Broken Weed Action Plan 2001-2005 (2001) prepared by Department of Natural Resources and Environment.
- Implementation of IPAS is largely administered by DEPI.
- Progress reported in Goulburn Broken CMA’s annual report.

### GOULBURN BROKEN CMA COMMUNITY LANDCARE SUPPORT STRATEGY (2010; DRAFT)

- Goulburn Broken Landcare Support Strategy 2004-09; annual performance stories prepared in 2005-06, 2007-08 and 2009-10.
- Strategy reviewed 2008.
- Victorian Landcare Program Strategy Plan (2012) provides further guidance; an implementation plan for the Goulburn Broken is expected in 2013, linked to Communications, Marketing and Community Engagement Strategy.

### GOULBURN BROKEN COMMUNICATIONS, MARKETING AND COMMUNITY ENGAGEMENT STRATEGY (2010)

- Major review is expected in 2013, linked especially to RCS, Landcare Support Strategy and Victorian CMA-wide framework (2012).

### GOULBURN BROKEN CLIMATE CHANGE INTEGRATION STRATEGY 2012-15

- Goulburn Broken Climate Change Position Paper 2007-2010
- Position Paper Reviewed in 2009 and 2010.
- Major review 2015.

### MONITORING EVALUATION AND REPORTING STRATEGY FOR THE GOULBURN BROKEN CATCHMENT (2004)

- Reviewed annually.
- Major review 2013 (following government endorsement of RCS).

## APPENDIX THREE:

# Legislation underpinning the RCS

Federal
<b>Aboriginal and Torres Strait Islander Heritage Act 1984</b> – provides a mechanism for the Australian Government to protect traditionally important areas or objects that are under threat and not protected by other laws
<b>Australian Heritage Commission Act 1975 (Register of the National Estate)</b> – establishes the Australian Heritage Commission which works to conserve, improve and present the national estate
<b>Environment Protection and Biodiversity Conservation Act 1999</b> – provides the legal framework for the protection and management of nationally and internationally important flora, fauna, ecological communities and heritage places
<b>Native Title Act 1993</b> – establishes the framework for the protection and recognition of native title
<b>Water Act 2007</b> – makes provision for the management of the water resources of the Murray–Darling Basin
State
<b>Aboriginal Heritage Act 2006</b> – provides protection for all Aboriginal places, objects and human remains
<b>Alpine Resorts (Management) Act 1997</b> – provides the framework for the management of alpine resorts
<b>Archaeological and Aboriginal Relics Preservation Act 1972</b> – makes provision for the preservation of Archaeological and Aboriginal Relics
<b>Catchment and Land Protection Act 1994</b> – provides the framework for the integrated management and protection of catchments
<b>Climate Change Act 2010</b> – provides the framework for Victoria’s action on climate change
<b>Conservation, Forests and Lands Act 1987</b> – provides a framework and administrative provisions for the land management system
<b>Cooperative Management Agreement 2004</b> – an agreement designed to provide a formal role for Yorta Yorta people in managing designated areas of Yorta Yorta traditional country on Crown Land within Victoria
<b>Crown Land (Reserves) Act 1978</b> – provides for reservation of Crown Land for a variety of public purposes
<b>Environment Protection Act 1970</b> – establishes the Environmental Protection Authority and makes provision for the Authority’s powers, duties and functions
<b>Fisheries Act 1995</b> – provides the framework for the regulation, management and conservation of Victorian fisheries and aquatic habitats
<b>Flora and Fauna Guarantee Act 1988</b> – provides basic lead powers and management systems for the protection of native species
<b>Forests Act 1958</b> – provides for the management of State forests
<b>Heritage Rivers Act 1992</b> – provides for the protection of public land alongside and in certain parts of heritage rivers and river catchment areas which have significant nature conservation, recreation, scenic or cultural heritage attributes
<b>Land Act 1958</b> – provision for the leasing, occupation and sale of unreserved Crown Land
<b>Murray-Darling Basin Act 1993</b> – enables the agreement between the Australian, NSW, SA, QLD and Victoria governments on water, land and other environmental resources of the Basin to be carried out



<b>National Parks Act 1975</b> – makes provision for National and other parks including their management and administration
<b>Parks Victoria Act 1998</b> – establishes Parks Victoria whose responsibilities include the management of the State’s national, state, regional and metropolitan parks
<b>Planning and Environment Act 1987</b> – establishes a framework for planning the use, development and protection of land in Victoria
<b>Reference Areas Act 1978</b> – provides for the proclamation of reference areas to serve as a reference for comparative purposes
<b>State Environment Protection Policy (Waters of Victoria) 2003</b> – help to protect water environments by providing a ‘blueprint’ of agreed environmental outcomes and strategic directions for protecting Victoria’s waters
<b>Sustainable Forests (Timber) Act 2004</b> – provides for the sustainable management of forests
<b>Traditional Owner Settlement Act 2010</b> – enables the Government to make agreements to recognise Traditional Owners and their rights with respect to Crown Land
<b>Victorian Environment Assessment Council Act 2001</b> – establishes the Council to investigate and provide recommendations regarding the protection and ecologically sustainable management of public land
<b>Victorian Conservation Trust Act 1972</b> – establishes the Trust for Nature
<b>Water Act 1989</b> – establishes rights and obligations in relation to use of water resources
<b>Wildlife Act 1975</b> – provides for the establishment and management of wildlife and nature reserves including licensing, research and enforcement and hunting

## APPENDIX FOUR:

# List of relevant policy, strategies and agreements

A significant number of policies inform the development of the RCS and a summary list of these is provided below. These strategies provide guidelines for what needs to be considered when developing strategic priorities. Both the RCS and sub-strategies provide a justification of how priorities relating to the Goulburn Broken Catchment will be progressed. New and emerging policies can be considered when developing sub-strategies or revising the RCS.

Federal
<b><i>A Directory of Important Wetlands in Australia (EA 2001)</i></b> – identifies important wetlands and provides a substantial knowledge base of what defines wetlands, their variety and the dependence on them of many flora and fauna species
<b><i>A Framework for Determining Commonwealth Environmental Watering Actions 2009</i></b> – provides a framework for determining Commonwealth environmental watering actions in the Murray-Darling Basin
<b><i>Australia's Biodiversity Conservation Strategy 2010–2030</i></b> – guiding framework for conserving our nation's biodiversity over the coming decades
<b><i>Australian Pest Animal Strategy 2007</i></b> – addresses the undesirable impact of exotic vertebrate animals and to prevent the establishment of new exotic vertebrate pests
<b><i>Basin Salinity Management Strategy 2001-2015</i></b> – provides a framework for communities and Governments within the basin to control salinity and protect natural resource values
<b><i>Living Murray First Step Decision (MDBC 2003)</i></b> – acknowledged the then program of works and water recovery were only initial efforts to restoring the health of the River Murray. As part of the first step, a water recovery and environmental works program was implemented to achieve environmental outcomes at the six icon sites
<b><i>Murray–Darling Basin proposed Basin Plan</i></b> – currently under development (as at May 2012), the proposed Basin Plan seeks to offer a revised approach to the management of the Basin and its water resources to achieve a healthy working Basin
<b><i>National Framework for the Management and Monitoring of Australia's Native Vegetation (2001)</i></b> – aims to reverse the long-term decline in the quality and extent of Australia's native vegetation cover
<b><i>National Indigenous Reform Agreement (Closing the Gap)</i></b> – provides targets and objectives for all Australian Governments, who have shared responsibility for Closing the Gap in Indigenous disadvantage across key areas including education attainment and economic participation
<b><i>National Water Quality Management Strategy (1992)</i></b> – aims to protect the nation's water resources, by improving water quality while supporting the businesses, industry, environment and communities that depend on water for their continued development
<b><i>Strategy for Australia's National Reserve System 2009–2030</i></b> – strategy to achieve an effective reserve system by 2030 that secures biodiversity assets
<b><i>The Australian Weeds Strategy (revised 2007)</i></b> – addresses weed incursions and is an element of the integrated approach to national biosecurity
<b><i>Wetlands Policy of the Commonwealth Government of Australia 1997</i></b> – has defined and guided activities to ensure that all levels of government and the community are working together to conserve wetlands

## State

<b><i>Alpine Resorts Strategic Plan 2004 (Alpine Resorts 2020 Strategy)</i></b> – guides sustainable long term planning and management
<b><i>Biosecurity Strategy for Victoria 2009</i></b> – outlines the vision of biosecurity management
<b><i>Indigenous Partnership Framework 2007-10 (reviewed 2010)</i></b> – overarching strategy to facilitate participation of Traditional Owners in all aspects of land and natural resource management
<b><i>Indigenous Partnership Framework 2007-10 (reviewed 2010)</i></b> – overarching strategy to facilitate participation of Traditional Owners in all aspects of land and natural resource management
<b><i>Invasive Plants and Animal Policy Framework 2010</i></b> – framework for the management of existing and potential invasive species within the context of the Biosecurity Strategy for Victoria
<b><i>Our Water Our Future (DSE 2004)</i></b> – outlined the then Government's water strategy for Victoria
<b><i>Native Vegetation Management – A Framework for Action (Revised 2005)</i></b> – sets out the broad approach to achieving a net gain in extent and quality of native vegetation
<b><i>Policy for Sustainable Recreation and Tourism on Victoria's Public Land 2002</i></b> – framework to assist and support public land managers to determine and assess recreation and tourism activities on public land
<b><i>State Environment Protection Policy (Waters of Victoria 1988)</i></b> – sets the framework for government agencies, businesses and the community to work together, to protect and rehabilitate Victoria's surface water environments
<b><i>State Environment Protection Policy (Groundwaters of Victoria) 1997</i></b> – sets an integrated framework of environment protection goals for groundwater
<b><i>Sustainability Charter for Victoria's State Forests 2006</i></b> – vision and key objectives for the management of Victoria's State Forests
<b><i>2009 Victorian Bushfires Royal Commission</i></b> – influencing State and regional policy and planning on a number of issues including (but not limited to) land use and native vegetation management
<b><i>Victorian Bushfire Strategy 2008</i></b> – seeks to reduce the threat of bushfires and increase the ability of bushfire agencies to be better prepared to meet future challenges
<b><i>Victorian Action Plan for Second Generation Landcare 2002</i></b> – guiding document for Victorian Government support to Landcare
<b><i>Victorian Flood Management Strategy 1998</i></b> – seeks to achieve effective flood management
<b><i>Victorian Planning Provisions 1998-1999</i></b> – sets a series of goals for biodiversity management
<b><i>Victorian River Health Strategy 2002 (under review as at May 2012)</i></b> – provides a common vision for the management of rivers in Victoria
<b><i>Victoria's Nature based Tourism Strategy 2008–2012</i></b> – advocates for a range of tourism activities and infrastructure on public and freehold land
<b><i>Victoria's Salinity Management Framework 2000</i></b> – provides an outline of Victoria's progress in the management of salinity

## Regional

<b><i>Hume Regional Growth Plan</i></b> – will assess the growth potential, land supply, employment precincts and housing needs in identified regional growth areas. Significant work will be undertaken to identify open space, infrastructure and services for these communities
<b><i>Hume Strategy for Sustainable Communities (Hume Strategy)</i></b> – is a 10 year strategic plan to provide advice and make recommendations to inform decision making and investment in the Hume Region
<b><i>Municipal environmental strategies</i></b> – (various) outline a proactive, collaborative and strategic approach to protecting the local environment
<b><i>Municipal Planning Schemes</i></b> – the Planning and Environment Act enables municipal councils to introduce planning schemes to control land use. The Victoria Planning Provisions (VPPs) provide a state-wide uniform format for municipal planning schemes. The VPPs contain a State Planning Policy Framework for floodplain management and a local Planning Policy Framework, which includes four area controls for land liable to flooding (DSE, 2012)
<b><i>Northern Region Sustainable Water Strategy</i></b> – framework to secure the water future for urban, industrial, agricultural and environmental water users for the next 50 years

## APPENDIX FIVE:

## Roles of Catchment partners

Agency / Authority / Organisation / Individual	Role relative to the development and implementation of the RCS
<b>Australian Government – Department of Agriculture Fisheries and Forestry</b>	The Department of Agriculture Fisheries and Forestry (DAFF) works to sustain the way of life and prosperity of all Australians. It does this by advising the government and our stakeholders how to improve the productivity, competitiveness and sustainability of our portfolio industries. Regionally, DAFF plays an important role in the implementation of the RCS funding projects across the Catchment.
<b>Australian Government - Department of Sustainability, Environment, Water, Population and Communities</b>	<p>The Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) is responsible for a number of matters including; environment protection and conservation of biodiversity, natural, built and cultural heritage, environmental research, and water policy and resources.</p> <p>SEWPaC administers the EPBC Act. Regionally, SEWPaC plays an important role in the implementation of the RCS by funding projects across the Catchment.</p>
<b>Alpine Resorts Co-ordinating Council and Alpine Resort Management Boards</b>	<p>The Alpine Resorts Co-ordinating Council (ARCC) is a statutory body established under the Victorian Alpine Resorts Management Act 1997. It reports to the Minister for Environment and Climate Change and addresses issues of broad concern to alpine resort stakeholders and government and is focused on three key areas: Strategic positioning and advocacy, Co-operation and Research.</p> <p>The Alpine Resorts are permanent Crown land reserves, each managed by an Alpine Resort Management Board appointed by, and responsible to, the Minister for Environment and Climate Change. The Boards are also established under the Alpine Resorts Management Act 1997.</p> <p>The Alpine Resort Management Boards are responsible for the development, promotion, management and use of each Alpine Resort. They also provide or arrange required basic services and utilities including water and energy supply, and sewerage and garbage disposal. The Boards are required to carry out their functions in an environmentally sound way and in accordance with an approved strategic management plan. Each Board is represented on the ARCC.</p>
<b>Community groups (e.g. CMNs, Landcare and environmental groups)</b>	The Goulburn Broken Catchment's 91 natural resource management groups, 11 networks, and five sustainable farming groups mobilise community involvement, attract corporate, philanthropic and corporate funding, and influence and implement significant parts of the RCS in local areas, usually with an emphasis on onground works. They are represented on many of the CMA's advisory groups and steering committees.
<b>Department of Transport, Planning and Local Infrastructure</b>	<p>Providing guidance about planning in Victoria is one of the roles of the Department of Transport, Planning and Local Infrastructure (DTPLI).</p> <p>DTPLI is responsible for leading the development of Regional Growth Plans. Regional growth plans are being developed to provide broad direction for land use and development across regional Victoria. They will also provide more detailed planning frameworks for key regional centres. Regional Growth Plans will identify important economic, environmental, social and cultural resources to be preserved, maintained or developed. The Goulburn Broken Catchment sits within the Hume Regional Growth Plan area.</p>



<b>Department of Environment and Primary Industries</b>	<p>The Department of Environment and Primary Industries (DEPI) is responsible for land and fire, regional services, natural resources and environment, water, agriculture and fisheries.</p> <p>DEPI designs and delivers policies and programs that enable Victoria's primary industries to sustainably maximise the wealth and wellbeing they generate. It is responsible for protection and management of natural resources.</p> <p>DEPI performs its range of functions in partnership with service delivery partners including catchment management authorities. It is responsible for administering the CaLP Act 1994 and other important legislation, many of which are in Appendix two.</p> <p>Regionally, DEPI provides funding and technical, extension and research services.</p>
<b>Environment Protection Authority</b>	<p>The Environment Protection Authority's (EPA) sole role is to regulate pollution and has independent authority to make regulatory decisions under the Environment Protection Act 1970. Based on its regulatory risk model EPA prioritises its compliance and enforcement activity by addressing the biggest risk to the environment and health. EPA aspires to create a healthy environment that supports a liveable and prosperous Victoria. By effectively regulating pollution in Victoria, we strive to deliver clean air, healthy waterways, safe land and minimal disturbances from noise and odour for Victorians.</p>
<b>Goulburn Broken Catchment Management Authority</b>	<p>The Goulburn Broken Catchment Management Authority (CMA) is a statutory authority established under the Catchment and Land Protection Act 1994. It plays a pivotal role in NRM in the Catchment. There are many policies that inform this role, listed in Appendices three and four.</p> <p>The Goulburn Broken CMA prepares the Goulburn Broken RCS and coordinates and monitors its implementation. It does this by working with all tiers of government, other agencies, community groups, industry, individuals, and research and funding organisations.</p>
<b>Goulburn-Murray Water</b>	<p>Goulburn-Murray Water (G-MW) has substantial interaction with the environment, partnerships with a number of stakeholders and legislative requirements leading to a large and diverse environmental risk profile. G-MW aims to maximise water resource availability for customer use, while meeting key environmental goals and contributing to a sustainable and productive natural environment. G-MW's environmental objectives are listed in the Environment Policy Statement. In summary G-MW is committed to minimising and preventing any adverse impact on the environment caused by our activities.</p> <p>Activities and initiatives include catchment management (including salt interception management), surface and sub-surface drainage support, water quality and land management planning.</p>
<b>Goulburn Valley Water</b>	<p>Goulburn Valley Water's (GVW) delivery of water and sewage services to its customers has a considerable impact on non renewable natural resources. Primary objectives of the organisation include a commitment to improve environmental performance by minimising resource demand and preventing pollution. In order to translate these commitments into practice, the organisation has established an Environment Policy and an Environmental Management System (EMS).</p>
<b>Individuals / land managers</b>	<p>Under the <i>CaLP Act 1994</i>, responsibilities of land managers include (but are not limited to) take all reasonable steps to:</p> <ul style="list-style-type: none"> <li>• Prevent the spread of, and as far as possible eradicate, established pest animals</li> <li>• Eradicate regionally prohibited weeds</li> <li>• Prevent the growth and spread of regionally controlled weeds</li> <li>• conserve soil and avoid contributing to land degradation on someone else's land.</li> </ul> <p>Land managers must also seek authority to interfere, obstruct or carry out works in relation to a waterway, bore or drainage course, or (in some cases) a private dam.</p> <p>Regionally, landholders across the Catchment invest significant resources (time, money and land) into activities that contribute to meeting the objectives of the RCS. This contribution is further outlined in the People section of the Assets of the Goulburn Broken Catchment supplement.</p>
<b>Industry groups</b>	<p>Peak industry groups such as Murray Dairy and the Victorian Farmers Federation can strongly influence catchment management through their networks with regional land managers.</p>

<b>Local government</b>	<p>Services provided by councils are diverse. They include property, economic, human, recreational and cultural services. Councils also enforce State and local laws relating to such matters as land use planning, environment protection, public health, traffic and parking and animal management. They maintain significant infrastructure, provide a range of services and enforce various laws for their communities (DPCD, 2012a).</p> <p>Local government plays a significant role in land use planning, which is administered under the Planning and Environment Act 1987, with each municipality having a local planning scheme that describes directions and controls for developments (DPCD, 2012b). They also have other important roles including public awareness, engagement and education as well as local partnerships such as Conservation Management Networks.</p> <p>Regionally, the Goulburn Broken CMA actively participates in development of environment strategies for the Benalla Rural City, Campaspe Shire, City of Greater Shepparton, Mansfield Shire, Moira Shire and Strathbogie Shire Councils. The Goulburn Broken CMA is a key member and supporter of the Goulburn Broken Local Government Biodiversity Reference Group led by Moira Shire in partnership with the other local governments represented in the catchment.</p>
<b>Other groups</b>	<p>The Goulburn Broken CMA and community and advisory groups develop close relationships with many organisations as needs arise during research, planning and implementation, including Victorian Farmers Federation, the Goulburn Broken Greenhouse Alliance, Committees of Management (Crown land reserves) and the various environment and climate action groups across the Catchment.</p>
<b>Parks Victoria</b>	<p>Under the <i>Parks Victoria Act 1998</i>, Parks Victoria's (PV) responsibilities are to provide services to the State and its agencies for the management of parks, reserves and other public land. With the approval of the Minister, it may also provide land management services to the owner of any other land used for public purposes. The Act requires that, in carrying out its functions, Parks Victoria must not act in a way that is not environmentally sound. Parks Victoria's responsibilities encompass the management of: all areas reserved under the National Parks Act 1975, metropolitan waterways and adjacent land under the Water Industry Act 1994, nominated Crown land reserved under the Crown Land (Reserves) Act 1978, conservation reserves reserved under the Crown Land (Reserves) Act 1978 and managed in accordance with approved land use recommendations under the Land Conservation Act 1970, areas reserved under the Heritage Rivers Act 1992, planning for all Ramsar sites and management of some sites, piers and jetties in Port Phillip Bay and Western Port and recreational boating on these Bays pursuant to powers conferred by the Marine Act, 1988 and the Port of Melbourne Authority Act 1958, other areas as specified under the Parks Victoria Act 1998 (Parks Victoria, 2012b)</p> <p>Regionally, Parks Victoria and the Goulburn Broken CMA work jointly in the delivery of Commonwealth and State funded projects.</p>
<b>Traditional Owners</b>	<p>The role of Traditional Owners is outlined in the introduction of this document. In addition, Registered Aboriginal Partners have responsibilities relating to the management of Aboriginal cultural heritage under the Act. These include evaluating Cultural Heritage Management Plans, providing advice on applications for Cultural Heritage Permits, decisions about Cultural Heritage Agreements and advice or application for interim or ongoing Protection Declarations.</p>
<b>Trust for Nature</b>	<p>Trust for Nature (TfN) is Victoria's specialist private-land conservation statutory entity whose statewide services include covenanting, land purchase, ongoing post-protection landowner support, short-term management agreements and environmental market agreements. Conservation covenants protect the natural features of an area in perpetuity, and ensure, through management plans, that any use is compatible with the conservation of the land's natural or cultural values.</p> <p>TfN works in securing the permanent protection and ongoing management of high quality remnants within the Catchment, adding value to the conservation of biodiversity, community engagement and the National Reserve System.</p>
<b>Victorian Catchment Management Council</b>	<p>The Victorian Catchment Management Council (VCMC) is appointed under the CaLP Act 1994. Its statutory roles are to advise the Minister for the Environment and the Minister for Water, and other Ministers as requested, on land and water management issues; to report annually on operation of the CaLP Act; and report every five years on the environmental condition and management of Victoria's land and water resources, through the VCMC Catchment Condition Report.</p>

## APPENDIX SIX:

# Social-ecological system thresholds

The following thresholds are *expected* to be important considerations when making decisions within SESs. These thresholds are expected to vary within different landscapes of each SES. An important part of RCS implementation will be the development of this table.

Many additions and modifications to the table, including links to supporting evidence, will be made when planning for each SES, which is part of RCS implementation. Developing and documenting thresholds can be expensive, so careful thought is needed before proceeding. A key task in exploring thresholds will be to identify which ones are critical to the resilience of the system.

Level of rigour in evidence	Description
(1) Level 1	Experiential evidence, expert panel etc.
(2) Level 2 (+Level 1)	Documented internal evidence - grey literature etc.
(3) Level 3 (+Level 1&2)	Peer reviewed literature collated and reviewed
(4) Level 4 (+Level 1,2&3)	Peer reviewed literature reviewed and synthesised

Threshold parameter	Socio-ecological system					
	1 Agricultural Floodplains	2 Productive Plains	3 Upland Slopes	4 Commuting Hills	5 Southern Forests	6 Urban Centres
<b>Native vegetation</b>						
Riparian width (from top of bank)	Widths depend on management purposes eg water quality or large fauna habitat					
Riparian corridor width						
Patch size	>3 ha (1)			40 ha (3)		
Patch size for species groups of concern			>40 ha (3)			
Vegetation condition (structural and compositional integrity and appropriate disturbance regimes) for species of concern					>thresholds (1)	
Fire frequency	Minimum and maximum tolerable fire intervals of many flora species and vegetation communities have been identified					
Structural diversity				tbd (2) *		
Connectivity gaps, including roadsides and riparian strips, for species of concern			<40 m (3)			
Linked remnants (habitat hectare score)	35 (1)					35 (1)
Extent: negative		<10% (3)				
Extent: positive		>30% (3)				
Rocky outcrops native grass and herb cover		<30% (1)				
Remnant quality (habitat hectare score)		<35; >60 (1)				
<b>Threatened species</b>						
Threatened species populations	> viability thresholds tbd					viability thresholds tbd

\* tbd - to be determined

Threshold parameter	Socio-ecological system					
	1 Agricultural Floodplains	2 Productive Plains	3 Upland Slopes	4 Commuting Hills	5 Southern Forests	6 Urban Centres
<b>Agricultural viability</b>						
Land available for irrigated agriculture	Area tbd (1)					
Water available for irrigated agriculture and associated food processing	Volume tbd (1)					
Viability of agricultural properties outside of future irrigation footprint				tbd (1)		
<b>Watertables</b>						
Watertable depths following rainfall events	< 2 m (3)					
Area of SIR with high watertables	% (2)					
Productivity losses (if drainage works incomplete)	10% (2)					
<b>Water regime</b>						
Flood regime (timing, frequency, extent and duration) for maintaining waterways and wetlands communities	Water regimes that support many wetland and floodplain biota (vegetation, frogs, birds, native fish and invertebrates) have been identified					
Flood regime (timing, frequency, extent and duration) for maintaining Red Gum communities						tbd
<b>Productive and social capacity</b>						
Productive capacity and community long term impact		Drought frequency and length (1) (tbd) Flood severity (tbd)				
Community contributions		Volunteer base decline (2)				
Permanent/absentee ownership ratio			tbd (1)			
Community cohesion for cross boundary/tenure issues			social capital measures tbd			
<b>Water quality</b>						
Nitrogen, phosphorus, salts and sediment			< critical levels (3)			
Dissolved oxygen level	> 5 mg/L or 80-90% saturation (as per ANZECC guidelines for oxygen dependent aquatic species)					
Water temperature	For native fish spawning, growth, migration and survival (some thresholds for some species are known)					
Riparian width for filtration			>50 m (2)			
Riparian zone condition for filtration			tbd			
<b>Fire regime</b>						
Uncontrolled bushfire				tbd		
Bushfires beyond current fire suppression capacity					tbd	
<b>Built environment and floods</b>						
Land or properties impacted by floods within each urban community						Proportion of land or number of properties tbd
Costs of floods (social and economic)						tbd



## APPENDIX SEVEN:

# Details of community consultation informing the RCS

Communication and engagement category	Representation	Number of participants or contacts
<b>Project governance</b>		
Project Management Team	Goulburn Broken CMA, DEPI, DTPLI, G-MW, Local Government, Parks Victoria	13 meetings 20 participants
<b>Stakeholder engagement with key agencies and local government</b>		
Face to face meetings	Examples including: <ul style="list-style-type: none"> <li>• CEO and staff of GVW</li> <li>• Staff of Trust for Nature</li> <li>• Australian Government - CfOC and SEWPaC investors</li> <li>• DEPI program investors</li> </ul>	12 meetings
Presentations to Council or meetings of Council officers	Meetings with CEO and mayor of Benalla, Campaspe, City of Greater Shepparton, Mansfield, Mitchell, Moira, Murrindindi and Strathbogie Councils Follow up presentations to Mansfield, Mitchell, Moira and Murrindindi councillors Local Government advisory groups and committee	16 meetings/presentations Total number of people = 138
Presentations to and workshops with advisory committees and reference groups	Local Government Biodiversity Reference Group, Goulburn Broken CMA advisory groups	11 meetings Approximate total number of people x 150
<b>Technical expertise</b>		
Expert panels		3 workshops 10 participants on panel 1 12 participants on panel 2 8 participants on panel 3
Agency briefings and feedback sessions	DEPI, GVW, CFA, LGAs, G-MW	6 sessions Total number of participants = 180
Goulburn Broken CMA staff and Board	Presentations to staff and at monthly Board meetings and workshops	5 staff presentations/discussions 100+ staff 13 Board presentations
<b>Traditional Owners</b>		
Face to face meetings	Representative of Yorta Yorta Nations Aboriginal Corporation	Throughout RCS development
Presentations	Taungurung Clans Aboriginal Corporation councillors	1 presentation/discussion Total number of participants = 9

Communication and engagement category	Representation	Number of participants or contacts
<b>General community</b>		
Face to face interviews and group interview sessions	Range of landholders (e.g. farmers, small landholders) representing demographic and geographic diversity across Catchment	65 interviews with individuals 5 group interviews - total number of participants x 40
Catchment forums	Self-selecting community members	8 forums Total number of participants x 68
Presentations to community groups	Gecko ClaN Landcare Network, U3A, Rotary, Kiwanis, GMLN, Upper Goulburn Landcare Network	15 meetings/presentations Estimated total number of participants = 200+
Submissions and comments on draft RCS	Written, emailed, verbal and WeConnect submissions and comments	35 (details in Appendix six)
<b>Web 2.0 (e.g. social media)</b>		
WeConnect	Registered subscribers and unique visitors to WeConnect website	Registered subscribers = 80 Unique visitors = 1000+
Facebook	20 RCS Posts 2 Facebook advertisements	Posted directly to 103 people who liked page These posts also appeared on 22,534 friends of fans pages Reached 17,738 Facebook users
Twitter	Promotion of RCS Community Forums	4 Tweets with links to WeConnect
<b>Promotion of Regional Catchment Strategy activities</b>		
Newspaper advertisements	Promotion of RCS Community Forums in 10 regional newspapers	Total circulation estimated at 80,566
Radio promotion	Promotion of RCS Consultation Period	120 advertisements on STAR FM (target audience 18-39yrs) and 3SR FM (target audience 30-54yrs) – total reach estimated at 336,000 Radio interviews with ABC local radio and UG FM
Monthly RCS update newsletter	Circulation to community advisory groups and via email lists, project management team, staff and via WeConnect Wiki	10 updates distributed

<b>RCS comments and submissions</b>		
John Avar	Anne Graesser, G-MW	Jane Roots, Regional DEPI
Terry Batey, DEPI	Mary Harwood, SEWPac	City of Greater Shepparton
Jan Beer	Brigitte Keeble	GeKKO Clan
Tara Callingham, GVW	Roger Kirkham	Murray Dairy
Goulburn Broken CMA Board	Daniel McLaughlin, Parks Victoria	Winton Wetlands
Terry Court	Peter Mitchell, BEAM Mitchell	Mitchell Shire
John Dainton	Environment Group	DTPLI
Jessica Davison, Regional DTPLI	John Pettigrew	DEPI head office
Gary Deayton	Helen Reynolds, GVEG	Goulburn Valley Water Action Group
Pat Feehan, GBC Regional Water Quality Group	Anna Roberts, DEPI	Murrindindi Shire
	Doug Robinson, Trust for Nature	Goulburn Broken CMA staff

# Thank you

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- Gary Deayton, Local Government
- Anne Graesser, Goulburn-Murray Water
- Terry Batey, Sharon Lewis, Jane Roots, Kate Stothers and Sue Berwick, Department Environment and Primary Industries
- Daniel McLaughlin, Parks Victoria
- Chris Solum, Goulburn-Murray Water Strategic Connections Project (formerly Northern Victoria Irrigation Renewal Project)

## Goulburn Broken Catchment Management Authority representatives:

Chris Norman (Chair), Simon Casanelia, Mark Cotter, Casey Damen, Melanie Haddow, Amanda McClaren, Kirsten Roszak, Gaye Sutherland, Wayne Tennant, Mark Turner, Carl Walters, Steve Wilson and Jenny Wilson

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*Left to right: Wayne Tennant, Steve Wilson, Kirsten Roszak, Chris Norman, Jenny Wilson, Darelle Siekman, Casey Damen, Helen Murdoch, Terry Batey, Sue Berwick, Anne Graesser, Carl Walters, Katie Warner*

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